Wood Buffalo Environmental Association

Progress Report

2022-2023

Q4

January-March 2023

SUBMITTED APRIL 2023

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1 Contract Scope and Delivery

This Progress Report is submitted quarterly by the WBEA on behalf of its members to Alberta Environment and Parks (AEP) in accordance with the services and deliverables listed in Schedule A of Government of Alberta contract 20AEM838-03 and 20AEM842-03, as amended.

As per the AEP contracts, listed below, the WBEA provides environmental monitoring services through the following annual Oil Sands Monitoring (OSM) work plans and associated costs.

AEP Contract	Work Plan Name	Work Plan Reference
20AEM838-03	Atmospheric Pollutant Active Monitoring Network	A-LTM-S-1-2223
20AEM842-03	Integrated Atmospheric Deposition Monitoring	A-PD-6-2223

2 Introduction

The WBEA is a multi-stakeholder, community-based, not-for-profit association, and operates in the largest municipality in Canada. The WBEA monitors the air in the Regional Municipality of Wood Buffalo (RMWB) 24 hours a day, 365 days a year and conducts a variety of air, land, and odour monitoring programs. The information collected from all the WBEA's air monitoring stations between Conklin and Fort Chipewyan - most located at or near oil sands plants - is openly and continuously shared with stakeholders and the public on the WBEA's website (www.wbea.org) and through annual reports, community engagement, and outreach activities.

An Air Quality Task Force was established in 1985 to address environmental concerns raised by the Fort McKay First Nation related to oil sands development. In 1990, this Task Force became the Regional Air Quality Coordinating Committee which was endorsed by the Clean Air Strategic Alliance (CASA) as a regional air shed in 1996. In 1997, the WBEA was incorporated as an Alberta Non-Profit Society and assumed responsibility for air quality monitoring, aligned with the boundaries for the RMWB. The WBEA became a working partner of the Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA) in 2014. With the dissolution of the organization on June 30, 2016, at that time, the WBEA began working with the Oil Sands Monitoring (OSM) Program and AEP to fulfill its mandate to provide independent ambient air monitoring in the region. The WBEA now submits annual work plans to the OSM Program. Once the work plans, and any required changes, are approved, the WBEA receives a contract for the work from Alberta Environment and Parks. This Progress Report is a quarterly update on the work agreed to in the OSM Work Plans and the associated AEP Contract, as described above.

Ambient air and laboratory data must be quality assured and controlled prior to submittal to Alberta Environment's Air Data Warehouse. Therefore, the data validation process follows one month behind the current month (i.e. May data is reviewed and submitted by the end of June). For ease of submission going forward, where appropriate, the progress report will include data and statistics for the previous quarter, whose data have already gone through the data validation process.

3 Project Plans

3.1 Atmospheric Pollutant Active Monitoring Network, 2022-2023 Work Plan Reference A-LTM-S-1-2223

The components of the Atmospheric Pollutant Active Monitoring Network Work Plan that are fulfilled, or supported, by the WBEA are described below:

(1) The long-term core ambient air monitoring network includes continuous and time-integrated air monitoring. The Wood Buffalo Environmental Association (WBEA) operates 29 ambient air monitoring stations (AMSs) in the Athabasca Oil Sands Region (including the acute air monitoring station in Fort McKay - Waskōw ohci Pimâtisiwin). The airshed collects time-integrated samples for the National Air Pollution Surveillance (NAPS) program and other parameters that cannot be collected through continuous monitoring. The long-term core air monitoring network was developed to fulfill EPEA Approval compliance monitoring requirements and satisfy community and scientific interests.

(2) Air monitoring activities related to Recommendations 14/15 in the report "Recurrent Human Health Complaints Technical Information Synthesis – Fort McKay Area" (Alberta Energy Regulatory and Alberta Health, 2016) continue to be implemented. Implementation of these recommendations will improve air monitoring consistency within 30 km of Fort McKay and allow improved characterization of air pollutants that cause air quality and odour concerns in the community. Some aspects of this monitoring are intended to be short-term or focused, as described in Section 10.0 Work Plan Approach/Methods.

(3) Measurements previously collected at the Oski-ôtin research monitoring station operated by ECCC have been transitioned to the Waskōw ohci Pimâtisiwin and Bertha Ganter AMSs located in Fort McKay. A side-by-side comparison for specific air quality parameters monitored by WBEA and ECCC is being considered for 2022-23. Analysis of the completed 2013-2020 Oski-otin data set, including a comprehensive statistical analysis, refinement of source apportionment and model evaluations, will be completed in 2022-23.

(4) The WBEA created an odour monitoring app (COMP) that allows the public to provide anonymous information on the odours they experience. The app collects information such as odour type, intensity, duration, timing and location. The collected information is compared to data at WBEA ambient air monitoring stations to determine if or how ambient air trends are related to odours.

(5) The transition to an adaptive monitoring approach as directed by the OSM Program will continue in 2022-23. This will involve a structured approach to: (a) review the existing monitoring network and document the purpose or objective for each station and for each parameter monitored at each station; (b) develop a shared understanding of regulatory and community expectations that will guide any OSM adaptive monitoring framework based adjustments required to the current long-term surveillance program; (c) determining which air quality parameters are applicable for the EEM approach; (d) establish baselines for selected parameters; and (e) establish limits of change for selected parameters.

The objectives of the 2022-23 work plan are:

(1) To measure impacts from Oil Sands development on ambient air quality.

(2) To provide ambient air data that citizens, industrial members, and regulatory bodies can use to make informed decisions on health, facility compliance, and environmental management policy.

(3) To provide ambient air data for community needs, including the Air Quality Health Index (AQHI), the Fort McKay Air Quality Index (FMAQI), and measuring representative ambient concentrations in populated areas.

(4) Implement ambient air monitoring approved by the Fort McKay Air Quality and Odour (FMAQO) Advisory Committee (specific to Recommendations 1, 14 and 15).

(5) To measure air parameters in Fort McKay that will assist in odour identification and source characterization/attribution during air quality and odour events.

(6) To understand the impacts of Oil Sands development on the odours experienced in communities in the AOSR.

(7) To understand the relationship between the odours experienced by community members and the ambient air data collected at active air monitoring stations.

(8) To measure air parameters in Fort McKay that will assist in dustfall identification and source characterization during dustfall and low visibility events.

(9) To understand the impacts of Oil Sands development on the dustfall experienced in Fort McKay.

(10) To understand the relationship between the dustfall experienced by community members in Fort McKay and the ambient air data collected at active air monitoring stations.

(11) To ensure that monitoring carried out in the region is relevant to the concerns of community members.

(12) To implement the adaptive monitoring approach, as directed by the OSM Program Oversight Committee, where appropriate in the Atmospheric Pollutant Active Monitoring Network.

(13) Create an Indigenous-led air monitoring program in the Peace Athabasca Delta and at reserve locations in partnership with WBEA.

(14) Expand the Fort Chipewyan air monitoring capabilities to fill the air quality data gap with time integrated sampling.

(15) Build community capacity through training of ACFN and MCFN Personnel for sampling program operations and maintenance.

Q4 Milestones/Deliverables

(1) Continuous Monitoring - Operate 29 ambient air monitoring stations including the acute air monitoring station in Fort McKay (Waskow ohci Pimatisiwin station - FMAQOAC Recommendation I).

i. Complete monthly calibrations at all ambient air monitoring stations in the WBEA network in compliance with Alberta's Air Monitoring Directive (AMD). Perform preventative maintenance and repairs, as required.

The WBEA performed approximately 150 monthly calibrations on analyzers and reported monthly on approximately 280 parameters, including approximately 120 meteorological sensors. Operational average times for the previous quarter are included in Table 2 below.

Monthly calibrations and maintenance were completed at 29 monitoring stations in compliance with the AMD. Preventative maintenance and repairs were carried out when required.

ii. Perform annual calibrations on meteorological sensors at air monitoring stations.

Annual calibrations, which are conducted throughout the year, continued during the second quarter. All meteorological calibrations were completed by the end of fall 2022.

iii. Provide locations of Portable Stations in the WBEA Network.

Table 1, below, outlines the portable locations for the second quarter of 2022-2023. AMS 102 was moved to the Jackfish 1 CNRL facility the end of June to complete 6 months of monitoring to meet the requirements of EPEA Approval 224816-01-00. AMS 105 is currently housing the RSC & VOC GCs at Bertha Ganter-Fort McKay (please refer to Section 11(iii)) for more information.

Table 1. Location of Portable Stations in WBEA Network

WBEA Portable Number	October	November	December
AMS 102	**Jackfish 1**	**Jackfish 1**	**Jackfish 1**
AMS 104	**WBEA Centre**	**WBEA Centre**	**WBEA Centre**
AMS 105	**Bertha Ganter – Fort McKay**	**Bertha Ganter – Fort McKay**	**Bertha Ganter – Fort McKay**

iv. Provide continuous analyzer operation statistics, by month.

The table below provides the WBEA continuous analyzer operation statistics by month.

Table 2. WBEA Continuous Analyzer Operation Statistics, by Month

Month	Average Operational Time (%)	# of Analyzers with Operational Uptime %						Total # of Analyzers
		< 90*	90 to 92	93 to 94	95 to 96	96 to 98	98 to 100	
October	98.9	4	3	1	1	9	134	152
November	99.0	2	0	3	5	9	133	152
December	99.5	0	0	1	5	7	139	152

*For additional information on analyzers operating at less than 90%, please refer to Section 12(ii)

(2) Time-integrated monitoring - Deploy and collect all required time-integrated samples, instrument maintenance, and sample results.

i. Time-integrated sampling updates, as per NAPS schedule.

The locations of all time-integrated samples in the WBEA network are described in Table 3. The WBEA collected and deployed up to 297 samples per month as described in Table 4. All samples were sent to their respective labs for analysis. Table 4 provides statistics regarding time-integrated sample collection incidents and recovery percentages.

Table 3. WBEA Time-Integrated Samples

Air Monitoring Station	Time Integrated Sampling Parameters							
	VOC	$PM_{2.5}$ Mass, Metals and Ions	$PM_{2.5}$ Mass, EC/OC	PM_{10} Mass, Metals and Ions	PAH	Precipitation	Dustfall	TSP
Fort McKay-Bertha Ganter	X	X	X	X	X	X	X	
Patricia McInnes	X	X		X	X		X	
Athabasca Valley	X	X		X	X		X	
Barge Landing	X							
Fort McKay South	X			X				
Fort Chipewyan	X	X		X	X			
Anzac	X	X		X	X		X	
Wapasu			X			X		
Stony Mountain			X			X		
Conklin	X	X		X	X		X	
Janvier	X	X		X	X		X	
Ells River	X			X				X
Fort Hills	X			X				

Table 4. Time Integrated Sample Collection- Incidents and Recovery

Month	No. of Incidents	Total No. of samples	% Recovery	# NAPS days per month	Samples Types							
					PM2.5	PM10	EC/OC	VOC	PAH	Precip	TSP	Dustfall
# of samples					70	100	15	55	40	12	5	11
October 2022	1	297	99.7	5	0	0	0	1	0	0	0	N/A
November 2022	1	308	99.7	5	0	0	0	1	0	0	0	0
December 2022	8	365	97.8	6	1	2	0	0	1	3	4	0

ii. Submit time-integrated data with monthly data reports.

