Hamilton

COMMUNICATION UPDATE

TO:	Mayor and Members Board of Health
DATE:	February 16, 2024
SUBJECT:	High-Density Passive Air Quality Monitoring in the City of Hamilton (City Wide)
WARD(S) AFFECTED:	City Wide
SUBMITTED BY: **SIGNATURE:**	Kevin McDonald Director, Healthy Environments Division Public Health Services

This communication provides the Board of Health with an update regarding the findings of the "High-Density Passive Air Quality Monitoring in the City of Hamilton" study conducted by University of Toronto researchers, which aimed for neighbourhood scale measurements and assessment of differences in air quality across the city.

Summary
University of Toronto Professor Matt Adams and his research team conducted an air quality monitoring project in the City of Hamilton from February 2022 to May 2023. The project collected air samples at the level of neighbourhood by selecting air sampling sites based on geographical and population characteristics.

The findings from this project align with monitored air pollution data from the Hamilton Air Monitoring Network, modelled data obtained from the Hamilton Airshed Modelling System, and with Health Canada's 2023 findings that identified industry, home firewood burning, and transportation as the sources contributing to most of the air pollution associated with premature mortality.

Overall, the project supports the current understanding of Hamilton's airshed by adding to existing air quality information. It also reinforces the need for public education and the development of strategies focusing on industrial, home firewood burning, and transportation sources.

Background

Previous research conducted in the City of Hamilton, focusing on air quality and health protection, identified the need for air quality data at the neighbourhood level.[1] This University of Toronto project aimed to provide this kind of air quality data by selecting air pollution sampling sites based on geographical and population characteristics. The University of Toronto researchers conducted a two-year project in 2022 and 2023 to evaluate the local air quality in Hamilton. Sampling was conducted across the entire city, guided by land use and socioeconomic characteristics of the population.

As a partner in this project, Environment Hamilton organized four public sessions during the project. These sessions aimed to inform the community about the study, the resulting data, and the implications for human health. The dates and topics covered in each session included:

- December 15, 2021, Public Session No. 1: Introduction to the project and an opportunity for public input and feedback;
- April 12, 2022, Public Session No. 2: An expert panel discussion about how air quality is regulated in Ontario;
- January 30, 2023, Public Session No. 3: An update on the project's progress; and,
- July 11, 2023, Public Session No. 4: Presentation of project's results and next steps.

A sampling site was located in each ward (15 sample locations). For quality assurance purposes, eight additional sites were selected to collocate with active monitors including those overseen by of the Ministry of Environment, Conservation and Parks. An additional 45 sampling sites were chosen, based on socioeconomic conditions, land use conditions, and areas identified via public feedback.

The six air pollutants measured from February 2022 to May 2023 were benzene (C_6H_6), nitrogen dioxide (NO_2), oxides of nitrogen (NO_X), nitric oxide (NO), ground-level ozone (O_3), and sulphur dioxide (SO_2). In addition, the project measured polycyclic aromatic hydrocarbons (PAHs), including benzo[a]pyrene, during two months of the summer at 28 locations in Hamilton and West Burlington. This group of air pollutants were selected because of community and government concerns, as identified by Clean Air Hamilton.[2]

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[1] Radisic, S., Newbold, K.B. Factors influencing health care and service providers' and their respective "at risk" populations' adoption of the Air Quality Health Index (AQHI): a qualitative study. BMC Health Serv Res 16, 107 (2016). Available from: https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-016-1355-0

[2] Clean Air Hamilton. 2021 Air Quality Progress Report March 2023. Available from: https://pub-hamilton.escribemeetings.com/filestream.ashx?DocumentId=353788

Passive sampling techniques were used for each pollutant, providing high-quality data, comparable to Environmental Protection Agency Federal Equivalent Method Instruments for time-integrated sampling. The number of collected air pollution samples included: 370 samples for ground-level ozone (O_3) and nitrogen dioxide (NO_2), 356 for oxides of nitrogen (NO_X) and 368 for sulphur dioxide (SO_2); all samples were two weeks long. The mean concentration values were 29 parts per billion for ground-level ozone (O_3), 7 parts per billion for nitrogen dioxide (NO_2), 13 parts per billion for nitrogen (NO_X), and 2 parts per billion for sulphur dioxide (SO_2). The project also reports that benzene was not detected as it was found to not exceed the method detection limits. Although the measured two-week-long mean concentration values of the pollutants are not directly comparable to the Ontario Ambient Air Quality Criteria or the Canadian Ambient Air Quality Standards, it is useful to be aware that the values were below both the Ambient Air Quality Criteria and Canadian Ambient Air Quality Standards.

The project also indicates that the total concentration of Polycyclic Aromatic Hydrocarbons, excluding naphthalene, averaged 18 nanograms per cubic meter (ng/m^3) across all sites. Polycyclic Aromatic Hydrocarbons have been mainly associated with lung and skin cancer.[3] While also not directly comparable to the standards, this value was above the 24-hour benzo[a]pyrene Ambient Air Quality Criteria and Canadian of 0.05 nanograms per cubic meter (ng/m[4]) The sites with the highest concentrations of Polycyclic Aromatic Hydrocarbons were typically located in the downtown core with total Polycyclic Aromatic Hydrocarbons concentrations averaging 30 nanograms per cubic meter (ng/m^3) and those with the lowest concentrations typically found on the city's suburban areas averaged 12 nanograms per cubic meter (ng/m^3). This finding is similar to another study conducted in Toronto that found benzo[a]pyrene levels in the urban area exceeded the 24-hour Ambient Air Quality Criteria 40% of the time and was typically found to be 5 times higher than that in the semi-urban area.[4] Furthermore, a Canada-wide study found concentrations of polycyclic aromatic hydrocarbons (PAHs) were highest near industrial emitters and lowest in the Arctic.[5] Hence, benzo[a]pyrene exceedances are an issue in many cities in Canada and are not unique to Hamilton. Research has shown that in addition to industrial activities, the main sources of

[3] CAREX Canada. PAHs Profile. 2024. Available from: https://www.carexcanada.ca/profile/polycyclic_aromatic_hydrocarbons/

[4] Maryam Moradi, Hayley Hung, James Li, Richard Park, Cecilia Shin, Nick Alexandrou, Mohammed Asif Iqbal, Manpreet Takhar, Arthur Chan, and Jeffrey R. Brook. Environmental Science & Technology 2022 56 (5), 2959-2967. Available from: https://pubs.acs.org/doi/epdf/10.1021/acs.est.1c04299

[5] Alexandra Tevlin, Elisabeth Galarneau, Tianchu Zhang, Hayley Hung. Polycyclic aromatic compounds (PACs) in the Canadian environment: Ambient air and deposition, Environmental Pollution, Volume 271, 2021. Available from: https://www.sciencedirect.com/science/article/pii/S0269749120369219

polycyclic aromatic hydrocarbons (PAHs) include forest fires, incomplete combustion of fossil fuels, and wood burning.[4]

The project's examination of the air pollution distribution in the City of Hamilton found that ozone concentrations were highest in the rural areas of Hamilton and more likely to be associated with higher socioeconomic status. Nitrogen dioxide, sulphur dioxide and Polycyclic Aromatic Hydrocarbons, including benzo[a]pyrene, were found to be elevated near the industrial core of the city and more likely to be associated with lower socioeconomic status. These findings are consistent with the findings from the Toronto study noted above.[5]

As expected, the project found that nitrogen dioxide was elevated near major roads. In addition, sulphur dioxide was found to be at the highest concentrations near the Hamilton Beach area. These study findings are consistent with data obtained from the Hamilton Airshed Modelling System[6], identifying transportation and industrial sources as primary emission sources in the City of Hamilton, and with Health Canada's 2023 report that identified industry, home firewood burning, and transportation as the sources contributing to the majority of air pollution associated with premature mortality.[7]

Because, research studies, conducted on a global scale, have identified outdoor air pollution as hazardous to human health[8], and data collected in the city has identified local, as well as, transboundary sources and contributions to air pollution in Hamilton. Hamilton Public Health Services recognizes the importance of using this information to improve Hamilton's air quality. Accordingly, Hamilton Public Health Services prioritizes continued work with the Ministry of Environment Conservation and Parks via regular communications and committee meeting such as Clean Air Hamilton to "share expertise and information related to" decreasing industrial contributions in the community.[9] In

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[6] Hamilton Board of Health. April 16, 2018. Hamilton Airshed Modelling System (HAMS). Available from:
https://pub-hamilton.escribemeetings.com/filestream.ashx?DocumentId=149955
https://pubhamilton.escribemeetings.com/filestream.ashx?DocumentId=149957

[7] Health Canada. 2023. Health Impacts Of Air Pollution From Transportation, Industry And Residential Sources In Canada, Estimates of premature mortality and morbidity outcomes at nation al, provincial, territorial, and air zone levels. Available from: https://publications.gc.ca/collections/collection_2023/sc-hc/H144-112-2022-eng.pdf

[8] Global Burden of Diseases Risk Factor Collaborators (2019). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019, The Lancet, 396, 1223-1249, Available online at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30752-2/fulltext

[9] Ontario. Ministry of Health and Long-Term Care. Ontario public health standards: requirements for programs, services, and accountability, 2021. Available from: https://files.ontario.ca/moh-ontario-public-health-standards-en-2021.pdf

addition, Hamilton Public Health Services reviews and comments on the City's Transportation Master Plan to "balance all modes of transportation [and] become a healthier city" [10] and brings awareness to health hazards associated with home firewood burning[11] along with applicable local by-laws.[12]

Overall, this University of Toronto project contributes to the understanding of Hamilton's airshed by adding to existing air quality information in the City along with further reinforcing the need for continuing public education and the development of strategies focusing on air pollution sources such as industrial, transportation, and home firewood burning.

Should you require further information about this Communication Update, please do not hesitate to contact Matthew Lawson, Manager, Health Hazards and Vector Borne Diseases at Ext. 5823 or matthew.lawson@hamilton.ca.

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" to Board of Health Communication Update: (2024-02-16) High Density Passive Air Quality Monitoring In The City Of Hamilton

[10] City of Hamilton. 2022. Transportation Master Plan.
Available from: https://www.hamilton.ca/sites/default/files/2022-08/masterplan-transportation-update-2018.pdf

[11] City of Hamilton. Climate Change and Air Quality: Air Quality of Everyday Activities. 2022. Available from: https://www.hamilton.ca/people-programs/public-health/environmental-health-hazards/climate-change-air-quality#air-quality-everyday-activities

[12] City of Hamilton. BY-LAW NO. 02-283 To Regulate Open Air Burning. Available from: https://www.hamilton.ca/sites/default/files/2022-01/02-283.pdf

HIGH DENSITY PASSIVE AIR QUALITY MONITORING IN THE CITY OF HAMILTON

Elysia Fuller-Thomson, MSc & Matthew Adams, Ph.D

Executive Summary

A two-year study was conducted in Hamilton to evaluate the local air quality. Sampling was conducted across the entire city, with a focus on areas of concern from the public, stratified by land use and socioeconomic characteristics of the population.