WBEA time-integrated data has been collected and centralized within a database. A catalogue containing sample types, number of data points, and date ranges is available to view on the WBEA website. Time-integrated data can be refined and downloaded in a spreadsheet format from the website. The catalogue and download page are available at the following URL: https://wbea.org/network-and-data/integrated-data-search/.

(3) Continue the WBEA's Quality Assurance Program

i. Maintain the WBEA's Reference Centre, monthly calibrations on reference analyzers, perform CGAs, maintain primary reference materials.

Over the last quarter, regular maintenance and calibrations were carried out on the reference center instruments each month. Six calibrators were audited and prepared for deployment, seven flow meters were audited, and the ozone primary standard was cross-referenced.

ii. Complete quarterly calibrations and audits on all time-integrated sampling equipment.

Quarterly time-integrated sampler calibrations and audits were conducted throughout the network through February 2023.

iii. Complete annual internal audits at all WBEA ambient air monitoring stations and additional ones, as required.

The WBEA has an internal audit program that follows the same procedures as Alberta Environment and Protected Areas; however, the WBEA applies stricter audit criteria. If an analyzer fails these criteria, it will initiate an investigation into the cause to determine whether the analyzer requires maintenance. Table 5 lists all internal audits that were conducted in the WBEA Network this quarter.

Table 5. List of Internal WBEA Audits Performed in Third Quarter 2022-23

Air Monitoring Station	Audit Date	Parameters Audited	Audit Response	Follow-up
Mildred Lake	January 11, 2023	SO2, H2S, NMHC, Temp/RH	No issues observed with audit.	None required.
Stony Mountain	Jan 19-20, 2023	SO2, TRS, NMHC, O3, NOX, CO, CO2, PM2.5, temp/RH	NOX failed WBEA criteria on the low GPT point, converter efficiency calculation as a result in an imbalance of channels, and NMHC failed as average response was high to audit limits (6.8%). Source was narrowed down to calibration gas in both circumstances, both to be replaced.	Ongoing.
Jackfish 2/3	Jan 20, 2023	SO2, H2S, NOX, temp/RH	No issues observed with audit.	None required.
Jackfish 1	Feb 8, 2023	SO2, H2S, NOX, temp/RH	NOX failed WBEA criteria on GPT response and converter efficiency, identified 2 issues: 1) the HVAC system thermostat setpoints were spaced apart leading to station temp drift and analyzer drift, and 2) calibration gas certification was just outside NOX/NO imbalance limits. H2S failed to stabilize for over 45 minutes and will require maintenance.	H2S to be repaired or replaced for stability time improvement, NO calibration gas to be replaced. Thermostat settings were revised to improve station temperature stability.
Ells River	Feb 14, 2023	SO2, TRS, NMHC, NOX, PM2.5, temp/RH	No issues observed with audit.	None required.
Fort Chipewyan	Feb 28, 2023	SO2, TRS, O3, NOX, CO, CO2, PM2.5, temp/RH	No issues observed with audit.	None required.
Lower Camp	Mar 10, 2023	SO2, H2S, NMHC, temp/RH	No issues observed with audit, HMP155 was borderline high to audit standard.	HMP155 to be replaced.
Surmont 2	Mar 15, 2023	SO2, H2S, THC, NOX, temp/RH	H2S failed WBEA criteria on average response (6.5% high) and noise as the UV lamp/trigger pack appear to be in the early stages of failing causing noisy response.	H2S to be repaired or replaced.

(4) Operate the Community Odour Monitoring Program (COMP) App.

The Community Odour Monitoring Program, launched in September 2017, is ongoing. The COMP website can be viewed at comp.wbea.org, which provides near real-time odour observation information, real-time data from the WBEA's community air monitoring stations for odour-causing compounds and hosts the COMP annual reports.

The number of odour observations that were submitted through the COMP app are listed in the Table 6.

Table 6. Number of Odour Observations Submitted in 2022.

Month	Observations	Unique Users
January	24	15
February	6	3
March	9	6
April	3	2
May	6	5
June	5	5
July	15	12
August	27	16
September	9	8
October	7	5
November	3	2
December	4	3

i. Create awareness of the COMP and COMP App for community members.

This quarter, the WBEA implemented an advertising campaign for COMP at the local movie theater through the month of March.

ii. Submit 2022 COMP Annual Report to AEP and post on the WBEA website.

Currently finalizing the 2022 COMP report. The report will be available in April 2023.

(5) Complete site commissioning of the new Mildred Lake AMS location.

The Mildred Lake AMS location is not in compliance with the Air Monitoring Directive (AMD) and the station needs to be moved, in addition, the shelter needs to be replaced to accommodate the installation of additional monitoring parameters at the station. The new shelter was procured, the land survey, wildlife sweep, and brush clearing were completed, and the appropriate site authorizations were received. However, all activity has been suspended due to powerline construction scheduled near the proposed location. The WBEA is working with the appropriate Member to determine a path forward. A possible new location for the station is under consideration.

(6) Modify operations and reporting to meet new requirements in the Air Monitoring Directive (AMD) and the new AAAQG for TRS.

Once the AEP's anticipated 30-minute average TRS guideline is implemented, the WBEA will be required to update its data management system to produce 30-minute averages. The TRS guideline has yet to be released. No other modifications were required to meet AMD requirements in the fourth quarter.

(7) Continue partnership with Athabasca Chipewyan First Nation (ACFN) and Mikisew Cree First Nation (MCFN) to create an Indigenous-led air monitoring program in the Peace Athabasca Delta.

The WBEA, ACFN, and MCFN are in the third year of a three-year plan to expand the air monitoring capabilities within the community of Fort Chipewyan and support the Air Quality Monitoring in the Peace Athabasca Delta ICBM work plan. The focus of the third year is the expansion of time-integrated sampling at the Fort Chipewyan AMS, and the addition of deposition monitoring at identified remote sites.

i. Purchase and install a PM2.5 EC/OC sampler.

The WBEA acquired the PM 2.5 EC/OC sampler which was installed in February. EC/OC sampling began in February. ACFN and MCFN members were also trained on the operation of the sampler and sample changeout procedures.

ii. Report data in routine monthly and annual reports to be consistent with the current ambient air monitoring program.

Reporting of the Fort Chipewyan AMS is included in the WBEA's routine monthly and annual reports, which are submitted to Alberta Environment and Parks.

(8) Phase 2 of the Continuous Hydrocarbon Instrument Evaluation.

The intent of phase one of this study was to investigate collocated results from a series of candidate analyzers and evaluate any differences in the data response between the different analytical technologies to understand potential bias between technologies. The reason for this analysis is that the WBEA has recently replaced 51i analyzers with 55i analyzers at several stations. When comparing historical data sets, it is important to understand these differences.

Based on the findings of the phase one study, there is now interest to better understanding the differences in response based on manufacturer. Phase one results indicated that the Response factor for the 51iTHC analyzer was much lower than expected for propane only. Phase two testing aims to answer the question on RF for propane using different manufactured FID systems. Analysis of the ambient data between the five analyzers, similar to stage one analysis of ambient data, will indicate if there are any differences in FID technology.

Currently, the new Mannix shelter is outfitted with the following instruments that will be involved in the phase two study.

- Thermo 51i
- Thermo 55i
- Mocon 9000NMHC

- Envea NMHC

Station deployment is on-hold awaiting site clearance requirements.

(9) Phase 2 of the Continuous Particulate Instrument evaluation.

The rationale for phase one of the particulate instrument evaluation was to collect co-located data from the old and new $PM_{2.5}$ continuous monitoring technology to understand any differences in response between the methods. A secondary reason was to collect PM 10 and 2.5 federal reference method (FRM) data to compare to both technologies for reference. The last is to compare T640 PM_{10} data to the FRM for PM_{10} to validate the T640 as it is not an federal equivalent method (FRM) analyzer for PM_{10}.

Based on the findings from phase one of the PM study, this phase will further examine particulate data collected at the PM Study site (AMS 511) located in the same compound as Fort McKay South AMS 13 in the WBEA network. The site selected as the original site, Horizon AMS 15, is no longer available and did not meet the space requirements. The AMS 13 site compound has the space and power available to accommodate this study. The purpose for phase two of this study is to respond to the recommendations from phase one and attempt to find a change in the PM monitoring method to more accurately collect $PM_{2.5}$ data.

- The study will involve the following instruments:
  - API T640
  - API T640x (FEM for PM 10 & PM 2.5)
  - API T640 + BGI mini PM10 head
  - SHARP 5030
  - Partisols (PM 2.5 & 10)

The shelter was deployed to site in March 2023. Currently under the final stages of station integration and testing before going live.

(10) Implement a Regional Dustfall Monitoring.

The WBEA's Ambient Air Technical Committee (AATC) approved the proposed Regional Dustfall Monitoring Proposal at the September 14th, 2022 committee meeting. The study is focused on residential and recreational areas that are accessible to the public and will measure the monthly collection of dustfall according to ASTM method1739-98.

The dustfall collectors will be located at 6 sites: Bertha Ganter AMS, Patricia McInnes AMS, Athabasca Valley AMS, Anzac AMS, Janvier AMS, Conklin AMS. The collectors will be installed in October, with sampling starting in November and running for a two-year period. The results will be compared to the Alberta Ambient Air Quality Guideline (AAAQG) for Dustfall in residential and recreation areas of 53mg/100cm. Following the two-year study period, a report will be created comparing the dustfall measurements to the PM2.5, PM10,

and TSP measurements also taken at the Community AMSs. Sampling started on November 1st, 2022. A Lab has been selected for sample analysis, and a contract has been established.

In the fourth quarter, regular sample collection and deployment are ongoing.

(11) Fulfill monitoring Recommendations 14/15 from the Fort McKay Air Quality and Odours Advisory Committee (FMAQOAC) in accordance with the schedule outlined in the approved OSM Program work plan. Document all activities completed

i. Operations, maintenance, and reporting of air measurements for the Poplar Creek AMS.

The decision on whether to install the Poplar Creek AMS has been referred to the Rec 14/15 committee, and the WBEA is awaiting their decision on the path forward.

ii. Analysis and Reporting of VOC and RSC compounds for the Triggered Samplers.

This project was initiated through the Rec 14/15 committee monitoring workplan. The intent is to design and build prototype VOC canister and RSC tube sampling systems to capture triggered samples during events of semicontinuous NMHC and continuous TRS readings in the Fort McKay region. The WBEA designed and ordered two custom-made triggered samplers – one for RSC compounds, based on a methodology the WBEA developed in 2017, and one for VOCs. Both samplers were installed at Bertha Ganter-Fort McKay AMS in March 2022. Field sampling has begun, and the first samplers have been sent to the lab for analysis. The current RSC trigger is 1.9 ppb TRS/ 5-min average, based on the methodology reference previously. The current VOC trigger is 0.3 ppm NMHC/5-min average which was modified in November from the previous trigger which was 0.6 ppm. These triggers may be updated as necessary based on operational performance. Since installation, 93 Trigger RSCs and 32 VOC canisters were collected for analysis.

iii. Operation, maintenance and data analysis of both VOC and RSC GC.