We measured six air pollutants: benzene (C_6H_6), nitrogen dioxide (NO_2), oxides of nitrogen (NO_X), nitric oxide (NO) (available as $NO_X - NO_2$), ground-level ozone (O_3), and sulphur dioxide (SO_2) during each season in Hamilton. We also measured polycyclic aromatic hydrocarbons (PAHs) during the summer, including benzo[a]pyrene. These pollutants were selected due to community and government concerns, as noted in past Clean Air Hamilton Reports. Passive sampling techniques were used for each pollutant, providing high-quality data comparable to EPA Federal Equivalent Method Instruments for time-integrated sampling.

Air pollution sampling sites were chosen to capture the city's geographical and population characteristics variation. For C_6H_6, NO_2, NO_X, NO, O_3, and SO_2, one site was first located within each ward, which was selected to represent average land use conditions (15 sample locations) and eight sites were collocated with active monitors (e.g. MECP air monitors) for quality assurance purposes. An additional 45 sampling sites were chosen based on varying socioeconomic conditions, land use conditions and areas of community concern. PAHs were sampled only once in the summer for two months at 28 locations in Hamilton and West Burlington.

Environment Hamilton organized four public sessions during the project to communicate with the public. These sessions aimed to inform the community about the study, the resulting data, and its implications for human health. The sessions covered the following topics:

- Public Session No. 1: Introduction to the project and an opportunity for public feedback.
- Public Session No. 2: An expert panel discussion on how air quality is regulated in Ontario.
- Public Session No. 3: An update on the project's progress.
- Public Session No. 4: Presentation of project results and the next steps.

The number of collected air pollution samples was high, with 370 samples obtained for O_3 and NO_2, 356 for NO_X and 368 for SO_2; all samples were two weeks long. The mean concentration values were 29 ppb for O_3, 7 ppb for NO_2, 13 ppb for NO_X, and 2 ppb for SO_2. Benzene samples did not exceed method detection limits.

Ozone air pollution concentrations were highest in the rural areas of Hamilton, contrasting the patterns of other pollutants. Nitrogen dioxide, sulphur dioxide, and PAHs (including benzo[a]pyrene) were elevated near the industrial core and generally reduced in concentration as you move away from it. Sulphur dioxide demonstrated its highest concentrations along the Burlington Beach Strip. Nitrogen dioxide was additionally elevated near major roads in the city.

Comparing air pollution concentrations with measures of marginalization suggested a pattern for NO_2 and less so for PAHs, where only people of low marginalization risk lived in the least polluted areas. All measures of marginalization were present for higher pollution areas.

Acknowledgements

We need to acknowledge many individuals whos contributions allowed this research to be completed. From the University of Toronto, we would like to acknowledge Jack Cheng, Jenny Siliang Cui, Amanda E. Norton, Kerstyn Lutz, Simran Persaud, Scarlett Rakowska, Priya Patel, Sophie S. Roussy, Sarah Faisal, Charity D. Reyes, Gabrielle N.R. Olmedo, and Yanchuan Shao who all contributed to the research support during the project. At Environment Canada, we would like to acknowledge Jacob Mastin, Jasmin Schuster Ph.D. and Tom Harner Ph.D.; without them, the PAH analysis would not have been possible.

We recognize the financial support for the project from Health Canada. We also recognize the Natural Sciences and Engineering Research Council of Canada and the University of Toronto Centre for Urban Environments for financially supporting the additional PAH sampling.

Lynda Lukasik and Ian Borsuk from Environment Hamilton were critical project team members who ensured community support and integration.

Lastly, the project would have never occurred without the support from Public Health – City of Hamilton, especially the contributions from Shelley Rogers, Sally Radisic Ph.D., Trevor Imhoff, and Matthew Lawson.

Table of Contents

1. Introduction

1.1 Background

Hamilton is a mid-sized city in southern Ontario with a population of over half a million people. Historically, its economy has been industrial since it was founded, with a strong presence in the steel industry. Hamilton's land use is diverse, with an industrial core, high-density urban core, and significant suburban area (often separated by the Niagara Escarpment) that transitions to low-density residential and rural properties as one moves away from Lake Ontario. In addition to the varying land uses, Hamilton has many major transportation networks. Multiple freeways pass through the city, including an international airport and an active waterfront port. These mixed land use and transportation networks cause spatially varying air pollution concentrations in Hamilton at a relatively small scale. These spatial variations have been observed with mobile air pollution sampling, but those data are only brief snapshots in time, and longer-term observation is required to understand air pollution patterns.

The globalization of industrial manufacturing in the late twentieth century significantly impacted Hamilton's economy and the prosperity of residents and businesses, particularly concerning long-term unemployment. Several neighbourhoods in the downtown core are near industrial land uses, and these neighbourhoods have, on average, lower incomes, educational levels, and poorer health outcomes. These conditions could result in an inequitable distribution of air pollution exposure contrasted with socioeconomic indicators.

The City of Hamilton has been active in understanding the impact of air pollution and working towards its reduction through Clean Air Hamilton. The City of Hamilton operates two air pointers periodically relocated throughout the City to monitor air quality levels in neighbourhoods. These devices produce excellent technical results but have logistical siting limitations due to their size and their need for an electrical outlet. In practice, this means that downtown neighbourhoods with less open and green space have no or few practical siting options for those air quality monitors. For several years, Hamilton has been looking into smaller, more portable air quality monitoring options to understand better air quality issues in those neighbourhoods closest to industrial and commercial land uses.

1.2 Objectives and Scope

The objective of this environmental justice air quality study in Hamilton, Ontario, is to comprehensively assess and develop a knowledge base to address disparities in air quality within the region, focused on ensuring equitable distribution of environmental benefits and burdens, comparing pollution to measures of marginalization.

We are using the Ontario Marginalization Index to calculate the level of community marginalization, where marginalization entails excluding individuals and groups, hindering their full engagement in society. Those marginalized may encounter obstacles in obtaining meaningful employment, suitable housing, education, recreational opportunities, clean water, healthcare services, and other essential social determinants of health. The repercussions of marginalization are profound, affecting both community and individual health (Public Health Ontario, 2021). Air pollution health risk communication tools, such as Canada's Air Quality Health Index (AQHI), use the term “at-risk” for individuals more likely to experience adverse health outcomes from elevated air pollution concentrations. At-risk populations include seniors, pregnant people, infants and young children, people who work outdoors, people involved in strenuous outdoor exercise, and people with an existing illness or chronic health conditions, such as cancer, diabetes, mental illness and lung or heart conditions (Environment and Climate Change Canada, 2016).

Marginalization measures community-level risk factors, and at-risk populations are individual-level characteristics, both potentially leading to greater adverse health outcomes.

This study aims to achieve the following specific objectives, incorporating site selection based on air pollution characteristics and passive air sampling:

1. Targeted Site Selection: Identify and select study sites within Hamilton based on air pollution-specific characteristics, including areas with known or suspected sources of pollution and areas where marginalized communities are disproportionately affected. This targeted approach ensures that the study addresses critical areas with the greatest need for environmental justice improvements.

2. Passive Air Sampling: Implement passive air sampling techniques to collect data on air pollutant concentrations at various study sites, allowing for a comprehensive and cost-effective assessment of air quality disparities over time.

3. Environmental Equity Analysis: Examine contemporary factors contributing to air quality disparities, including land use, industrial zoning, transportation infrastructure, and policy decisions, emphasizing environmental justice concerns.

4. Community Engagement: Engage with local communities, environmental justice organizations, and stakeholders to ensure that their perspectives, concerns, and experiences are integrated into the study and that the findings are communicated effectively to affected populations.

5. Data Transparency and Accessibility: Utilize a user-friendly platform for sharing air quality data, findings, and recommendations with the public to promote transparency, public awareness, and community empowerment.

6. Environmental Justice Framework: Apply an environmental justice framework throughout the study, emphasizing fairness, equity, and meaningful participation in decision-making processes related to air quality management.

7. Collaboration: Collaborate with local governmental agencies, research institutions, environmental organizations, and other stakeholders to leverage expertise and resources for a comprehensive, community-driven approach to air quality improvement.

By incorporating targeted site selection and passive air sampling techniques into the study design, these objectives aim to provide a more precise and data-driven assessment of air quality disparities in Hamilton, thereby contributing to more effective environmental justice initiatives and equitable access to clean air.

2. Methodology

2.1 Site Selection

The study area covered all fifteen Wards of Hamilton, Ontario, Canada. Air monitoring locations were carefully chosen with a deliberate strategy, ensuring a comprehensive assessment of air quality in Hamilton. The goal was to strike a balance between multiple factors, ensuring that the data collected would be representative and informative for our diverse community.

To achieve this balance, we focused on several key considerations. First and foremost, we wanted to cover all 15 wards of Hamilton, acknowledging that air quality concerns can vary from one ward to another. This approach allowed us to address residents' unique environmental challenges in different parts of the city.

In addition to ward distribution, we were keen to incorporate feedback from the general public, which was gathered during our initial public meeting. Areas that were identified as concerning by the community were given special attention. We believe it is essential to respond to the concerns of our residents and prioritize their well-being.

Furthermore, we strategically placed monitoring sites that captured a variation of expected concentration and hot spots. These locations are particularly critical, as they often exhibit elevated pollutant levels due to various factors, such as industrial activities or heavy traffic. By monitoring these areas, we can gain insights into potential sources of pollution and assess their impact on air quality.

To ensure a comprehensive understanding of the situation, we also considered the socioeconomic characteristics of the population. It has been documented previously that marginalized communities may bear a disproportionate burden of air pollution. Therefore, our monitoring locations were selected to encompass a range of socioeconomic backgrounds, allowing us to assess any air quality disparities.

Additionally, we carried out collocation with active air samplers at some monitoring sites. This step was essential to evaluate the performance of passive samplers and ensure the accuracy of the data collected. We can evaluate data quality by comparing the results from both types of samplers.

In total, 68 pollutant monitoring sites were strategically selected across Hamilton, as shown in Figure 2.1. These locations represent a comprehensive approach to air quality assessment, and we are committed to providing the community with a clear and detailed understanding of the air they breathe. This information will serve as a valuable resource for informed decision-making and improving our city's air quality.