This deliverable includes ongoing improvement of the monitoring methodology, data analysis, and provision of quality-controlled data to stakeholders. Once full implementation and testing is complete, the semi-continuous gas chromatograph monitoring will be included as part of the long-term active air monitoring network. The The WBEA technician and Markes technician installed a new Markes system, the instrument is operational but still has intermittent issues, troubleshooting ongoing. The RSC GC is not operational, the instrument hard drive is full, which caused the instrument to stop sampling. The WBEA technician is currently working with the manufacturer to resolve this issue. The WBEA has also posted a GC technician position. This individual will be responsible for the operation and upkeep of both GC systems.

(12) Provide data from the WBEA's ambient air monitoring network.

i. Maintain processing, validation, and reporting of all WBEA ambient air quality data. Make all data available on the WBEA's website.

During the fourth quarter, monthly ambient air data was reviewed, as per the WBEA's monthly data validation process. Level II data, which is quality controlled, is available on the WBEA's website 30 days after the end of the calendar month in which they were collected at https://wbea.org/historical-monitoring-data/

WBEA time-integrated data has been collected and centralized within a new database. A catalogue containing sample types, number of data points, and date ranges is available to view on the WBEA website. Time-integrated data can be refined and downloaded in a spreadsheet format from the website. The catalogue and download page is available at the following URL: https://wbea.org/network-and-data/integrated-data-search/ .

ii. Report exceedances of the Alberta Ambient Air Quality Objectives and Guidelines, and non-compliances of the Air Monitoring Directive to the Alberta Government as established by WBEA's Immediate Reporting Protocol and the Fort McKay Acute Response Triggers (FMART) Process.

The WBEA notifies members of exceedances in the ambient air network using the Air Quality Events app. Exceedances are also reported through the WBEA's ambient air monitoring monthly data reports. These reports can be found at https://wbea.org/resources/reports-publications/air-monitoring-reports/ambient-monthly-reports/.

Additionally, the WBEA developed an Air Quality Events database that allows users to search through any air quality events that occur in the Network. The database can be accessed at https://wbea.org/air/air-quality-events/.

Exceedances and non-compliances that occurred in the WBEA network are listed in Table 7 and Table 8, respectively.

Table 7. Exceedances October- December 2022

Event Type	Station	Date	Hour Ending	Period	Parameter	Concentration
AAAQO	Jackfish 1	October 2, 2022	20:00	1-hr	H2S	13.3 ppb
AAAQO	Mannix	October 3, 2022	2:00	1-hr	H2S	9.3 ppb
AAAQO	Barge Landing	October 4, 2022	24:00	24-hr	PM2.5	33.1 µg/m3
AAAQO	Buffalo Viewpoint	October 4, 2022	24:00	24-hr	PM2.5	35.9 µg/m3
AAAQG	Stony Mountain	October 4, 2022	23:00	1-hr	PM2.5	80.4 µg/m3
AAAQG	Janvier	October 4, 2022	22:00	1-hr	PM2.5	105.9 µg/m3
AAAQG	Anzac	October 4, 2022	20:00	1-hr	PM2.5	108.2 µg/m3
AAAQG	Athabasca Valley	October 4, 2022	20:00	1-hr	PM2.5	92.7 µg/m3
AAAQG	Patricia McInnes	October 4, 2022	20:00	1-hr	PM2.5	92.2 µg/m3
AAAQG	Ells River	October 4, 2022	19:00	1-hr	PM2.5	119.8 µg/m3
AAAQG	Fort Hills	October 4, 2022	19:00	1-hr	PM2.5	129.8 µg/m3
AAAQG	Fort McKay South	October 4, 2022	19:00	1-hr	PM2.5	147.5 µg/m3
AAAQG	Barge Landing	October 4, 2022	19:00	1-hr	PM2.5	167.0 µg/m3
AAAQG	Athabasca Valley	October 4, 2022	19:00	1-hr	PM2.5	160.2 µg/m3
AAAQG	Patricia McInnes	October 4, 2022	19:00	1-hr	PM2.5	156.1 µg/m3
AAAQG	Buffalo Viewpoint	October 4, 2022	19:00	1-hr	PM2.5	195.3 µg/m3
AAAQG	Bertha Ganter - Fort McKay	October 4, 2022	19:00	1-hr	PM2.5	147.2 µg/m3
AAAQG	Ells River	October 4, 2022	18:00	1-hr	PM2.5	138.5 µg/m3
AAAQG	Fort Hills	October 4,	18:00	1-hr	PM2.5	148.0 µg/m3

		2022				
AAAQG	Wapasu	October 4, 2022	18:00	1-hr	PM2.5	95.6 µg/m3
AAAQG	Fort McKay South	October 4, 2022	18:00	1-hr	PM2.5	157.2 µg/m3
AAAQG	Barge Landing	October 4, 2022	18:00	1-hr	PM2.5	190.3 µg/m3
AAAQG	Buffalo Viewpoint	October 4, 2022	18:00	1-hr	PM2.5	216.6 µg/m3
AAAQG	Bertha Ganter - Fort McKay	October 4, 2022	18:00	1-hr	PM2.5	158.1 µg/m3
AAAQG	Fort Hills	October 4, 2022	17:00	1-hr	PM2.5	126.3 µg/m3
AAAQG	Wapasu	October 4, 2022	17:00	1-hr	PM2.5	125.2 µg/m3
AAAQG	Barge Landing	October 4, 2022	17:00	1-hr	PM2.5	111.7 µg/m3
AAAQG	Fort Chipewyan	October 4, 2022	13:00	1-hr	PM2.5	219.0 µg/m3
AAAQG	Fort Chipewyan	October 4, 2022	12:00	1-hr	PM2.5	158.0 µg/m3
AAAQG	Fort Hills	October 5, 2022	21:00	1-hr	PM2.5	113.7 µg/m3
AAAQG	Fort Hills	October 5, 2022	19:00	1-hr	PM2.5	86.7 µg/m3
AAAQO	Mannix	October 5, 2022	3:00	1-hr	H2S	9.5 ppb
AAAQO	Fort Hills	October 8, 2022	24:00	24-hr	PM2.5	33.5 µg/m3
AAAQO	Conklin	October 8, 2022	24:00	24-hr	PM2.5	29.0 µg/m3
AAAQO	Barge Landing	October 8, 2022	24:00	24-hr	PM2.5	36.0 µg/m3
AAAQO	Buffalo Viewpoint	October 8, 2022	24:00	24-hr	PM2.5	35.6 µg/m3
AAAQO	Bertha Ganter - Fort McKay	October 8, 2022	24:00	24-hr	PM2.5	30.3 µg/m3
AAAQG	Conklin	October 8, 2022	21:00	1-hr	PM2.5	83.6 µg/m3
AAAQG	Conklin	October 8, 2022	20:00	1-hr	PM2.5	107.1 µg/m3

AAAQG	Conklin	October 8, 2022	19:00	1-hr	PM2.5	108.8 µg/m3
AAAQO	Mildred Lake	October 9, 2022	2:00	1-hr	H2S	32.7 ppb
AAAQO	Fort Hills	October 18, 2022	24:00	24-hr	PM2.5	33.9 µg/m3
AAAQO	Barge Landing	October 18, 2022	24:00	24-hr	PM2.5	36.0 µg/m3
AAAQO	Buffalo Viewpoint	October 18, 2022	24:00	24-hr	PM2.5	34.8 µg/m3
AAAQG	Fort Hills	October 18, 2022	18:00	1-hr	PM2.5	87.4 µg/m3
AAAQG	Fort Hills	October 18, 2022	17:00	1-hr	PM2.5	89.4 µg/m3
AAAQO	Janvier	October 19, 2022	24:00	24-hr	PM2.5	31.5 µg/m3
AAAQO	Conklin	October 19, 2022	24:00	24-hr	PM2.5	29.2 µg/m3
AAAQO	Anzac	October 19, 2022	24:00	24-hr	PM2.5	29.2 µg/m3
AAAQO	Barge Landing	October 19, 2022	24:00	24-hr	PM2.5	30.6 µg/m3
AAAQO	Athabasca Valley	October 19, 2022	24:00	24-hr	PM2.5	30.6 µg/m3
AAAQO	Buffalo Viewpoint	October 19, 2022	24:00	24-hr	PM2.5	40.8 µg/m3
AAAQO	Surmont 2	October 19, 2022	24:00	24-hr	PM2.5	30.1 µg/m3
AAAQO	Patricia McInnes	October 21, 2022	24:00	24-hr	PM2.5	54.0 µg/m3
AAAQO	Buffalo Viewpoint	October 21, 2022	24:00	24-hr	PM2.5	38.3 µg/m3
AAAQG	Patricia McInnes	October 21, 2022	21:00	1-hr	PM2.5	144.9 µg/m3
AAAQG	Patricia McInnes	October 21, 2022	20:00	1-hr	PM2.5	110.7 µg/m3
AAAQG	Patricia McInnes	October 21, 2022	19:00	1-hr	PM2.5	204.0 µg/m3
AAAQO	Patricia McInnes	October 22, 2022	24:00	24-hr	PM2.5	53.8 µg/m3
AAAQO	Buffalo	October 22,	24:00	24-hr	PM2.5	31.9 µg/m3

	Viewpoint	2022				
AAAQG	Buffalo Viewpoint	October 22, 2022	8:00	1-hr	PM2.5	81.5 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	6:00	1-hr	PM2.5	103.3 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	5:00	1-hr	PM2.5	150.8 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	3:00	1-hr	PM2.5	152.3 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	2:00	1-hr	PM2.5	244.9 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	1:00	1-hr	PM2.5	339.3 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	24:00	1-hr	PM2.5	139.9 µg/m3
AAAQG	Patricia McInnes	October 23, 2022	21:00	1-hr	PM2.5	138.6 µg/m3
AAAQG	Fort Hills	November 8, 2022	19:00	1-hr	PM2.5	86.3 µg/m3
AAAQO	Barge Landing	November 11, 2022	24:00	24-hr	PM2.5	29.8 µg/m3
AAAQG	Fort Hills	November 19, 2022	17:00	1-hr	PM2.5	93.0 µg/m3
AAAQO	Lower Camp	November 19, 2022	17:00	1-hr	H2S	11.3 ppb
AAAQG	Bertha Ganter - Fort McKay	November 30, 2022	24:00	30-day	Dustfall	64.3 mg/100cm2/30days
AAAQG	Athabasca Valley	December 5, 2022	1:00	1-hr	PM2.5	120.1 µg/m3
AAAQG	Athabasca Valley	December 10, 2022	5:00	1-hr	PM2.5	91.2 µg/m3
AAAQG	Athabasca Valley	December 14, 2022	13:00	1-hr	PM2.5	102.7 µg/m3
AAAQG	Athabasca Valley	December 14, 2022	1:00	1-hr	PM2.5	145.2 µg/m3
AAAQO	Buffalo Viewpoint	December 23, 2022	24:00	24-hr	PM2.5	49.8 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	12:00	1-hr	PM2.5	92.9 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	11:00	1-hr	PM2.5	184.6 µg/m3