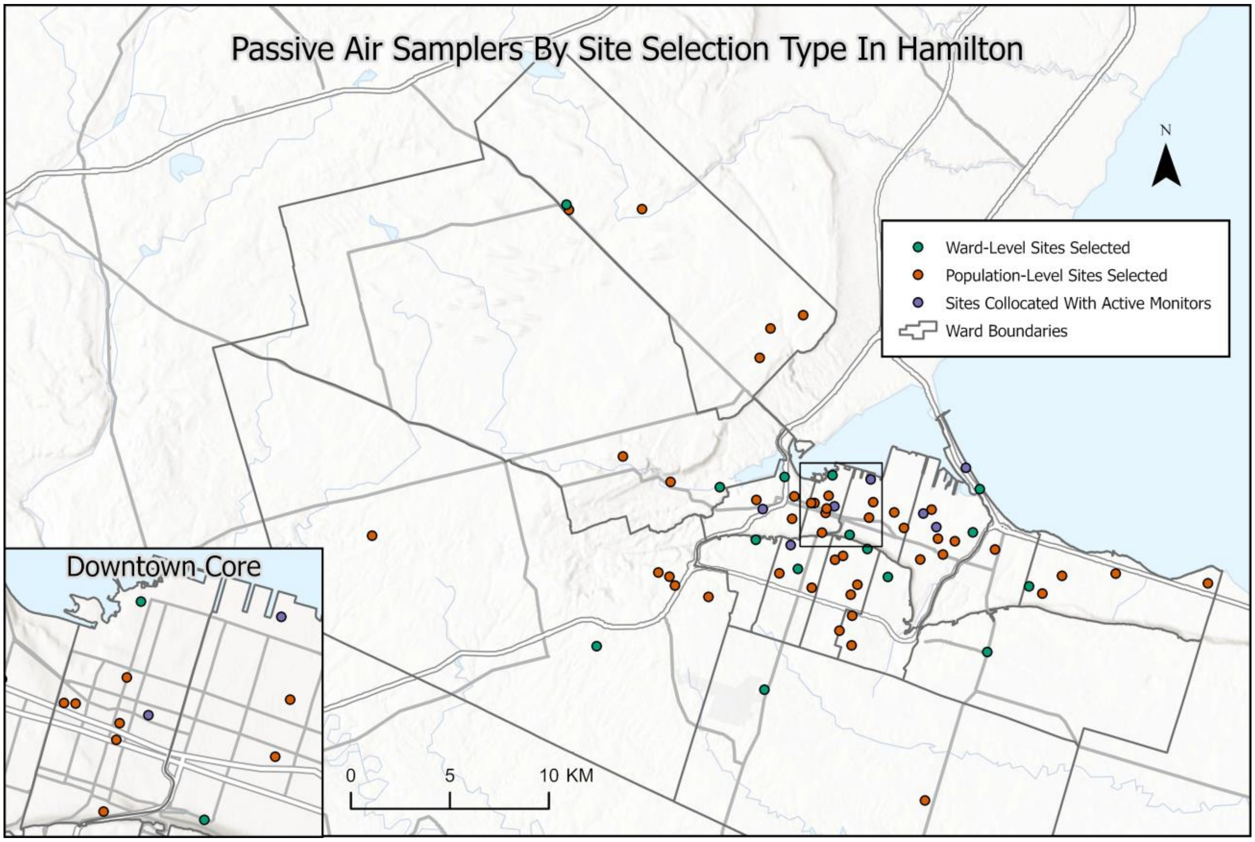

Figure 2.1 Air Monitoring Locations (Excluding PAHs)

2.1.1 Selection of Ward-Level Sites

The selection of the 15 ward sites for air monitoring was a thoughtful process to ensure that each ward in Hamilton was accurately represented in our study. To achieve this, we employed Geographic Information Systems (GIS) technology to calculate land use proportions within a 150-meter radius around each streetlight pole in Hamilton. This approach allowed us to make informed decisions when selecting the most suitable monitoring site for each ward.

First and foremost, we determined the land use proportions within the specified buffer around each streetlight pole. This involved assessing the types of land use in the vicinity of the pole, including residential, commercial, industrial, and green spaces, among others. Using GIS, we could precisely quantify the extent of each land use category within the given radius.

The final selection of monitoring sites was based on the location that best represented each ward's mean land use value. In other words, we sought sites where various land use proportions closely mirrored the average distribution within their respective wards. This approach aimed to provide a balanced and accurate reflection of the ward's unique characteristics.

By selecting representative sites for each ward in this manner, we ensured that our air monitoring efforts would best be able to mimic the specific environmental conditions and challenges faced by the residents in the ward. This approach guarantees that the data collected will reflect the diversity in land use patterns across Hamilton and help us better understand the impact of various land uses on air quality within our city.

2.1.2 Collocation Sites

We selected seven specific locations, known as "collocation sites" to assess the performance of the Ogawa passive air samplers when compared to continuous air monitoring systems. These monitoring systems were operated by the Ministry of the Environment, Conservation, and Parks (MECP), the HAMN Air Monitoring Network (HAMN), and the City of Hamilton. It is important to note that the City of Hamilton's Air Pointers were moved in April 2022, where one was taken down, and the other was moved to another site. The collocation sites are presented in Figure 2.2.

The MECP had monitoring stations in Hamilton Downtown, Hamilton West, and Hamilton Mountain. Each location was assigned an identification number: 29000, 29118, and 29214, respectively.

The HAMN air monitoring network also had two specific monitoring stations: one at Niagara St. and Land St. with ID 29567 and another at Beach Blvd. with ID 29102.

This effort aimed to compare the data collected by the Ogawa passive sampler with the data obtained from these established monitoring systems, which allowed us to evaluate the performance and accuracy of the passive sampler with continuous monitoring, providing valuable insights into air quality at these sites.

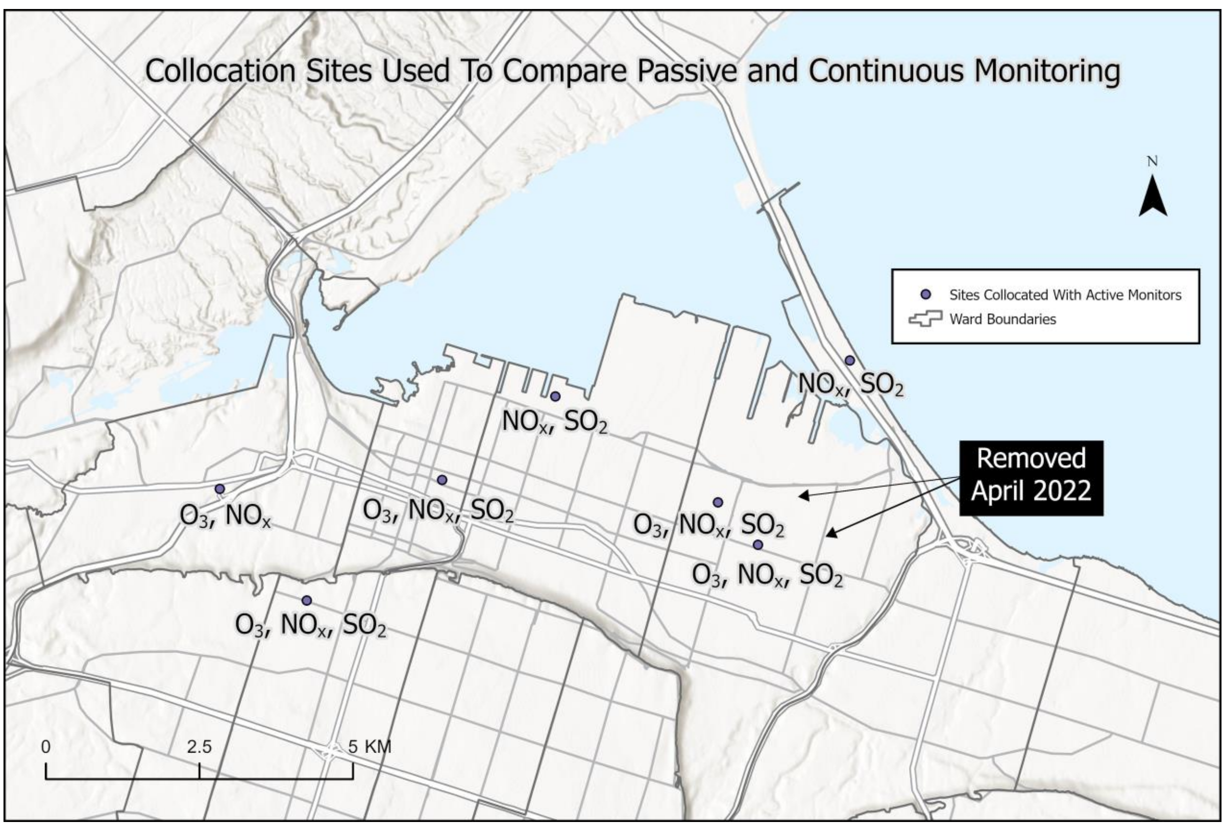

Figure 2.2 Collocation Sites. Pollutants measured by real-time monitroing indicated.

2.1.3 Selection of Ward-Level Sites

The selection of the remaining 45 monitoring sites was a complex and data-driven process aimed at capturing the full spectrum of socioeconomic characteristics, relevant land uses, and areas of community interest throughout the City of Hamilton. Our goal was to create a set of sites that would be representative of the entire population and provide a comprehensive view of air quality in the city.

To achieve this, we undertook a multifaceted approach. First, we considered multiple variables for each potential monitoring location: Hamilton's street poles. These variables included significant land use classes derived from past land use regression models in Hamilton, which are land use characteristics associated with varying air pollution concentrations. Additionally, we considered the distance of each potential site from highways, bodies of water, industrial areas, and open land. These factors are known to influence air quality and were thus essential in our decision-making process.

Furthermore, each streetlight pole was linked to its respective dissemination area's population density and four marginalization indices provided by Public Health Ontario. These indices encompassed residential instability, material deprivation, dependency, and ethnic concentration, helping us assess socioeconomic conditions and disparities within the city.

To select the final monitoring sites, we applied the K-means clustering algorithm. This approach grouped all potential streetlight sites into 45 clusters, optimizing the intra-cluster similarity of various variables, including land use and marginalization indices. This process aimed to ensure that the chosen sites would capture the diversity of predictor variables and socioeconomic characteristics across Hamilton.

We looked at the site that was most representative of each cluster (group of similar locations) as a potential choice for where we would set up our monitoring station. To account for areas of community concern, we calculated the distance for points of concern to the potential air monitoring locations. This rigorous process was repeated 5,000 times, and the group of sites with the lowest total distance to the community areas of concern was identified and selected. This method allowed us to choose monitoring sites that would provide the most comprehensive and representative data, taking into account socioeconomic disparities, land use patterns, and community-specific concerns, ensuring that our air quality assessment is thorough and equitable for all residents of Hamilton.

2.2 Site Selection PAH Sampling

Based on three criteria, PAH sampling included 28 sites manually located across Hamilton and western Burlington. Firstly, we ensured that at least one site was placed in each ward of Hamilton. Secondly, we spread the sites across the region to capture the full range of variations in PAC concentrations throughout the city. Lastly, the sites were positioned in a radial pattern extending from the industrial core (Figure 2.3). Additionally, we considered specific areas of interest, as indicated by the National Pollutant Release Inventory. This included prioritizing sites upwind and downwind of the airport, at highway intersections, and near locations known to emit PAHs based on the Canadian National Pollutant Release Inventory (Canada, 2017).