AAAQG	Buffalo Viewpoint	December 23, 2022	10:00	1-hr	PM2.5	94.8 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	8:00	1-hr	PM2.5	195.5 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	6:00	1-hr	PM2.5	140.7 µg/m3
AAAQG	Conklin	December 23, 2022	4:00	1-hr	PM2.5	83.8 µg/m3
AAAQG	Bertha Ganter - Fort McKay	December 31, 2022	24:00	30-day	Dustfall	97 mg/100cm2/30days
AAAQO	Jackfish 1	October 2, 2022	20:00	1-hr	H2S	13.3 ppb
AAAQO	Mannix	October 3, 2022	2:00	1-hr	H2S	9.3 ppb
AAAQO	Barge Landing	October 4, 2022	24:00	24-hr	PM2.5	33.1 µg/m3
AAAQO	Buffalo Viewpoint	October 4, 2022	24:00	24-hr	PM2.5	35.9 µg/m3
AAAQG	Stony Mountain	October 4, 2022	23:00	1-hr	PM2.5	80.4 µg/m3
AAAQG	Janvier	October 4, 2022	22:00	1-hr	PM2.5	105.9 µg/m3
AAAQG	Anzac	October 4, 2022	20:00	1-hr	PM2.5	108.2 µg/m3
AAAQG	Athabasca Valley	October 4, 2022	20:00	1-hr	PM2.5	92.7 µg/m3
AAAQG	Patricia McInnes	October 4, 2022	20:00	1-hr	PM2.5	92.2 µg/m3
AAAQG	Ells River	October 4, 2022	19:00	1-hr	PM2.5	119.8 µg/m3
AAAQG	Fort Hills	October 4, 2022	19:00	1-hr	PM2.5	129.8 µg/m3
AAAQG	Fort McKay South	October 4, 2022	19:00	1-hr	PM2.5	147.5 µg/m3
AAAQG	Barge Landing	October 4, 2022	19:00	1-hr	PM2.5	167.0 µg/m3
AAAQG	Athabasca Valley	October 4, 2022	19:00	1-hr	PM2.5	160.2 µg/m3
AAAQG	Patricia McInnes	October 4, 2022	19:00	1-hr	PM2.5	156.1 µg/m3
AAAQG	Buffalo	October 4,	19:00	1-hr	PM2.5	195.3 µg/m3

	Viewpoint	2022				
AAAQG	Bertha Ganter - Fort McKay	October 4, 2022	19:00	1-hr	PM2.5	147.2 µg/m3
AAAQG	Ells River	October 4, 2022	18:00	1-hr	PM2.5	138.5 µg/m3
AAAQG	Fort Hills	October 4, 2022	18:00	1-hr	PM2.5	148.0 µg/m3
AAAQG	Wapasu	October 4, 2022	18:00	1-hr	PM2.5	95.6 µg/m3
AAAQG	Fort McKay South	October 4, 2022	18:00	1-hr	PM2.5	157.2 µg/m3
AAAQG	Barge Landing	October 4, 2022	18:00	1-hr	PM2.5	190.3 µg/m3
AAAQG	Buffalo Viewpoint	October 4, 2022	18:00	1-hr	PM2.5	216.6 µg/m3
AAAQG	Bertha Ganter - Fort McKay	October 4, 2022	18:00	1-hr	PM2.5	158.1 µg/m3
AAAQG	Fort Hills	October 4, 2022	17:00	1-hr	PM2.5	126.3 µg/m3
AAAQG	Wapasu	October 4, 2022	17:00	1-hr	PM2.5	125.2 µg/m3
AAAQG	Barge Landing	October 4, 2022	17:00	1-hr	PM2.5	111.7 µg/m3
AAAQG	Fort Chipewyan	October 4, 2022	13:00	1-hr	PM2.5	219.0 µg/m3
AAAQG	Fort Chipewyan	October 4, 2022	12:00	1-hr	PM2.5	158.0 µg/m3
AAAQG	Fort Hills	October 5, 2022	21:00	1-hr	PM2.5	113.7 µg/m3
AAAQG	Fort Hills	October 5, 2022	19:00	1-hr	PM2.5	86.7 µg/m3
AAAQO	Mannix	October 5, 2022	3:00	1-hr	H2S	9.5 ppb
AAAQO	Fort Hills	October 8, 2022	24:00	24-hr	PM2.5	33.5 µg/m3
AAAQO	Conklin	October 8, 2022	24:00	24-hr	PM2.5	29.0 µg/m3
AAAQO	Barge Landing	October 8, 2022	24:00	24-hr	PM2.5	36.0 µg/m3
AAAQO	Buffalo Viewpoint	October 8, 2022	24:00	24-hr	PM2.5	35.6 µg/m3

AAAQO	Bertha Ganter - Fort McKay	October 8, 2022	24:00	24-hr	PM2.5	30.3 µg/m3
AAAQG	Conklin	October 8, 2022	21:00	1-hr	PM2.5	83.6 µg/m3
AAAQG	Conklin	October 8, 2022	20:00	1-hr	PM2.5	107.1 µg/m3
AAAQG	Conklin	October 8, 2022	19:00	1-hr	PM2.5	108.8 µg/m3
AAAQO	Mildred Lake	October 9, 2022	2:00	1-hr	H2S	32.7 ppb
AAAQO	Fort Hills	October 18, 2022	24:00	24-hr	PM2.5	33.9 µg/m3
AAAQO	Barge Landing	October 18, 2022	24:00	24-hr	PM2.5	36.0 µg/m3
AAAQO	Buffalo Viewpoint	October 18, 2022	24:00	24-hr	PM2.5	34.8 µg/m3
AAAQG	Fort Hills	October 18, 2022	18:00	1-hr	PM2.5	87.4 µg/m3
AAAQG	Fort Hills	October 18, 2022	17:00	1-hr	PM2.5	89.4 µg/m3
AAAQO	Janvier	October 19, 2022	24:00	24-hr	PM2.5	31.5 µg/m3
AAAQO	Conklin	October 19, 2022	24:00	24-hr	PM2.5	29.2 µg/m3
AAAQO	Anzac	October 19, 2022	24:00	24-hr	PM2.5	29.2 µg/m3
AAAQO	Barge Landing	October 19, 2022	24:00	24-hr	PM2.5	30.6 µg/m3
AAAQO	Athabasca Valley	October 19, 2022	24:00	24-hr	PM2.5	30.6 µg/m3
AAAQO	Buffalo Viewpoint	October 19, 2022	24:00	24-hr	PM2.5	40.8 µg/m3
AAAQO	Surmont 2	October 19, 2022	24:00	24-hr	PM2.5	30.1 µg/m3
AAAQO	Patricia McInnes	October 21, 2022	24:00	24-hr	PM2.5	54.0 µg/m3
AAAQO	Buffalo Viewpoint	October 21, 2022	24:00	24-hr	PM2.5	38.3 µg/m3
AAAQG	Patricia McInnes	October 21, 2022	21:00	1-hr	PM2.5	144.9 µg/m3
AAAQG	Patricia	October 21,	20:00	1-hr	PM2.5	110.7 µg/m3

	McInnes	2022				
AAAQG	Patricia McInnes	October 21, 2022	19:00	1-hr	PM2.5	204.0 µg/m3
AAAQO	Patricia McInnes	October 22, 2022	24:00	24-hr	PM2.5	53.8 µg/m3
AAAQO	Buffalo Viewpoint	October 22, 2022	24:00	24-hr	PM2.5	31.9 µg/m3
AAAQG	Buffalo Viewpoint	October 22, 2022	8:00	1-hr	PM2.5	81.5 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	6:00	1-hr	PM2.5	103.3 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	5:00	1-hr	PM2.5	150.8 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	3:00	1-hr	PM2.5	152.3 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	2:00	1-hr	PM2.5	244.9 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	1:00	1-hr	PM2.5	339.3 µg/m3
AAAQG	Patricia McInnes	October 22, 2022	24:00	1-hr	PM2.5	139.9 µg/m3
AAAQG	Patricia McInnes	October 23, 2022	21:00	1-hr	PM2.5	138.6 µg/m3
AAAQG	Fort Hills	November 8, 2022	19:00	1-hr	PM2.5	86.3 µg/m3
AAAQO	Barge Landing	November 11, 2022	24:00	24-hr	PM2.5	29.8 µg/m3
AAAQG	Fort Hills	November 19, 2022	17:00	1-hr	PM2.5	93.0 µg/m3
AAAQO	Lower Camp	November 19, 2022	17:00	1-hr	H2S	11.3 ppb
AAAQG	Bertha Ganter - Fort McKay	November 30, 2022	24:00	30-day	Dustfall	64.3 mg/100cm2/30days
AAAQG	Athabasca Valley	December 5, 2022	1:00	1-hr	PM2.5	120.1 µg/m3
AAAQG	Athabasca Valley	December 10, 2022	5:00	1-hr	PM2.5	91.2 µg/m3
AAAQG	Athabasca Valley	December 14, 2022	13:00	1-hr	PM2.5	102.7 µg/m3
AAAQG	Athabasca Valley	December 14, 2022	1:00	1-hr	PM2.5	145.2 µg/m3

AAAQO	Buffalo Viewpoint	December 23, 2022	24:00	24-hr	PM2.5	49.8 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	12:00	1-hr	PM2.5	92.9 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	11:00	1-hr	PM2.5	184.6 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	10:00	1-hr	PM2.5	94.8 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	8:00	1-hr	PM2.5	195.5 µg/m3
AAAQG	Buffalo Viewpoint	December 23, 2022	6:00	1-hr	PM2.5	140.7 µg/m3
AAAQG	Conklin	December 23, 2022	4:00	1-hr	PM2.5	83.8 µg/m3
AAAQG	Bertha Ganter - Fort McKay	December 31, 2022	24:00	30-day	Dustfall	97 mg/100cm2/30days

Table 8. WBEA Non-Compliances, October- December 2022

Date Reported	AEP Ref Number	Reporting Period	Location	Brief Description	Issue	Remedial Action
October 24, 2022	406044	October	Surmont 2	The PM2.5 analyzer at Surmont 2 air monitoring station (AMS) operated for less than 90% of October 2022 due to a leak detected.	Routine daily system checks identified that the PM2.5 analyzer at the Surmont 2 AMS measured low PM2.5 concentrations compared to the PM2.5 analyzers at nearby stations. On October 6th, a WBEA technician visited the site to conduct an investigation. The investigation found that following chamber cleaning on September 30th, a connection within the analyzer had not been securely restored. The analyzer continued to display a correct flow, but the flow withdrawn at the inlet of the analyzer was inadequate. The connection was restored, the inlet flow was verified, and the operation of the analyzer was restored on October 6th at 14:00 MST.	The connection was reconnected, the inlet flow was verified, and the operation of the analyzer was restored on October 6th at 14:00 MST.
October 28, 2022	406185	October	Mannix	The wind speed and wind direction sensor at Mannix AMS operated less than 90% of October 2022, due to sensor not aligned properly.	On October 12, during a routine daily system check, the WBEA identified that the wind direction sensor readings at the 20-meter elevation, which had been installed on October 5, were not aligned with the sensors at the other elevations on the tower, as well as with sensors located nearby. On October 14, the third-party contractor that was required for the tower climb corrected the sensor orientation, which was then verified by the WBEA. Data for the incident period of October 5 through 14 was invalidated.	October 14, the third-party contractor that was required for the tower climb corrected the sensor orientation, which was then verified by the WBEA.
November 24, 2022	406044	October	Bertha Ganter - Fort McKay	The wind speed and wind direction (WS/WD) sensor at Bertha Ganter-Fort McKay air monitoring station (AMS) operated for less than 90% of October 2022 due to sensor wind direction sensor's unstable operations.	The WBEA identified that the WD sensor signal had been periodically flatlining throughout the month of October. On October 24, the wind direction sensor was replaced, as a preventative maintenance measure, to ensure data quality. During the data validation process, data from these events were invalidated for a total of 92 hours, resulting in an operational time of 87% for the month of October 2022.	The wind direction sensor was replaced on October 24.
November 24, 2022	407075	November	Mildred Lake	The Total Hydrocarbon (THC), Non-Methane Hydrocarbon (NMHC), and Methane (CH4) analyzer at the Mildred	This instrument is a semi-continuous gas chromatograph that requires the CH4 and NMHC peaks to remain within the data capture windows. In early November, these peaks shifted outside of the optimal data capture windows. Between November 5 and 9, field maintenance was conducted to rectify	The THC/NMHC/CH4 analyzer was replaced on November 17.

				Lake air monitoring station (AMS) operated for less than 90% of November 2022 due to unstable baseline operations.	the issue including recalibration, readjustment of the data capture window retention time, and replacement of carrier cylinder gas. Ultimately, the analyzer was replaced on November 11, however, inconsistent response resulted in another analyzer replacement on November 17. Normal operations resumed, after a multipoint calibration on November 17, at 14:25 MST. Data for this incident period was invalidated for a total of 565 hours of downtime.	
December 7, 2022	407468	November	Anzac	The Total Hydrocarbon (THC), Non-Methane Hydrocarbon (NMHC), and Methane (CH4) analyzer at the Anzac air monitoring station (AMS) operated for 79.5% of November 2022 due to unstable baseline operations.	In late November, the analyzer baseline shifted outside of the normal range. The WBEA conducted several troubleshooting and maintenance actions to identify and rectify the issue. Ultimately, the analyzer was replaced on November 30 and normal operations resumed at 12:00 MST. Data for the incident period of November 23 through 30 was invalidated for a total of 146 hours of downtime.	The THC/NMHC/CH4 analyzer was replaced on November 30.
December 7, 2022	407469	November	Anzac	The surface leaf wetness sensor at the Anzac air monitoring station (AMS) operated for 82% of November 2022 due to communication issues.	On November 7, a communication issue with the surface leaf wetness sensor was identified through the daily system check. The WBEA conducted several on-site troubleshooting actions to identify the issue and determined that a high voltage signal to the data logger was affecting the leaf wetness sensor. The source of the high voltage input was removed on November 9 and the sensor returned to normal operation at 13:00 MST. Data for the incident period was invalidated for a total of 128 hours of downtime.	The source of the high voltage input was removed on November 9.
January 23, 2023	408914	December	Lower Camp MET Tower	The 163-meter elevation WS/WD/VWS at Lower Camp Met Tower operated less than 90% of December 2022 due to ice fog events.	In December 2022, a flat-line period in the WS/WD/VWS sensors' output signal occurred. Ice fog interfering with the sonic sensors is considered to be the most likely cause and the sensor operation returned to normal once weather conditions changed. Data from the event was invalidated for a total of 175 hours, resulting in a monthly operational time of 76% for December 2022.	NA
January 24, 2023	408948	December	Mannix Met Tower	The 75-meter elevation WS/WD/VWS at Mannix Met Tower operated less than 90% of December 2022 due to ice fog events.	In December 2022, intermittent flat-line periods in the WS/WD/VWS sensors' output signal occurred. Ice fog interfering with the sonic sensors is considered to be the most likely cause and the sensor operation returned to normal once weather conditions changed. Data from these events were invalidated for a total of 98 hours, resulting in a monthly operational time of 87% for December 2022.	NA

iii. Provide real-time air quality data from continuous air monitoring stations to AEP real-time website in the required format.

Real-time air quality data is provided on a continual basis to AEP via a secure file upload from the WBEA Data Management System.

iv. Submit Monthly Ambient Air Monitoring Report to the Alberta Government and submit data to the AEP Air Data Warehouse.

Table 9 lists the Monthly Air Monitoring Reports and Quality Assured Data that were submitted electronically via the Electronic Transfer System (ETS) to Alberta Environment and Parks.

Table 9. Schedule of Monthly Air Monitoring Reports and Quality Assured Data Submissions

Monthly Air Monitoring Report and Quality Assured Data	Date Submitted
October 2022	November 30, 2022
November 2022	December 22, 2022
December 2022	January 31 2023

v. Provide WBEA data to citizens, industry members, regulatory bodies, and governments so that it can be used to make informed decisions on health, facility compliance, and environmental management and policy. All data management and accessibility outcomes will be in alignment with the OSM Program direction.

The WBEA provides data to stakeholders on the WBEA website, and through various reporting structures, including the Alberta Data Warehouse, community outreach activities, and through WBEA committee meetings. The WBEA engages with 40 member organizations representing Indigenous communities, industry, three levels of government, and non-government organizations. The WBEA works with AEP, specifically OSM Program staff, to ensure data management and accessibility outcomes are aligned.

vi. Any data not submitted to the Alberta Data Warehouse or not on the WBEA website will be provided directly to AEP in an agreed upon format within three months of data collection.

In the event that WBEA data is not submitted to the Alberta Air Data Warehouse or not posted on the WBEA website, the WBEA will provide the data to AEP in an agreed-upon format within three months of data collection.

vii. Submit the WBEA Ambient Annual Report 2021 – Volume 1 Continuous Data; Volume 2 Integrated Data; and Volume 3 Site Documentation.

The 2022 Annual Report was submitted on March 30, 2023.

(13) Participate in Oil Sands Monitoring (OSM) Program related to optimizing and improving the active air monitoring network in the Athabasca Oil Sands Region (AOSR).

i. Participate in OSM Program Committees, activities, workshops, and webinars.

From January to March 2023, the WBEA participated in the OSM Air and Deposition TAC meetings, as required.

ii. Implement any additions, deletions, or any other changes to the WBEA active air monitoring network consistent with approved OSM Program workplan(s).

In this quarter, there were no additions, deletions, or other changes to the WBEA active air monitoring network that were not previously identified.

iii. Document any additions, deletions, or any other changes to the WBEA continuous or time-integrated air monitoring network not indicated previously. Identify and describe any deviations from the approved OSM Program.

This quarter, there were no additions, deletions, or other changes to the WBEA continuous or time-integrated air monitoring network that were not previously identified.

iv. Participate in development of Adaptive Monitoring Approach for Active Air Monitoring Network.

From January to March 2023, the WBEA participated in the OSM Air and Deposition TAC meetings, as required.

3.2. Integrated Atmospheric Deposition Monitoring, 2022-2023 Work Plan Reference A-PD-6-2223

Atmospheric deposition is a critical pathway that links stressors to responses. Deposition monitoring data are used by the Oil Sands Monitoring Program to assess responses, and to help determine the source(s) of stressors. The primary objectives for atmospheric deposition long-term monitoring are to:

(1) Determine levels and changes of atmospheric deposition for specific pollutants that pose a likely risk for forest, river, lake, and wetland ecosystem function, (OSM Objective #1 and #2)

(2) Quantify the contribution of OS emissions to deposition of pollutants of concern, particularly at ecological monitoring sites, and provide these data to ecological effects monitoring projects, (OSM Objectives #1 and #2)

(3) Improve integration within and across themes, including continued model comparison and delivering deposition maps required by other themes. (OSM Objective #3)

This work plan monitors the spatial and temporal changes in deposition of pollutants of concern at relevant ecological monitoring sites: acidifying (e.g., nitrogen, sulphur, and base cations) and eutrophying (e.g., nitrogen) pollutants at forest and wetland sites; and contaminants (i.e., polycyclic aromatic compounds (PACs) and trace metals) at forest, wetland, and aquatic sites. This work plan continues to employ adaptive monitoring philosophies by adapting monitoring in light of recent findings. For example, the Terrestrial Ecological Effects Monitoring (TEEM) program has begun addressing 75 recommendations to improve deposition and effects monitoring in the AOSR. These recommendations are based on a comprehensive analysis of ~20 years of data.

Source apportionment analyses and chemical transport models can both determine the contribution of specific OS and non-OS sources to deposition. Deposition modelling and GIS techniques will support the estimation of deposition at ecological monitoring sites where deposition could be a significant pathway for stressors but is not actually measured and allow for determination of contribution of OS sources.

Integration is an on-going and iterative process. The focus for 2022/23 will be: (i) completion of model comparison to surface monitoring network data, (ii) improvement using data from past studies and long-term monitoring, (iii) configuration of the model and its inputs to provide deposition maps and output to estimate change and for adaptive monitoring purposes, (iv) further alignment of deposition monitoring methods and approaches across the OS Regions, and (iv) continued transitioning, as appropriate, to the adaptive monitoring framework including formalizing baseline and limits of change for ambient deposition surveillance monitoring and modelling.

The following objectives relate to ambient deposition and effects surveillance monitoring (and should not be conflated with the OSM Program Objectives noted previously):

1) Monitor air concentrations and deposition of nitrogen, sulphur, base cations, and ozone at forest and wetland sites in the Oil Sands Regions, as well as nitrogen and sulphur deposition at

two downwind transboundary sites. These data are directly used with data from Objective #2 for assessing stressor-response links, as well as for model comparison.

2) Monitor soil and vegetation parameters in the Athabasca and Cold Lake regions for indicators of vegetative changes and acidification. Soil measurements are integrated with measured and/or modelled deposition data to assess stressor-response linkages.

3) Monitor air concentrations and deposition of PACs at selected forest, wetland, and continuous air quality monitoring sites in all three Oil Sands regions. These data are needed by this TAC, as well as the Terrestrial TAC, for assessing stressor-response links and source attribution. The number of proposed sites has been reduced to adapt to the fact that PAC levels in ambient air have not changed in a statistically significant way since these measurements began in 2012.

4) Monitor temporal and spatial changes in deposition through regional collection of lichen samples for trace metals, PAHs, total nitrogen, and total sulfur. Data derived from this biomonitoring provides critical information about the extent of stressors entering ecosystems via the deposition pathway.

5) Use a modelling approach developed in FY2021/22 to produce total (wet + dry) deposition maps for trace metals. Emissions databases of trace elements and PACs will be split into OS-related and non-OS emissions to assess their relative contributions to the total concentration and atmospheric deposition of these pollutants in the whole region. NOTE: this is a different model than GEM-MACH, since GEM-MACH does not include trace metals.