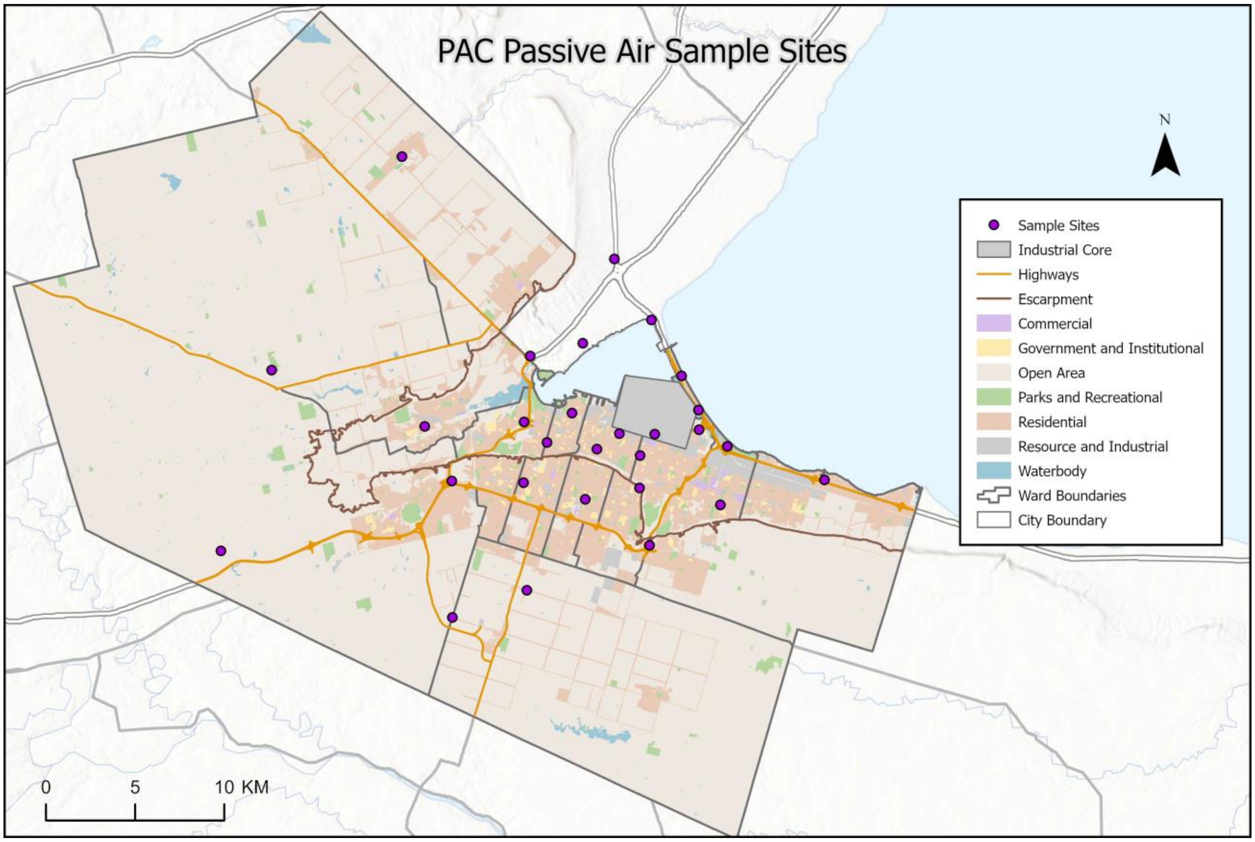

Figure 2.3 PAH passive air sample sites in Hamilton and Western Burlington, Ontario, Canada.

2.3 Equipment/Technology

Passive air pollution monitoring was used in this study. Passive air pollution monitoring is a method of assessing air quality without an air pump or using energy. It involves using specialized devices called "passive samplers" placed in the environment to collect data about air pollutants. These samplers do not require power or active mechanisms to function; instead, they rely on the natural flow of air to draw in particles or gases for analysis.

The passive samplers act as silent observers, quietly and continuously collecting air samples. These samples are later analyzed to determine the presence and concentration of various pollutants, such as nitrogen dioxide or sulphur dioxide.

Passive air monitoring is valuable because it offers a cost-effective and long-term way to gather air quality data. It complements active air monitoring methods, which involve continuous monitoring with powered equipment, by providing additional insights into pollutant levels over time. Also, it has a low infrastructure requirement, allowing sampling in dense urban areas. This study used three passive samper systems: Ogawa, SKC Ultra, and Tisch Environmental 200-PAS samplers.

Ogawa passive samplers measured NO_2, NO_X, NO, O_3, and SO_2. They are diffusion samplers that use a coated filter (pollutant-specific). All detection limits partially depend on sampling length (more extended sampling periods allow for a greater uptake). Ogawa sampling periods are typically one or two weeks. Although saturation can occur with passive samplers, it is not a concern with any expected concentrations in urban ambient air.

Nitrogen dioxide filters are coated in triethanolamine, and NO_2 is absorbed as the nitrite ion (NO_2^-), quantified by ion chromatography. Nitrogen oxides filters are coated in triethanolamine with the addition of PTIO (2-phenyl-4, 4, 5, 5,-tetramethylimidazoline-1-oxyl 3-oxide), and NO_2 + NO (oxidized to NO_2 - PTIO) are absorbed in the filter as the nitrite ion (NO_2^-), which was quantified by ion chromatography. Nitric oxide is calculated as the difference between the NO_X and the NO_2 concentrations measured at each location. Ozone filters are coated with nitrite ions, oxidized in the presence of O_3 to form the nitrate ion on the filter (NO_3^-), and quantified with ion chromatography. Sulphur dioxide filters are coated in triethanolamine, and SO_2 is absorbed as the sulphate ion (SO_4^{2-}) and quantified with ion chromatography.

The Ogawa passive samplers followed specific Ogawa protocols for analysis (Harvard School of Public Health, 2019; Ogawa & Co., USA, 2006). To ensure data reliability, thorough quality assurance and quality control steps were taken, including collecting blank samples in the field and the laboratory.

To measure the concentrations of the substances we were interested in, we employed a Dionex Aquion Ion Chromatography System and then applied a temperature, humidity and time adjustment to convert concentrations of the filter to concentrations in air. As part of our quality assurance efforts, we compared the data from sites where passive samplers were placed with the average measurements recorded by active monitoring stations from installation to removal.

We subtracted the NO_2 from the NO_X values to calculate the NO levels. These procedures were essential in maintaining the accuracy and trustworthiness of the data obtained through the Ogawa passive samplers.

SKC ULTRA Passive Samplers are diffusion samplers that provide low ppb to ppt detection of VOCs. Charcoal was used as the sorbent to absorb benzene, followed by solvent extraction and quantification with GC-FID (Gas Chromatography with Flame-Ionization Detection. Our samples from the SKC samplers did not demonstrate any peaks above the detection limits in our study, which suggests no extreme values occurred, but it did not allow for further analysis.

Polycyclic aromatic hydrocarbons (PAHs) were collected using Tisch Environmental 200-PAS Outdoor Passive Air Sampler stainless steel double-domed samplers. These samplers are the same as those used in the Global Atmospheric Passive Sampling network and can capture gaseous and particle-bound PAHs (Pozo et al., 2006). Before sampling, pre-cleaned polyurethane foam disks were inserted into the air samples after a standardized cleaning procedure described by Harner et al. (2013). In addition to the primary samples, field blanks were placed at the study site, and duplicate samples were set up at three regional locations.

Harner et al. (2013) outline how the samples were processed. In simpler terms, surrogates were added to the samples, and then the entire sample was subjected to an accelerated solvent extraction using petroleum ether and acetone. This process included fractionation with a silica column for purification, followed by concentration under a stream of nitrogen gas. The samples were then enhanced with deuterated standards and analyzed using gas chromatography-mass spectrometry (GC-MS).

An Agilent 6890 electron impact GC-MS connected to an Agilent 5975 Mass Selective Detector was used to analyze PAHs. The specific PAHs that were measured included six low molecular weight PAHs: acenaphthylene, acenaphthene, phenanthrene, fluorene, anthracene, and retene; 12 high molecular weight PAHs fluoranthene, pyrene, benzo[a]anthracene, chrysene, perylene, benzo[e]pyrene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, dibenzo[a,h]anthracene, indeno[1,2,3-c,d]pyrene; and one other polycyclic aromatic compound (PAC): dibenzothiophene.

PAHs and PACs are related but slightly different terms. PAHs are a group of organic compounds comprising multiple carbon atoms arranged in a ring-like structure with alternating carbon and hydrogen atoms. They are often formed during the incomplete combustion of organic materials like wood, coal, or gasoline. PAHs can also be found in things like cigarette smoke and grilled or charred food. Some PAHs are known to harm human health and the environment and are a concern in air quality and pollution studies. PACs is a broader term that includes PAHs and other similar compounds with a similar ring-like structure with alternating carbon and hydrogen atoms. PACs can include PAHs, as well as other related chemicals. Some of these compounds may have properties and effects different from PAHs and can also be found in various environmental sources.

In summary, while PAHs are a specific subset of PACs, PACs encompass a wider range of compounds with similar structures. PAHs and PACs are interested in environmental and health research due to their potential impacts, especially in the context of air and environmental pollution. For simplicity, we will refer to the collection of compounds as PAHs.

The multiple PAH species vary in their toxicity. We combined the PAHs using relative potency factors from Health Canada (2021), which allows for various pollutant concentrations to be combined with the new sum of pollution based on the relative toxicity of benzo[a]pyrene (the most toxic) to produce a single risk-based concentration, called benzo[a]pyrene equivalency (BaP-Eq). The factors included benzo[a]pyrene (RF = 1), benzo[a]anthracene (RF = 0.1), benzo[b]fluoranthene (RF = 0.1), benzo[g,h,i]perylene (RF = 0.01), benzo[k]fluoranthene (RF = 0.1), chrysene (RF = 0.01), dibenzo[a,h]anthracene (RF = 1), indeno[1,2,3-cd]pyrene (RF = 0.1), fluoranthene (RF = 0.001), and phenanthrene (RF = 0.001).

2.4 Background on Emipircal and Dispersion Models

Air pollution modelling can be classified into dispersion and empirical models. Dispersion models use a physics-based approach. These models simulate the physical processes of how pollutants disperse and interact with the atmosphere. They consider factors like wind speed, atmospheric stability, and the specific characteristics of emission sources. Dispersion models are particularly useful for understanding how pollutants spread in the atmosphere and how they impact air quality in different locations.

For instance, a dispersion model can help predict how a factory's smokestack emissions will disperse and affect air quality downwind. Dispersion models are often used for regulatory purposes and scenarios, such as assessing compliance with air quality standards. They can be more resource-intensive to develop and use, requiring extensive input data and expertise in atmospheric science.

Dispersion models encounter several limitations when applied in urban environments. Urban areas are characterized by complex terrain, tall buildings and intricate topography that can disrupt airflow and dispersion patterns, making it challenging for models to account for these complexities accurately. Additionally, cities often have numerous localized emission sources, such as vehicular traffic, industrial facilities, and heating systems, which exhibit dynamic emissions that vary by time and location, posing difficulties for precise modelling. Tall buildings can influence airflow and create microscale variations in air quality, while street canyons in urban layouts can trap and accumulate pollutants, phenomena that dispersion models may not adequately represent. Obtaining high-resolution meteorological data, essential for urban dispersion modelling, can be costly and limited in availability. Furthermore, chemical reactions among pollutants in urban environments require detailed data on chemical properties and reaction rates to be accurately represented. Finally, dispersion models can only incorporate known emission sources into the predictions.

On the other hand, empirical air pollution models are based on observed data and statistical relationships. These models use observed air quality data and associated variables to predict air pollution levels. The process typically involves collecting data from various monitoring stations over time and then using statistical methods to find patterns and correlations. Based on past observations, the resulting model can predict air quality at a specific location.

For example, an empirical model might use historical data on traffic density, industrial emissions, and weather conditions to predict daily levels of a particular pollutant in a city. These models are often simpler to develop and use when compared to dispersion models but may have limitations, especially when dealing with complex or changing environmental conditions.

2.5 Land-use regression models built/used

2.5.1 a Land Use Regression Description

In this study, we have employed land use regression air pollution modelling to estimate pollution concentrations at unobserved areas, an empirical modelling approach that will model air pollution from all sources as observed in air pollution measurements.

Land use regression modelling is a complex yet powerful tool used to explore and anticipate how various types of land use within an area can impact air quality. It is similar to creating a detailed map that allows us to understand how the different land uses in a city, such as residential neighbourhoods, industrial zones, commercial areas, parks, or highways, affect the air we breathe. Imagine you are in a city with diverse areas—some with homes, some with factories, and others with bustling businesses. Each area may have its unique air quality, influenced by the activities and structures there. Some areas enjoy cleaner air, while others experience higher pollution levels.

To create a land use regression model, you gather data from air quality monitoring stations positioned in different parts of the city. You also collect information about each area, such as the traffic volume on the roads, the presence of nearby industries, and the type of land use, whether residential, recreational, or commercial.

Then, using mathematical and statistical techniques, we build a model that can predict air quality based on these area-specific characteristics for a given city. The model helps us understand the relationships between land use and air quality. For example, it might show that areas with more factories and highways have lower air quality than places with more parks and houses. This information is crucial for urban planners and policymakers, as it guides decisions related to city development, zoning, and pollution control measures. It is a valuable tool in ensuring that we can live in healthier and more sustainable cities.

2.5.1 b Land Use Regression Application

After quantifying the concentrations at sample sites, land use regression (LUR) models were employed to predict pollution concentrations for unmonitored locations throughout Hamilton. The LUR approach utilized predictor variables and buffer distances as outlined in the European Study of Cohorts for Air Pollution Effects (Beelen et al., 2013). Buffer distances adhered to established literature precedents (Maddix and Adams, 2020). The land use characteristics applied in this study are presented in Table 2.1.

Land use regression models were developed for O_3, NO_2 and PAH carcinogenic toxicity. We did not model NO or NO_X as the NO_2 component is associated with this group's health effects. Sulphur dioxide had too many values below detection limits for confident modelling across space. A specific LUR model was developed for each pollutant, showing acceptable agreement with collocated monitors and measurable spatial variation. The average pollutant concentration was the dependent variable, and numerous potential predictor variables were considered. Each predictor variable underwent initial univariate regression analysis, and the variable with the highest adjusted R^2, accompanied by a significant slope, was included as the starting model.

Subsequently, the model was refined by stepwise addition of variables ranked by R^2. Variables were retained in the model if their inclusion increased the adjusted R^2 by 0.01, and the variance inflation factor was less than 4. This iterative process continued until meeting the specified criteria was no longer possible. Variables with a p-value greater than 0.05 were excluded from the final model.

To validate the model, several diagnostics, including Variation Inflation Factors and Moran's I, were applied to ensure model assumptions were met. These checks included confirming limited multicollinearity between predictors (Variation Inflation Factor < 4), identifying and addressing outliers, and verifying that spatial residuals followed a normal distribution. If a Variation Inflation Factor exceeded four, the most collinear variable was removed, and its effect was observed (Beelen et al., 2013). Model performance was assessed with leave-one-out cross-validation (LOO-CV).

Furthermore, all models were assessed for autocorrelation using Moran’s I, following the approach outlined by Maddix and Adams (2020).

Table 2.1: Predictor Variables Used in Land Use Regression Modelling

Predictor Variable	**Unit**	**Buffer Used**
Highway length within buffer	m	Yes (50, 100, 200, 400, 800 and 1600 m)
Major road length within buffer	m	
Local road length within buffer	m	
Railway length within buffer	m	
Park/recreation land use area within buffer	m^2	
Open land use area within buffer	m^2	
Industrial/resource land use area within buffer	m^2	
Commercial land use area within buffer	m^2	
Government/institutional land use area within buffer	m^2	
Residential land use area within buffer	m^2	
Waterbody land use area within buffer	m^2	
Population density	N (number)	
Latitude	m N	No
Longitude	m W	
Distance to nearest major roads	m	
Distance to nearest highways	m	
Distance to Lake Ontario	m	
Distance to chimney	m	
Distance to the airport	m	
Distance to industrial sector core	m	
Elevation	m	
Slope	Degrees	
NDVI	N/A	
Distance to NO_2 reporting industries	m	

The land use regression models were then applied to create air pollution maps that included air pollution estimates at unobserved locations. The map was based on a 100 x 100 meter grid. Land use characteristics were calculated for each grid cell, and the land use regression model was applied to estimate the air pollution concentration. All models were based on 2022 data.

2.6 Environment Justice Analysis

Environmental justice is the fair and equitable treatment of all individuals and communities, irrespective of their race, ethnicity, socioeconomic status, or background, in the distribution of environmental benefits and burdens. It seeks to ensure everyone has the same rights to a clean and healthy environment, free from discrimination or disproportionate exposure to environmental hazards and pollution. Environmental justice addresses the historical and ongoing disparities in the distribution of environmental risks and strives to rectify these inequities by advocating for equitable policies, public participation in decision-making, and access to environmental information and legal remedies for affected communities.

The Ontario Marginalization Index is a tool used to assess and quantify the social and economic disparities experienced by different communities or regions within the province. It provides a way to measure the degree of marginalization or social disadvantage that specific populations face. The

Ontario Marginalization Index includes various indicators or factors contributing to social and economic disparities. These indicators include income levels, educational attainment, employment opportunities, housing conditions, access to healthcare, and other socioeconomic variables. By analyzing and combining these indicators, the index creates a comprehensive picture of the relative disadvantage or marginalization experienced by different communities.

This index is commonly used in research, policy development, and public health studies to understand better and address social inequalities and disparities within Ontario. It helps policymakers and researchers identify areas or populations requiring targeted interventions and support to reduce marginalization and promote equity and social justice.

The Ontario Marginalization Index was selected for this research because it combines multiple census attributes into four dimensions that limit the correlation between the four dimensions, which are presented in Table 2.2.

Table 2.2: Ontario's Marginalization Indices. Modified from Matheson, Moloney and van Ingen (2023).

Dimensions	**Census Characteristics that Contribute to Index**
Household And Dwellings	• Proportion of the population living alone • Proportion of the population not youth • Average persons per dwelling (reverse coded) • Proportion of housing that are apartment buildings. • Proportion unmarried • Proportion of housing not owned • Proportion who have moved in the last 5 years
Material Resources	• Proportion of adults without a high school diploma • Proportion of single parents • Proportion of relative contribution of government transfers to income of 15+ • Proportion of 15+ unemployed • Proportion of the population that is low-income • Proportion of households needing major repair
Age and Labour Force	• Proportion of the population 65+ • Dependency ratio (proportion of children and seniors to working-age adults) • Proportion 15+ not working
Racialized and Newcomers	• Proportion of the population that is a visible minority • Proportion of the population that is a recent immigrant

To evaluate relationships between environmental justice, the land use regression models were applied to estimate air pollution concentrations within dissemination areas.

We analyzed the potential relationship between marginalization indices, social and economic disparities indicators, and the pollution maps we created for Hamilton: NO_2, O_3, and benzo[a]pyrene equivalency.

We used two statistical models for each pollutant. The first was a stepwise ordinary linear model, a statistical technique that helps us investigate the correlation between marginalization and pollution exposure. In this model, we included variables significantly associated with pollution exposure (with a p-value less than 0.05). To ensure the reliability of our analysis, we also checked for variance inflation factors, which indicate whether there is too much correlation among the variables, and examined spatial autocorrelation using Moran's I. Spatial autocorrelation tells us if there is a pattern in how the data is distributed across space. If we detected spatial autocorrelation, it suggested that our model was not accounting for the fact that nearby areas might be more similar in terms of pollution exposure, which could lead to biased estimates.

In such cases, we applied a spatial lag regression model, a statistical method that addresses spatial dependencies, to explore the connection between marginalization and benzo[a]pyrene equivalency.

To tackle spatial autocorrelation, the spatial lag regression model introduced a spatially lagged dependent variable into the model. This variable was created by multiplying a spatial weight matrix (using the queen contiguity criterion) with a spatial autoregressive parameter. The remainder of the model operated like an ordinary least square regression, a common statistical approach. In this framework, y represented the pollution exposure, x was a measure of marginalization, β was a regression coefficient that explained how much one variable affected another, and ε denoted the regression residuals, which were the differences between the observed values and the values predicted by the model.

We again examined Moran's I to check for spatial autocorrelation. The model we chose for interpretation was the one that showed no spatial autocorrelation in the residuals, ensuring a more accurate analysis of the data. All analysis was based on 2022 data.

3. Results

3.1 Descriptive Statistics

The number of samples was high, with 370 samples obtained for O_3 and NO_2, 356 for NO_X and 368 for SO_2. Two samples of O_3 were below detection limits, and 139 samples of SO_2 were below detection limits. The mean concentration values (excluding duplicates) were 29 ppb for O_3, 7 ppb for NO_2, 13 ppb for NO_X, and 2 ppb for SO_2. Paired duplicate samples, where two samples were collected at the same location, demonstrated root mean square error values of 1.6 of O_3, 1.7 ppb for NO_2, 1.5 ppb for NO_X, and 0.8 ppb for SO_2.

Long-term mean concentrations are presented in Figures 3.1 (O_3), 3.2 (NO_2), and 3.3 (SO_2). Appendix A presents seasonal mean concentration maps for O_3, NO_2 and SO_2.

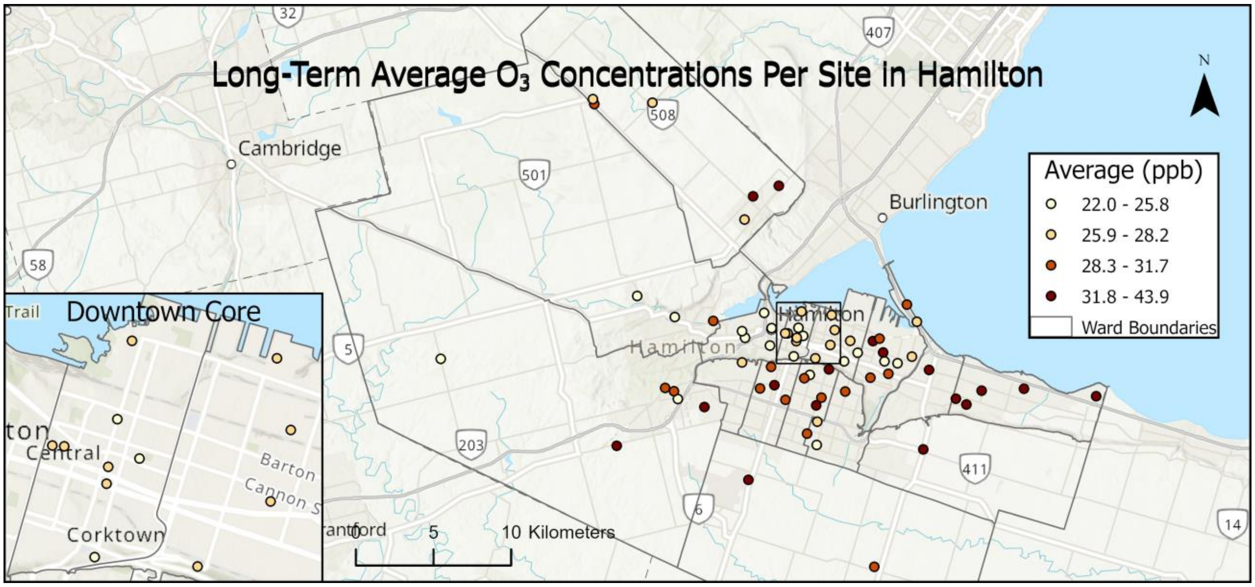

Figure 3.1 Long-term mean ozone concentrations.