6) Further improvement of model science based on evaluation results (e.g. based on work to date), including improvements to model emissions (for example, for odour event chemicals, PM2.5, and other VOCs, etc…), as well as the model's treatment of chemical processing within clouds, organic aerosol formation, total hydrocarbon deposition, sulphur and nitrogen deposition, and particle emissions. In addition, post-processing of model outputs to generate improved model deposition maps and for Adaptive Monitoring purposes.

7) Continue operating a monitoring site where all deposition measurement methods are co-located with an existing continuous monitoring station for the purpose of ensuring measurement comparability.

8) Test surrogate surface samplers, a method to quantify fugitive dust deposition, at a subset of air monitoring stations for the spring, summer and fall. If validated, these data will complement the wintertime snowpack measurements allowing for direct year-round quantification of fugitive dust deposition.

Q4 Milestones/Deliverables

(1) Conduct active air sampling via denuder system at WBEA monitoring sites.

January 2023:
Denuder and filter pack media changeout was conducted across the network between January 3rd-16th.

February 2023:
Denuder and filter pack media changeout was conducted across the network between November 1st- 8th.

March 2022:
Denuder and filter pack media changeout was conducted across the network between December 1st-8th.

(2) Conduct deposition monitoring via ion exchange resin (IER) sampling at WBEA monitoring sites on a seasonal schedule (column changeout in spring and fall).

The WBEA submitted a proposal to the TEEM Committee on December 8, 2022, to optimize the Ion Exchange Resin (IER) program. The network would be updated following the recommendations from the TEEM Publication Report "Recommendations Arising from the Analyses and Interpretations of 20 Years of Forest Health Monitoring" (Foster, 2020). The IER proposed changes were carried out during the fall IER changeout. The winter IERs were deployed in October 2022 and will remain in place until April 2023, when they will be collected, and the summer samples are deployed. The IERs were inspected for wildlife damage, and site maintenance was performed during October IER changeouts. Site conditions are assessed during site visits for other sampling activities.

(3) Evaluate remote ozone monitoring program.

The Remote Ozone Monitoring (OZN) program is part of a collection of integrated monitoring programs operated by the WBEA Deposition (DEP) monitoring group which provides continuous, 15-minute measurements of ozone and meteorological conditions in remote areas around the Wood Buffalo Region during the annual growing season - typically April through October.

Ozone is referred to as a "secondary pollutant" as it is not emitted directly into the air but is created by chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in the presence of ultraviolet radiation. As ozone is not emitted directly from a source, ozone creation and transportation can occur distances away from primary emission sources.

In late 2021, it was decided to revise and evaluate the remote ozone monitoring program. With the aid of the WBEA science advisors, an optimized remote ozone monitoring program proposal was created.

The TEEM Committee approved the new Remote Ozone Monitoring program proposal at the September 14, 2022 meeting. The program has two primary objectives:

i. Remote Ozone Monitoring.

The objective of the routine remote ozone monitoring is to measure the transformation of ozone that is created as a secondary pollutant from oil sands emissions. During this quarter, a comparison of two remote ozone analyzers from different manufacturers was conducted against the continuous ozone analyzer at the Athabasca Valley AMS. Three new sites will be established. Due to logistical issues beyond the WBEA's control, the Remote Ozone Monitoring program will commence in 2024.

ii. Stratosphere-Troposphere Exchange (STE) Ozone Monitoring.

The objective of STE ozone monitoring is to measure the ozone intrusion from the stratosphere into the troposphere through the tropopause. STEs occur in late winter/early spring in the AOSR and have been seen in the WBEA's continuous data. This will help determine the extent of stratospheric ozone contributions to ambient ozone concentrations in the region. This quarter, remote ozone analyzers with a cold weather modification were tested in the field for data quality and comparison. Due to logistical issues beyond the WBEA's control, the STE Ozone program will commence in 2024.

(4) Evaluate passive air sampling at WBEA monitoring sites.

The WBEA submitted a proposal to the TEEM committee on December 8, 2022 that the passive monitoring program be restarted in 2023. Before restarting the program, the WBEA reassessed the goals to determine the best path forward. As denuders give better data, the WBEA decided to expand the Denuder program and only use passive samplers for the species of interest that could not be collected via denuder. The passive program will change from 5 species of interest to 2, and from the spatially expansive program of the past to be co-located only at denuder sites. The program will consist of Nitrogen Dioxide (NO_2) and Ozone (O_3) collected by Ogawa passive samplers and will be co-located with WBEA denuder samplers. The proposal was passed, and sampling will begin in early 2023.

Sampling began in March 2023.

(5) Conduct tower inspections (meteorological and deposition).

Tower conditions are checked by WBEA Field Technicians during sampling and maintenance activities. Thorough checks of anchor points, guy wires, the tower

structure, and the fall protection systems are completed before climbing the tower structure.

The third-party contractor was on-site in February to complete tower repairs that were identified during the last formal inspection conducted in November 2022.

(6) Maintain air and deposition sampling equipment and site infrastructure.

Routine ongoing site maintenance is completed concurrently with deposition sampling activities.

(7) Complete required site-specific and/or program-specific documentation as per the WBEA or AMD requirements.

The development of site-specific documentation to satisfy WBEA requirements is an ongoing activity.

(8) Coordinate Community Engagement and Program Optimization opportunities.

The WBEA distributed a call for participation to its membership, on January 30, to re-establish the Traditional Knowledge Committee. A priority outcome for the Committee is community engagement on the Forest Health and Deposition programs, as well as guiding how Traditional Knowledge is represented in the WBEA to optimize and enhance its monitoring programs. Resources have been developed to be shared at community engagement sessions, and community members will be invited to visit monitoring sites, throughout the summer. The first meeting will be held on April 20.

(9) Deploy surrogate surfaces to a subset of air monitoring stations, across the range of particulate deposition, to test method.

This project is to collect samples using the Turf Surrogate Sampling method (one per site) at 2 sites in the WBEA network. The intent is to collect superior dry deposition data using this method based on trials conducted in the USA. The Turf Surrogate Surface (TSS) sampler consists of a disk-shaped airfoil supporting an artificial turf disk. The system is designed to collect dry-depositing gases and particles without altering the existing turbulent flow field. The WBEA has acquired a lab for sample preparation and analysis, which has a particularly complex procedure. The samplers were dropped off at the lab for preparation on October 19, 2022. The expected deployment is set for June 2023. This program will run for two summers (2023-2024) at Bertha-Ganter Fort McKay AMS and either Wapasu AMS or Stony Mountain AMS, co-located with precipitation collectors.

(10) Analysis of lichen samples that were collected as part of the 2021 regional lichen monitoring program.

All lichen samples collected as part of the 2021 regional lichen monitoring program were cleaned through the summer (approximately 182 samples). During the second quarter, the lichen analysis team was assembled and discussed the next steps for analysis. In the

third quarter, the lichen team was assembled, and they will coordinate the different analyses and processes that are required. This quarter, the inorganic sample was ground and sent to the respective labs for analysis; preliminary results from the lab have been received for sulphur and nitrogen. Organic samples are being prepared for grinding; still searching for a lab to complete organic samples analysis that will meet WBEA standards and MDLs.

(11) Analysis of needle and soil samples collected in 2021-22 from newly established Forest Health Monitoring sites.

Two new sites were established in 2021, sites 4015 and 4024. The soil samples analysis results were received on April 27, 2022. Lichen was also collected as part of the site establishment procedure and will be analyzed along with the Regional Lichen samples that were collected and described in the point above.

(12) Operate the regional meteorological monitoring network.

The Regional Meteorological Network (MET) is a part of a collection of integrated monitoring programs operated by the WBEA Deposition (DEP) monitoring group (formerly the Terrestrial Environmental Effects Monitoring [TEEM] group) and provides continuous, hourly measurements of meteorological conditions in remote areas around the Wood Buffalo region. The WBEA operates six meteorological towers throughout the region to collect data necessary for deposition calculations and modelling. The data is reviewed weekly and validated monthly. 2022 Meteorological data is available on the WBEA website. All meteorological data can be found at www.wbea.org/historical-monitoring-data.

(13) Catalogue and report data from the WBEA's integrated atmospheric deposition monitoring network.

i. Maintain the processing and validation of passive, ion exchange resin, dry deposition, and ozone data, and meta-data into WBEA's data management system.

Processing and validation are ongoing activities; current data availability for these parameters is listed below.

Table 10. Passive, Ion Exchange Resin, Dry Deposition, and Ozone Dataset Availability

Dataset	Timeframe
Denuder (dry deposition)	January 2015 to December 2021
Ion Exchange Resin	May 2008 to May 2020
Passive	HNO3 – April 2013 to January 2021 NH3 – December 2013 to January 2021 NO2, SO2, O3 - December 1999 to January 2021
Remote Ozone Continuous Data – Beaver River, Conklin, JP213	2015 Campaign 2016 Campaign 2017 Campaign 2018 Campaign

ii. Provide support for ongoing analysis and interpretation of deposition monitoring and modelling data.

The WBEA Science Advisors continued to support the OSM Model-Measurement Intercomparison. In addition, support for analysis and interpretation of WBEA data is provided upon request.

iii. Provide public access to program data via the WBEA website to citizens, industry members, regulatory bodies, and governments, so that it can be used to make informed decisions on health, facility compliance, and environmental management and policy. All data management and accessibility outcomes will be in alignment with the OSM Program direction.

WBEA time-integrated data and meteorological data has been collected and centralized within a database. A catalogue containing sample types, number of data points, and date ranges is available to view on the WBEA website. Time-integrated data and meteorological data can be refined and downloaded in a spreadsheet format from the website. The catalogue and download page are available at the following URL: https://wbea.org/network-and-data/integrated-data-search/. Data not yet available through the time-integrated database can be downloaded from: https://wbea.org/resources/reports-publications/air-monitoring-reports/data-downloads/

iv. Any data not submitted to the Alberta Air Data Warehouse or not on the WBEA website will be provided directly to AEP in an agreed upon format within three months of data collection.

If WBEA data is not submitted to the Alberta Data Warehouse or not posted on the WBEA website, the WBEA will provide the data to AEP in an agreed upon format within three months of data collection.

(14) Participate in Oil Sands Monitoring (OSM) Program related to optimizing and improving the atmospheric deposition monitoring network in the Athabasca Oil Sands Region (AOSR).

i. Participate in OSM Program Committees, activities, workshops, and webinars.

Refer to Section 13(i) for the WBEA's participation in OSM Program-related activities.

ii. Implement any additions, deletions, or any other changes to the WBEA atmospheric deposition monitoring network consistent with approved OSM Program workplan(s).

There were no changes to the WBEA atmospheric deposition monitoring network during this quarter that were not indicated previously.

iii. Document any additions, deletions, or any other changes to the WBEA atmospheric deposition monitoring network not indicated previously. Identify and describe any deviations from the approved OSM Program.

There were no changes to the WBEA atmospheric deposition monitoring network that were not indicated previously.

iv. Participate in development of Adaptive Monitoring Approach for Atmospheric Deposition Monitoring Network.

The WBEA Deposition Program has continued to employ adaptive monitoring philosophies by adapting monitoring to recent findings. The WBEA presented to its Terrestrial Ecological Effects Monitoring (TEEM) program Technical Committee the status of 75 recommendations to improve deposition and effects monitoring in the AOSR.

1. Appendix – Supplemental Information

Adhering to Contract Clauses

As per Clause 9, Personnel Replacement, of the WBEA Contracts with Alberta Environment and Parks, the WBEA is required to report any changes to the list of key personnel. The WBEA made no changes to its key personnel list during this reporting period. Any changes would be communicated to the AEP within five business days of the change.

As per Clause 21, Conflicts of Interest and Ethical Conduct, of WBEA's Contracts with Alberta Environment and Parks, the WBEA is required to report all potential or perceived conflicts of interest. The WBEA noted the following potential or perceived conflicts of interest during this reporting period. These conflicts are communicated to the AEP via email within five business days of each meeting.

Table 11. Declared Conflict of Interest

Data	Meeting	Member		Declared Conflict of Interest
March 10, 2023	GC Meeting	Janais Turuk	McMurray Métis	Works with Cold Lake First Nation (regarding item related to the OSM Program direction for CLFN to integrate with WBEA Berry Project)
		Ryan Abel	Fort McKay First Nation	Participates on OSM Air and Deposition TAC and Oversight Committee as alternate and Indigenous Caucus President of YMM Angel Flight Club
		Curtis Brock	Alberta Environment & Parks	Works for A-EPA
		Adi Adiele	Fort McKay Métis Nation	Participates on all six OSM TACs
		Sanjay Prasad	WBEA	Treasurer of YMM Angel Flight Club
March 22, 2023	AATC/OMP Meeting	David Spink	Fort McKay First Nation	Participates on OSM Air and Deposition TAC, participated in two Indigenous CBM project submissions that involve the WBEA (Fort McKay Metis Nation - odour project & Fort McKay First Nation - dust project)
		Nerissa Hernani	Syncrude	Represents COSIA on the Air and Deposition TAC
		Ryan Abel	Fort McKay First Nation	Participates on OSM Air and Deposition TAC, as alternate, member of the WBEA's GC, participates on the OSM Oversight Committee, as an alternate, and participates on the OSM Indigenous Caucus
		Danlin Su	Fort McKay First Nation	Participated in two Indigenous CBM project submissions that involve the WBEA (Fort McKay Metis Nation - odour project & Fort McKay First Nation - dust project)
		Charles Grimm	Suncor	Participates on OSM Air and Deposition TAC

March 15, 2022	GM Meeting	Luc White	ECCC	Works for ECCC
		Carla Davidson	Fort McKay First Nation	Participates on SIKIC and the Wood Buffalo Region Indigenous Sub-caucus
		Lori Cyprien	Athabasca Chipewyan First Nation	Participates on OSM Indigenous Community Based Monitoring Advisory Committee (ICBMAC)
		Ryan Abel	Fort McKay First Nation	Participates on OSM Air and Deposition TAC and Oversight Committee as alternate and Indigenous Caucus President of YMM Angel Flight Club
		Lindsay Wong	Mikisew Cree First Nation	Participates on OSM Data Management TAC as an alternate
		Curtis Brock	Alberta Environment & Parks	Works for A-EPA
		Peter Fortna	CRDAC	Participates on OSM ICBMAC and Indigenous Caucus
		Adi Adiele	Fort McKay Métis Nation	Participates on all six OSM TACs
		Chris Heavy Shield	Chipewyan Prairie Dene Nation	Participates on the OSM Oversight Committee
		Queenie Gray	Parks Canada	Participates on Wetlands TAC
		Lindsay Sutton	Teck Resources	Participates on OSM Steering Committee as an alternate
		Todd White	Teck Resources	Participates as Steering Committee Lead for COSIA Water, Land, and Monitoring
March 29, 2023	TEEM Committee Meeting	Carla Davidson	Fort McKay First Nation	Participates on SIKIC and OSM Air and Deposition TAC
		David Spink	Fort McKay First Nation	Participates on OSM Air and Deposition TAC
		Nerissa Hernani	Syncrude	Participates on OSM Air and Deposition TAC
		Charles Grimm	Suncor	Participates on OSM Air and Deposition TAC
		Ken Foster	Owl Moon	Participates on OSM TBM TAC as PI for the MAPS Program
		Sunhee Cho	AEP	Participates on OSM Air and Deposition TAC

Appendix

Summary of Stations & Parameters in the WBEA Network

The table below provides a listing of stations with their names and corresponding WBEA identification number and the air quality parameters measured by continuous methods at each site. Parameters measured include hydrogen sulphide (H_2S), total reduced sulphur (TRS), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), total hydrocarbons (THC), methane (CH_4), non-methane hydrocarbons (NMHC), ammonia (NH_3), carbon monoxide (CO), and carbon dioxide (CO_2). Sites are categorized as industrial or community, based on the setting in which they are located.

Table 12. Summary of stations and parameters measured continuously at WBEA sites.

WBEA ID	TYPE	STATION NAME	SO_2	$NO/NO_2/NO_X$	O_3	$PM_{2.5}$	TRS	H_2S	THC	Methane NMHC	CO	CO_2	NH_3
1	COMMUNITY	BERTHA GANTER-FORT MCKAY	X	X	X	X	X	X	X	X	X	X	X
2	COMPLIANCE	MILDRED LAKE	X					X	X	X			
3	METEOROLOGICAL	LOWER CAMP MET TOWER											
4	COMPLIANCE	BUFFALO VIEWPOINT	X	X	X	X		X	X	X			
5	COMPLIANCE/ METEORLOGICAL	MANNIX	X					X	X	X			
6	COMMUNITY	PATRICIA MCINNES	X	X	X	X	X		X	X			X
7	COMMUNITY	ATHABASCA VALLEY	X	X	X	X	X		X	X	X		
8	COMMUNITY/ COMPLIANCE	FORT CHIPEWYAN	X	X	X	X	X				X	X	
9	ATTRIBUTION	BARGE LANDING	X	X		X	X		X	X			
11	COMPLIANCE	LOWER CAMP	X					X	X	X			
13	COMPLIANCE/ ATTRIBUTION	FORT MCKAY SOUTH	X	X	X	X	X		X	X			
14	COMPLIANCE/ COMMUNITY	ANZAC	X	X	X	X	X		X	X			
17	COMPLIANCE	WAPASU	X	X	X	X		X	X				
18	BACKGROUND	STONY MOUNTAIN	X	X	X	X	X		X	X	X	X	
19	COMPLIANCE	FIREBAG	X	X				X	X				
20	COMPLIANCE	MACKAY RIVER	X	X				X	X				
21	COMMUNITY	CONKLIN	X	X	X	X	X		X	X			
22	COMMUNITY	JANVIER	X	X	X	X	X		X	X			
23	COMPLIANCE	FORT HILLS	X	X		X	X		X	X			
25	EMERGENCY RESPONSE	WASKOW OHCI PIMATISIWIN	X					X					
26	COMPLIANCE	CHRISTINA LAKE	X	X				X					
27	COMPLIANCE	JACKFISH 2/3	X	X				X					
29	COMPLIANCE	SURMONT 2	X	X		X		X	X				
30	COMPLIANCE	ELLS RIVER	X	X		X	X		X	X			
501	COMPLIANCE	LEISMER	X	X				X					
505	COMPLIANCE	SAWBONES BAY	X	X				X					
506	COMPLIANCE	JACKFISH 1	X	X				X					

WBEA ID	TYPE	STATION NAME	SO_2	$NO/NO_2/NO_X$	O_3	$PM_{2.5}$	TRS	H_2S	THC	Methane NMHC	CO	CO_2	NH_3
508	COMPLIANCE	KIRBY NORTH	X	X				X	X				

The following table provides a listing of stations and meteorological parameters measured by continuous methods. Parameters measured include ambient temperature, relative humidity, wind speed, wind direction, vertical wind speed, solar radiation, precipitation, and leaf wetness.

Table 13. Summary of stations and meteorological parameters measured continuously at WBEA sites.

WBEA ID	TYPE	STATION NAME	Temperature	RH	BP	Wind Speed	Wind Direction	Vertical Wind Speed	Solar Radiation	Precipitation	Leaf Wetness
1	COMMUNITY	BERTHA GANTER-FORT MCKAY	X	X		X	X		X	X	X
2	COMPLIANCE	MILDRED LAKE	X	X		X	X				
3	METEOROLOGICAL	LOWER CAMP MET TOWER	X	X		X	X	X			
4	COMPLIANCE	BUFFALO VIEWPOINT	X	X		X	X				
5	COMPLIANCE/ METEORLOGICAL	MANNIX	X	X		X	X	X			
6	COMMUNITY	PATRICIA MCINNES	X	X		X	X				
7	COMMUNITY	ATHABASCA VALLEY	X	X	X	X	X				
8	COMMUNITY/ COMPLIANCE	FORT CHIPEWYAN	X	X		X	X		X		X
9	ATTRIBUTION	BARGE LANDING	X	X	X	X	X				
11	COMPLIANCE	LOWER CAMP	X	X		X	X				
13	COMPLIANCE/ ATTRIBUTION	FORT MCKAY SOUTH	X	X		X	X				
14	COMPLIANCE/ COMMUNITY	ANZAC	X	X		X	X				X
17	COMPLIANCE	WAPASU	X	X		X	X			X	
18	BACKGROUND	STONY MOUNTAIN	X	X		X	X		X	X	X
19	COMPLIANCE	FIREBAG	X	X		X	X				
20	COMPLIANCE	MACKAY RIVER	X	X		X	X			X	
21	COMMUNITY	CONKLIN	X	X		X	X				
22	COMMUNITY	JANVIER	X	X		X	X				
23	COMPLIANCE	FORT HILLS	X	X		X	X				
25	EMERGENCY RESPONSE	WASKOW OHCI PIMATISIWIN	X	X		X	X				
26	COMPLIANCE	CHRISTINA LAKE	X	X		X	X				
27	COMPLIANCE	JACKFISH 2/3	X	X		X	X				
29	COMPLIANCE	SURMONT 2	X	X		X	X				
30	COMPLIANCE	ELLS RIVER	X	X		X	X		X		
501	COMPLIANCE	LEISMER	X	X		X	X				
505	COMPLIANCE	SAWBONES BAY	X	X		X	X				
506	COMPLIANCE	JACKFISH 1	X	X		X	X				
508	COMPLIANCE	KIRBY NORTH	X	X		X	X				

The table below provides a listing of stations and air quality parameters measured by integrated methods. Parameters measured include volatile organic compounds (VOC) and reduced sulphur compounds (RSC), particulate matter less than 2.5 µm aerodynamic diameter ($PM_{2.5}$) and associated metals and ions, particulate matter less than 10 µm aerodynamic diameter (PM_{10}) and associated metals and ions, polycyclic aromatic hydrocarbons (PAH), dichotomous samples, speciated denuder sampler (SASS), and precipitation samples.

Table 14. Summary of parameters measured using integrated methods at WBEA sites.