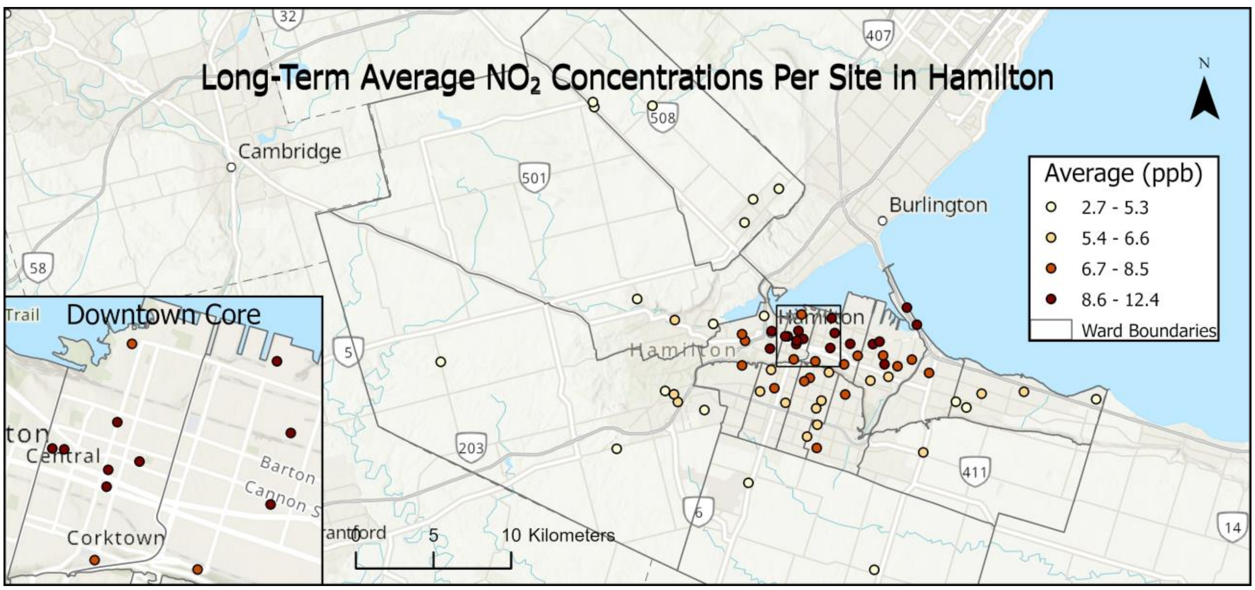

Figure 3.2: Long-term mean nitrogen dioxide concentrations.

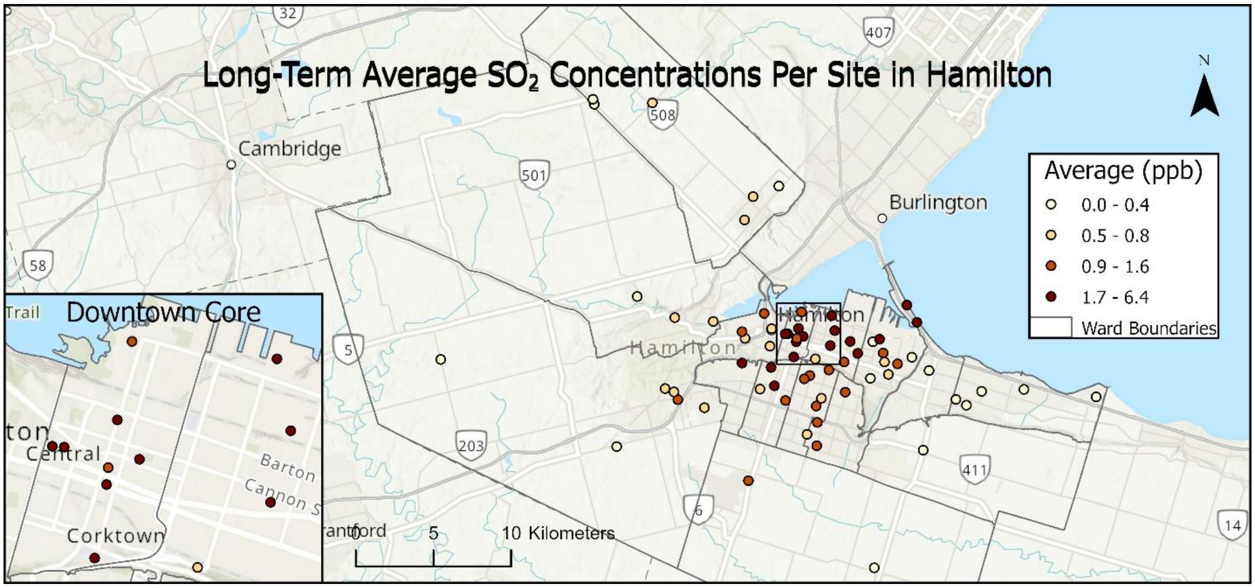

Figure 3.3: Long-term sulphur dioxide concentrations.

PAH analysis included two samples that could not be quantified, resulting in 27 sites, including two duplicate sites. One duplicate site sample was lost, and the site was in Ward 7. The average difference between the duplicate samples was 0.1 ng/m³, with a median difference of 0.07 ng/m³. Specifically for benzo[a]pyrene, the average difference between duplicates was 0.03 ng/m³. As a result, we report the duplicate sites as averaged values.

The total concentration of U.S. EPA priority pollutants PAHs, excluding naphthalene, averaged 18 ng/m³ across all sites. The sites with the highest concentrations of PAHs were typically located in the downtown core (refer to Figure 3.4). On the other hand, the lowest concentrations were often found on the city's outskirts and in Burlington.

The composition of PAHs included 61% low-weight PAHs and 39% heavy-weight PAHs. Among all the sites, phenanthrene was the most abundant PAC, ranging from 22% to 55% of the summed concentrations. Notably, downtown Hamilton, encompassing Wards 1-5, exhibited higher total PAH concentrations, averaging 30 ng/m³, whereas all other sites averaged 12 ng/m³ for the sum of priority EPA pollutants. For a more detailed breakdown of concentrations, please refer to Appendix B.

In Appendix C, you will find the comments from Environment Hamilton regarding the pubic engagement sessions.

Appendix D contains the O_3 air pollution sensor data; Appendix E (NO_2), Appendix F (NO_X), and Appendix G (SO_2). A map of sample site IDs is included in Appendix H for PAH samples, and in Appendix I, the sample site IDs for O_3, NO_2, NO_X and SO_2.

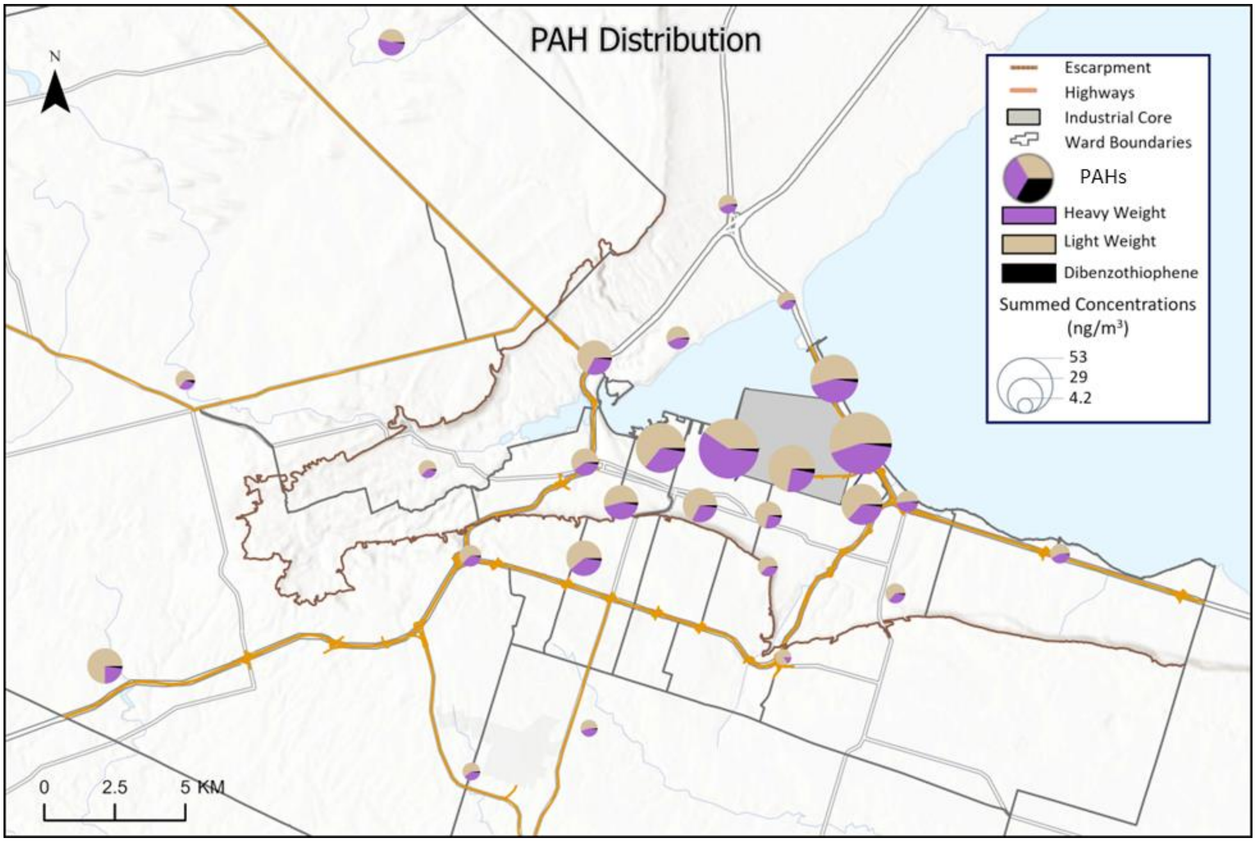

Figure 3.4 PAH distribution across the city of Hamilton. Low-weight versus heavy-weight PAH composition does not change drastically across the city. Peak concentrations are located within the downtown core.

Notably, the three sites located downwind of the industrial area ranked among the top five values, with concentrations of 0.33 ng/m³, 0.30 ng/m³, and 0.18 ng/m³.

For regional comparison, during the same season period (July to September) in 2021, integrated concentrations in Toronto, a neighbouring city, averaged 0.04 ng/m³ at the National Air Pollution Surveillance site and never exceeded 0.05 ng/m³. However, in our study area, 85% of the sites measured concentrations that exceeded the Ontario annual guidelines of 0.01 ng/m³, with 22% exceeding this guideline by ten times. This guideline was established to limit cancer risk to below one in a million excess cases. Benzo[a]pyrene concentrations are presented in Figure 3.5.

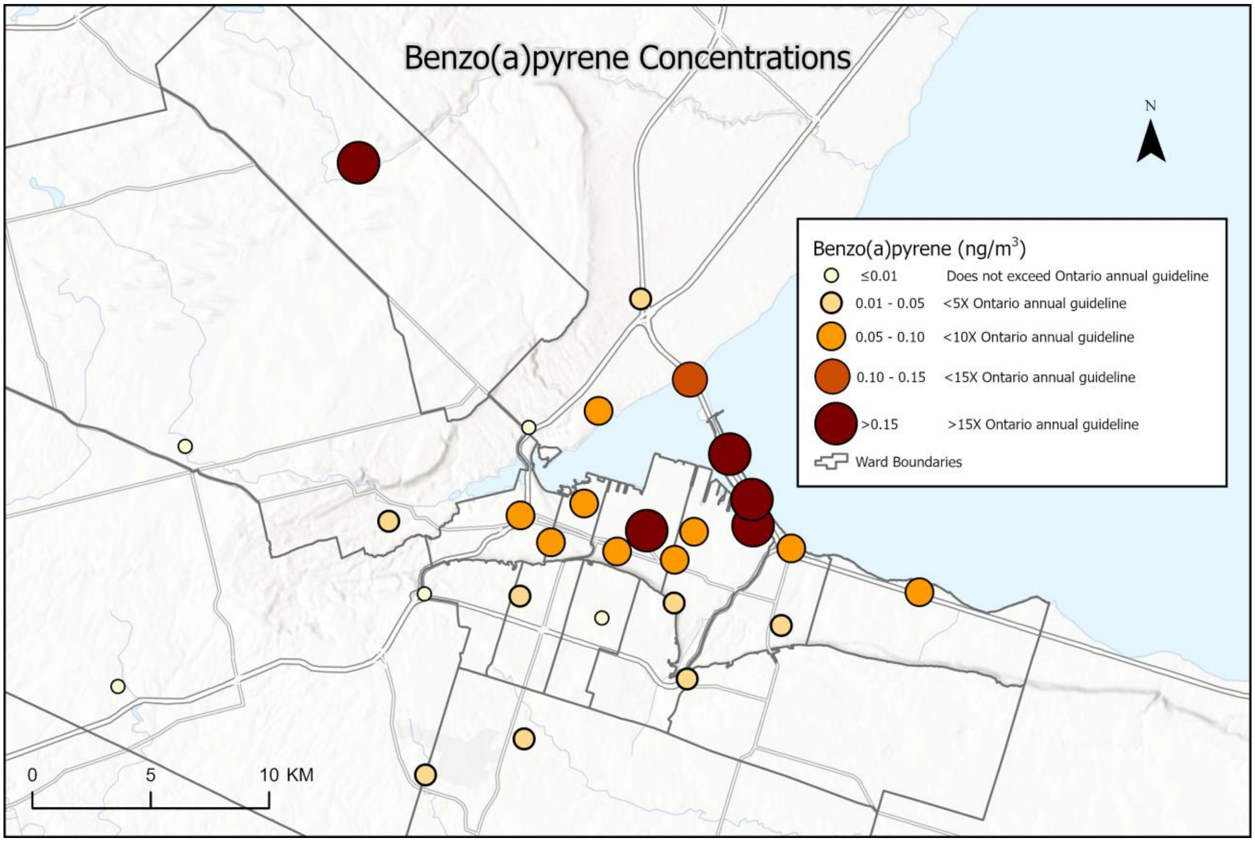

Figure 3.5: Benzo[a]pyrene concentrations (ng/m^3) across Hamilton and western Burlington, Canada. In Canada's regulatory framework, Benzo[a]pyrene is a surrogate for all PAHs.

3.2 Comparison with Active Samplers

We evaluated the performance of the Ogawa passive samplers by comparing their concentrations with the concentrations from the active air monitors (measurements in real-time) in Hamilton. Taking the average difference in passive sampler concentration minus the active sampler concentration, the average difference was -1 ppb for O_3 (active samplers underestimated by 1 ppb), +1 ppb for NO_2, and <0.1 ppb for SO_2. Overall, our samplers had very slight differences of 1 ppb or less, which is a strong agreement for a passive sampling approach.

3.3 Air Pollution Maps

The land use regression models' predictors, coefficients, and performance for both O_3 and NO_2 are outlined in Table 3.1. The NO_2 model performed much better at predicting concentrations than the land use regression for O_3. The maps of modelled pollution are presented in Figure 3.6 (NO_2) and Figure 3.7 (O_3). No autocorrelation was present in either model.

*Table 3.1**:** The land use regression models of passively monitored pollutants in Hamilton, ON*

Pollutant	**Model of adjusted annual concentration (ppb)**	**Adjusted R^2**	**LOOCV Mean R^2**	**RMSE (ppb)**	**MAE (ppb)**
NO_2 (ppb)	7.142 + 5.630e-05(length of rail within 1600 m buffer) - 1.786e-04(distance from industrial core) + 4.720e-05(government and institutional area within 200 m) + 8.187e-04(length of major roads within 200 m)	.77	.73	1.2	0.9
O_3 (ppb)	2.712 - 4.513e-06(parks and recreational area within 1600 m) + 4.006e-05(commercial area within 800 m) + 4.526e-04(distance from a chimney point)	0.35	0.30	3.5	2.9

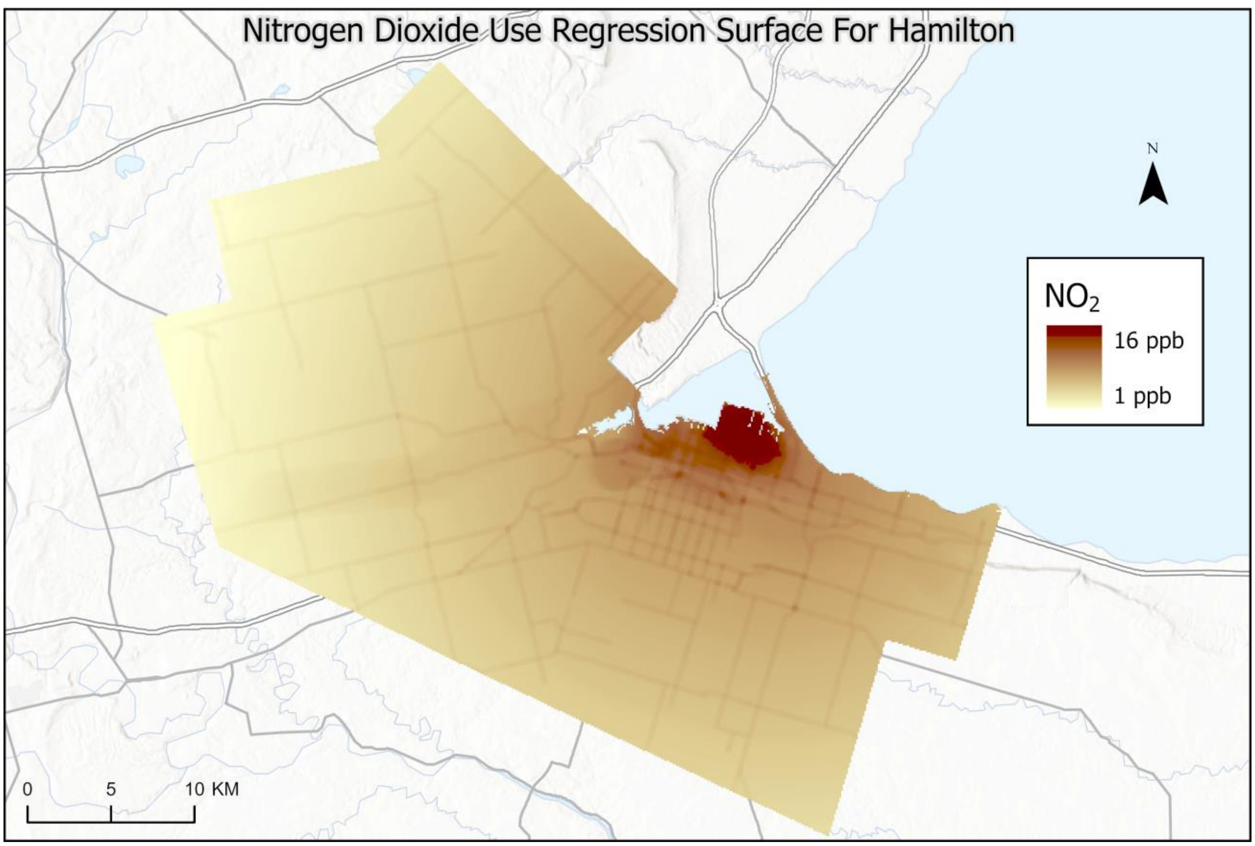

Figure 3.6: Land use regression models of NO_2 across Hamilton, Ontario.

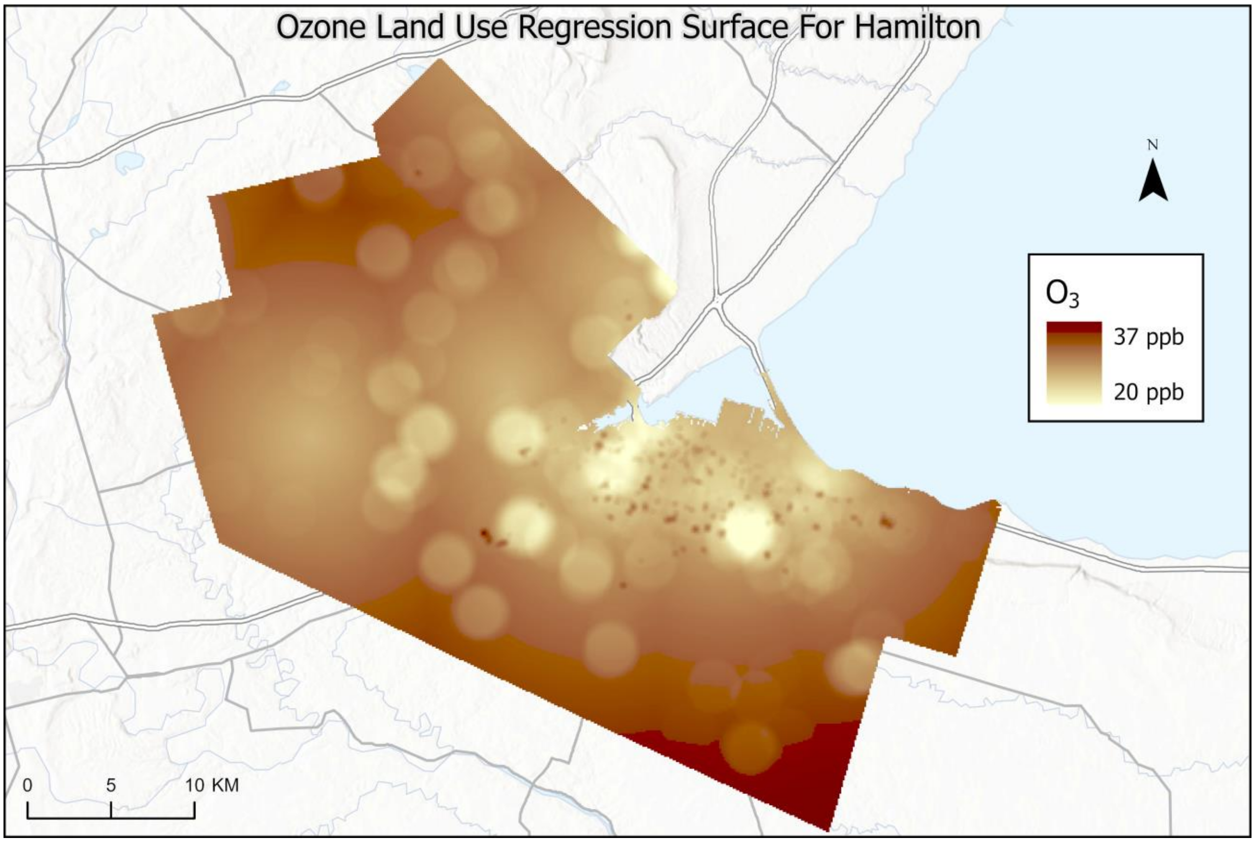

Figure 3.7: Land use regression models of O_3 across Hamilton, Ontario.