WBEA ID	TYPE	STATION NAME	VOC	$PM_{2.5}$	ECOC	PM_{10}	PAH	PRECIP	Dustfall	TSP
1	COMMUNITY	BERTHA GANTER-FORT MCKAY	X	X	X	X	X	X	X	
6	COMMUNITY	PATRICIA MCINNES	X	X		X	X		X	
7	COMMUNITY	ATHABASCA VALLEY	X	X		X	X		X	
8	COMPLIANCE/COMMUNITY	FORT CHIPEWYAN	X	X		X	X			
9	ATTRIBUTION	BARGE LANDING	X							
13	COMPLIANCE/ ATTRIBUTION	FORT MCKAY SOUTH	X			X				
14	COMPLIANCE/COMMUNITY	ANZAC	X	X		X	X		X	
17	COMPLIANCE	WAPASU			X			X		
18	ENHANCED DEPOSITION/ BACKGROUND	STONY MOUNTAIN			X			X		
21	COMMUNITY	CONKLIN	X	X		X	X		X	
22	COMMUNITY	JANVIER	X	X		X	X		X	
23	COMPLIANCE	FORT HILLS	X			X				
30	COMPLIANCE	ELLS RIVER	X			X				X

The following table provides a listing of stations and air quality parameters measured by continuous/semi-continuous methods. Parameters measured include aethalometer (black carbon), visibility sensor, particulate bound PAH, sulfur GC, and VOC GC.

Table 15. Summary of stations and parameters measured continuously/semi-continuously at WBEA sites.

WBEA ID	TYPE	STATION NAME	AE33 Aethalometer	Visibility Sensor	Wind Profiler/RASS	Sulfur GC	VOC GC
1	COMMUNITY	BERTHA GANTER-FORT MCKAY	X			X	X
4	COMPLIANCE	BUFFALO VIEWPOINT		X			
7	COMMUNITY	ATHABASCA VALLEY					
11	COMPLIANCE	BUFFALO VIEWPOINT		X			
17	COMPLIANCE	WAPASU			X		
18	ENHANCED DEPOSITION/ BACKGROUND	STONY MOUNTAIN	X				
25	EMERGENCY RESPONSE	WASKOW OHCI PIMATISIWIN					

The following table provides a listing of stations and air quality parameters measured by continuous/semi-continuous methods for research and development purposes. Parameters measured include direct ammonia measurement technique, direct NO_2 measurement technique and comparison with NO_y and standard NO_2 measurement techniques, particulate bound PAH, and continuous PM_{10} measurement (non-EPA FEM method).

Table 16. Summary of stations and parameters measured continuously/semi-continuously at WBEA sites.

WBEA ID	TYPE	STATION NAME	NH_3 Study	NO_2/NO_y	Particulate bound PAH	Continuous PM_{10}
6	COMMUNITY	PATRICIA MCINNES	X*			
7	COMMUNITY	ATHABASCA VALLEY		X*		
30	COMPLIANCE	ELLS RIVER				X*
25	EMERGENCY RESPONSE	WASKOW OHCI PIMATISIWIN			X*	

* Monitoring data used for research and development purposes only.

Figure 1 shows the most recent map of the WBEA Terrestrial Monitoring Network, while Figure 2 shows the most recent map of active stations in the Continuous Monitoring Network.

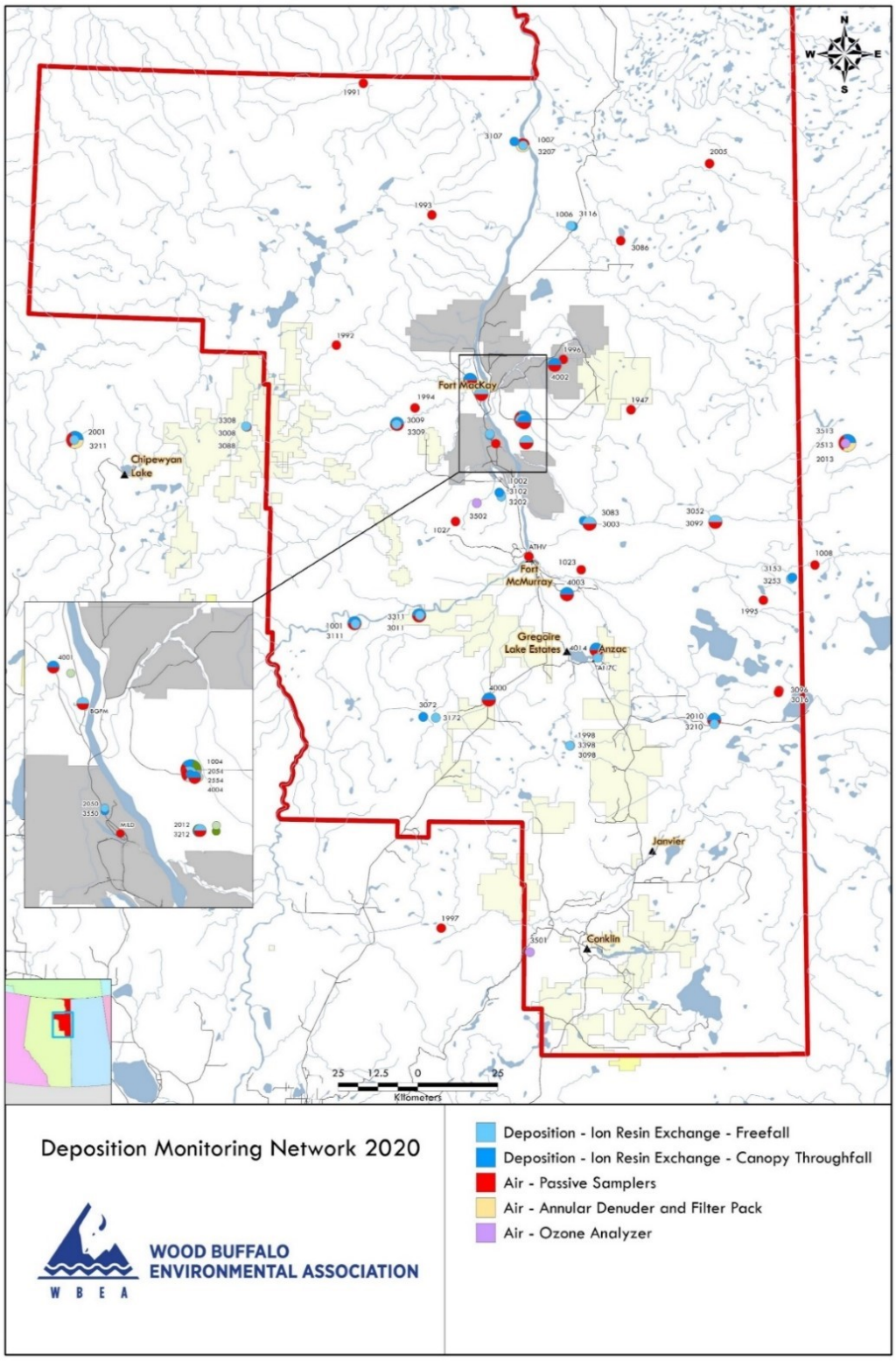

Figure 1. The WBEA Terrestrial Monitoring Network.

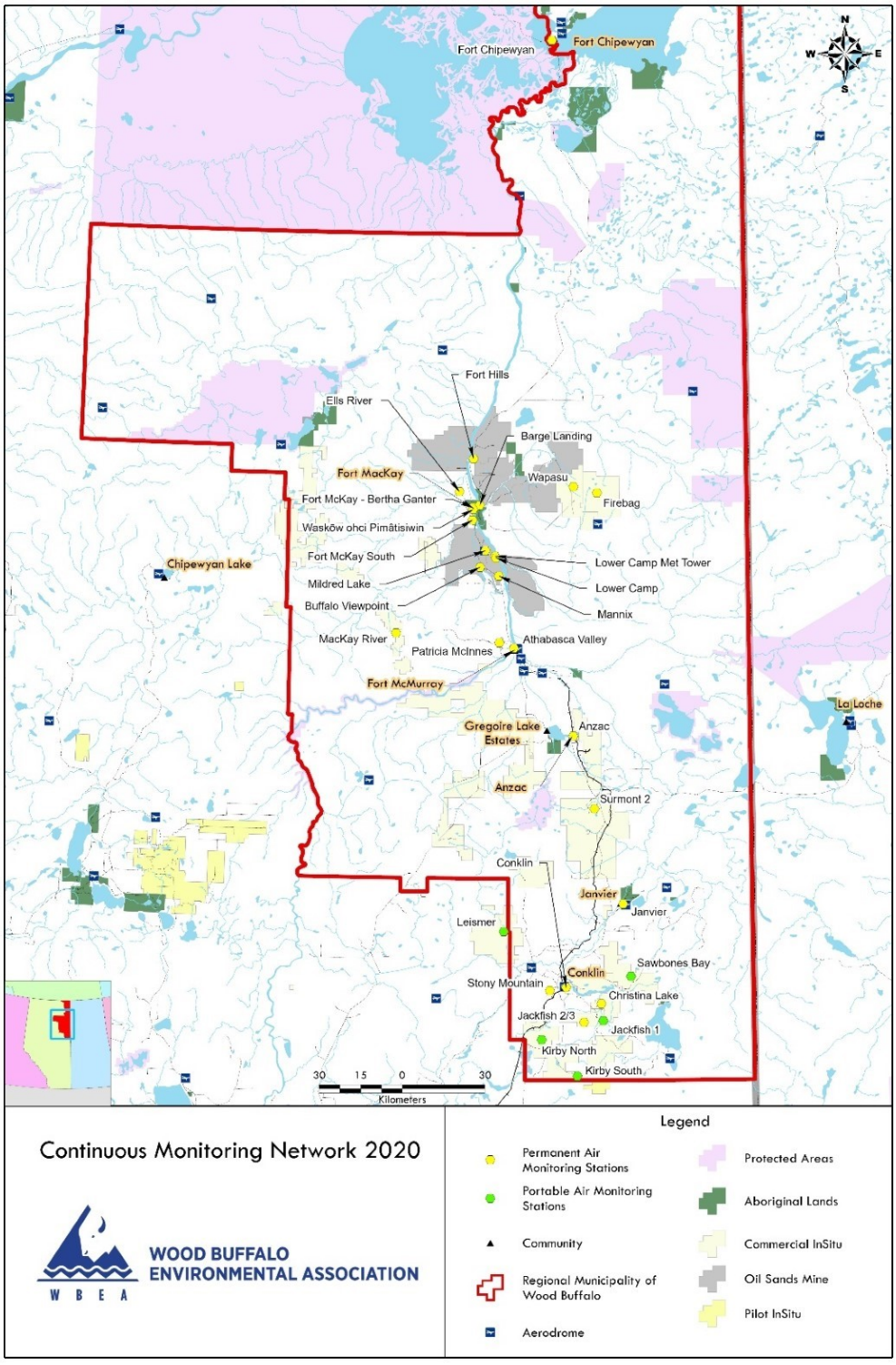

Figure 2. The WBEA Continuous Monitoring Network.