3.4 Land Use Regression PAHs

Modelling benzo[a]pyrene equivalency performed well. The land use regression model had an R^2 of 0.81 ($p < 0.001$), Moran's I was insignificant, and the model coefficients are presented in Table 3.2. The air pollution map is presented in Figure 3.8.

Table 3.2: The land use regression models of log(benzo[a]pyrene equivalency carcinogenic toxicity) across Hamilton and western Burlington

Variable	**Coefficient**	**Variable Significance**
Coefficient	-2.5	<0.001
Open Area within 200 m	-1.9×10^{-5}	<0.001
Waterbody Area within 400 m	6.9×10^{-6}	<0.001
Resource and Industrial within 1600 m	4.6×10^{-7}	<0.001
Distance from Lake Ontario	7.6×10^{-5}	0.014
Commercial Area within 1600 m	-1.6×10^{-6}	0.025

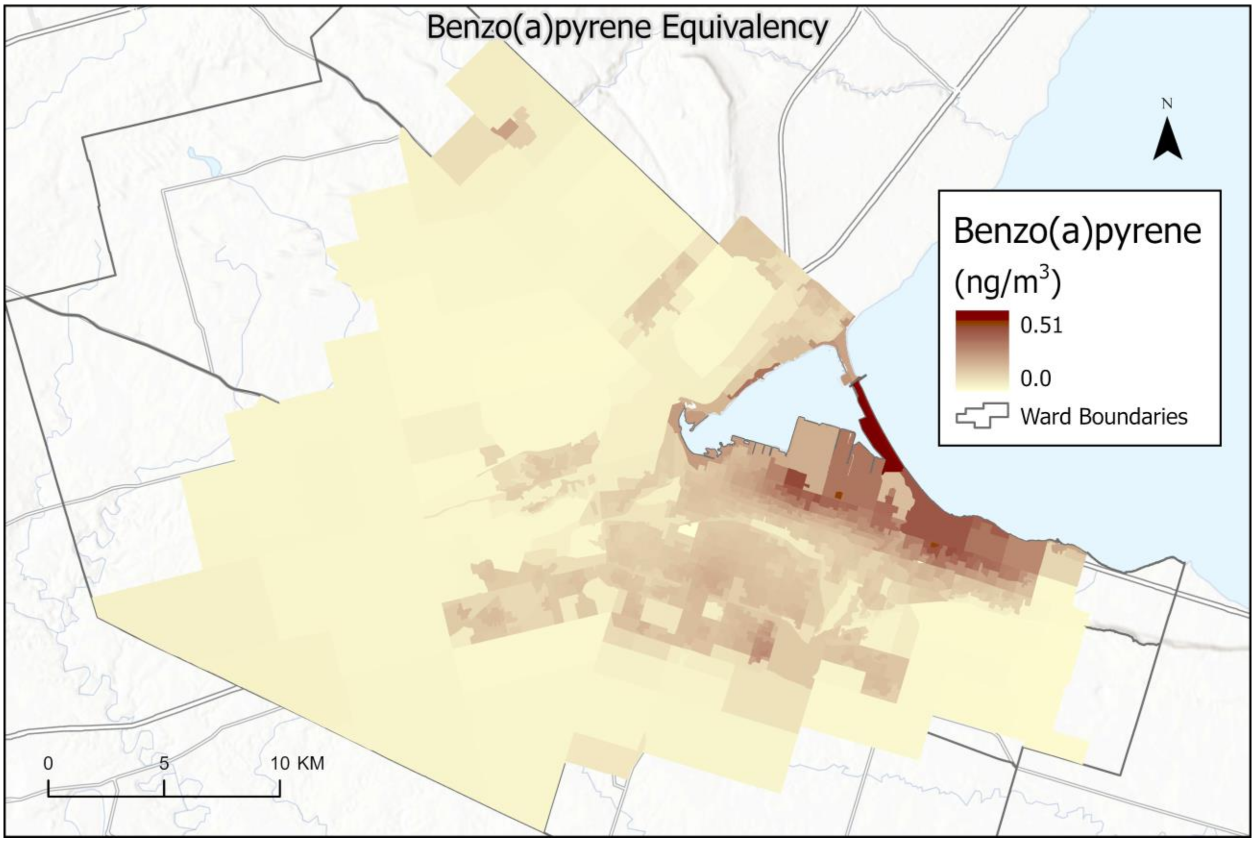

Figure 3.8: Benzo[a]pyrene equivalency as predicted by land use regression modelling for Hamilton and western Burlington, Canada, averaged by census dissemination area.

3.5 Environmental Justice

Each pollutant has different sources and demonstrated different spatial patterns; however, NO_2 and benzo[a]pyrene equivalency shared a similar high concentration near the industrial core. Nitrogen dioxide differed by having increased concentrations near the major roads. Ozone displayed distinct inequality and exposure patterns. Sulphur dioxide with many values below detection limits was excluded from this analysis, but it demonstrates concentration patterns similar to benzo[a]pyrene.

In Figures 3.9 (NO_2), 3.10 (O_3) and 3.11 (BaP-Eq), we present maps of the four dimensions of marginalization plotted against air pollution.

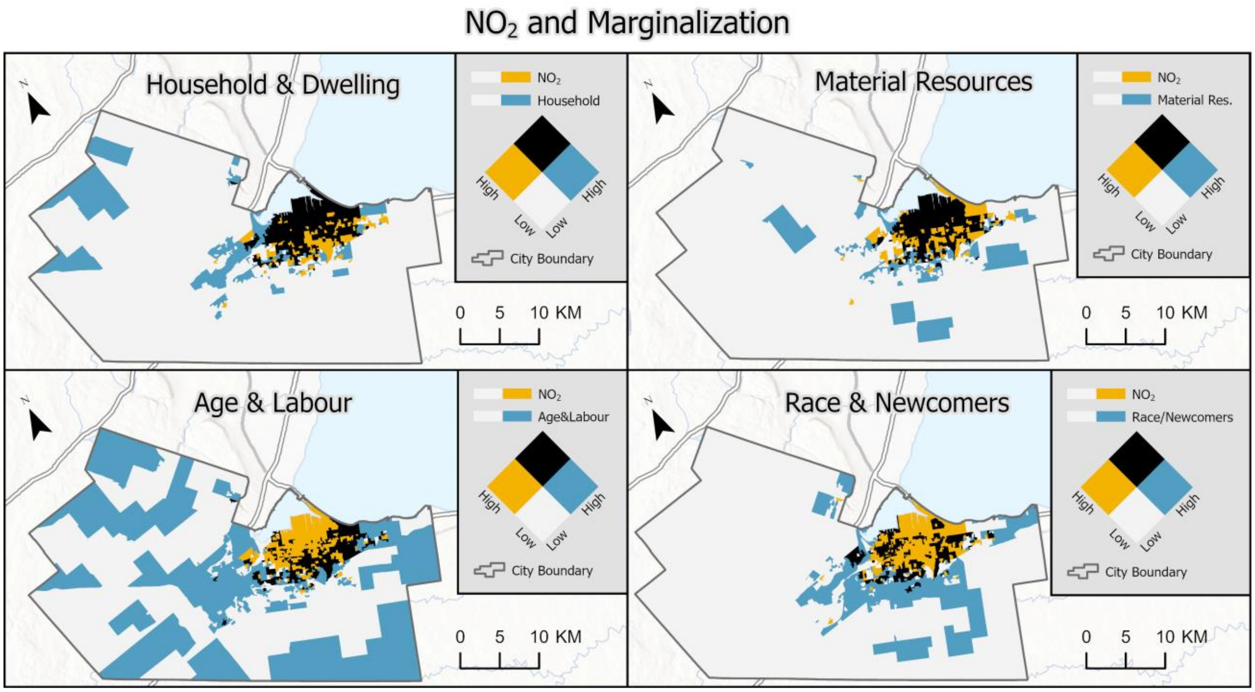

Figure 3.9: Highest and lowest 50th percentiles of NO_2 and marginalization factors in Hamilton and western Burlington, Canada.

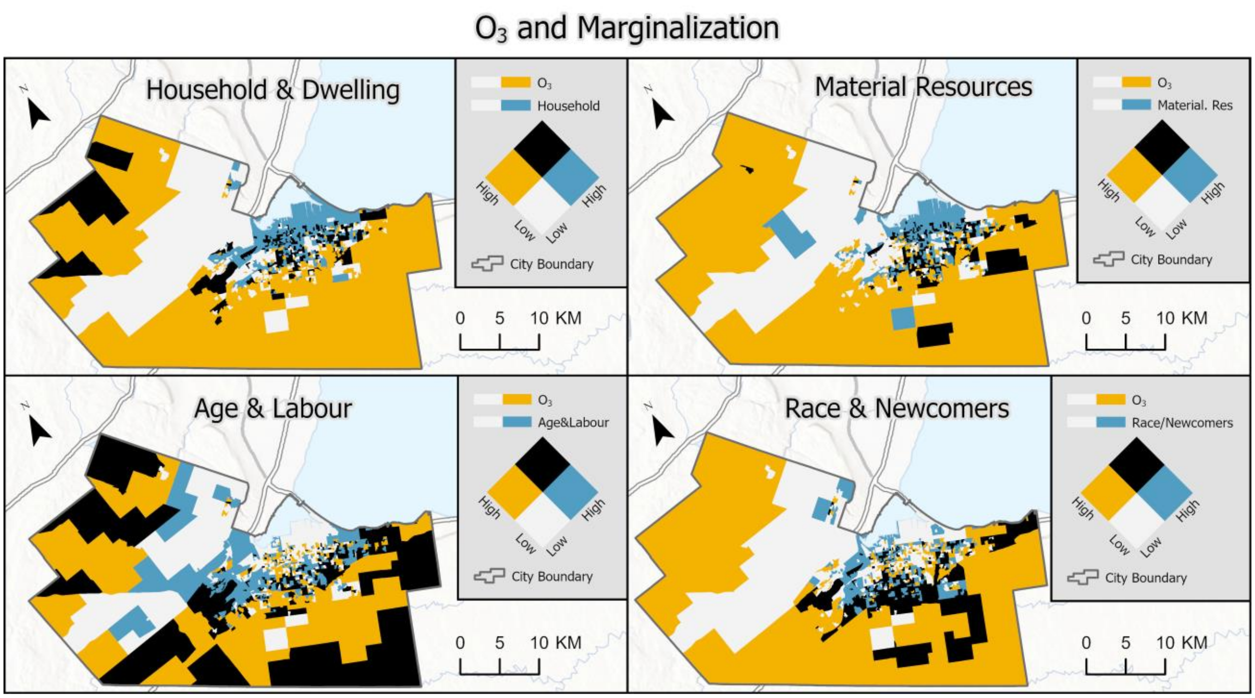

Figure 3.10: Highest and lowest 50th percentiles of O_3 and marginalization factors in Hamilton and western Burlington, Canada.

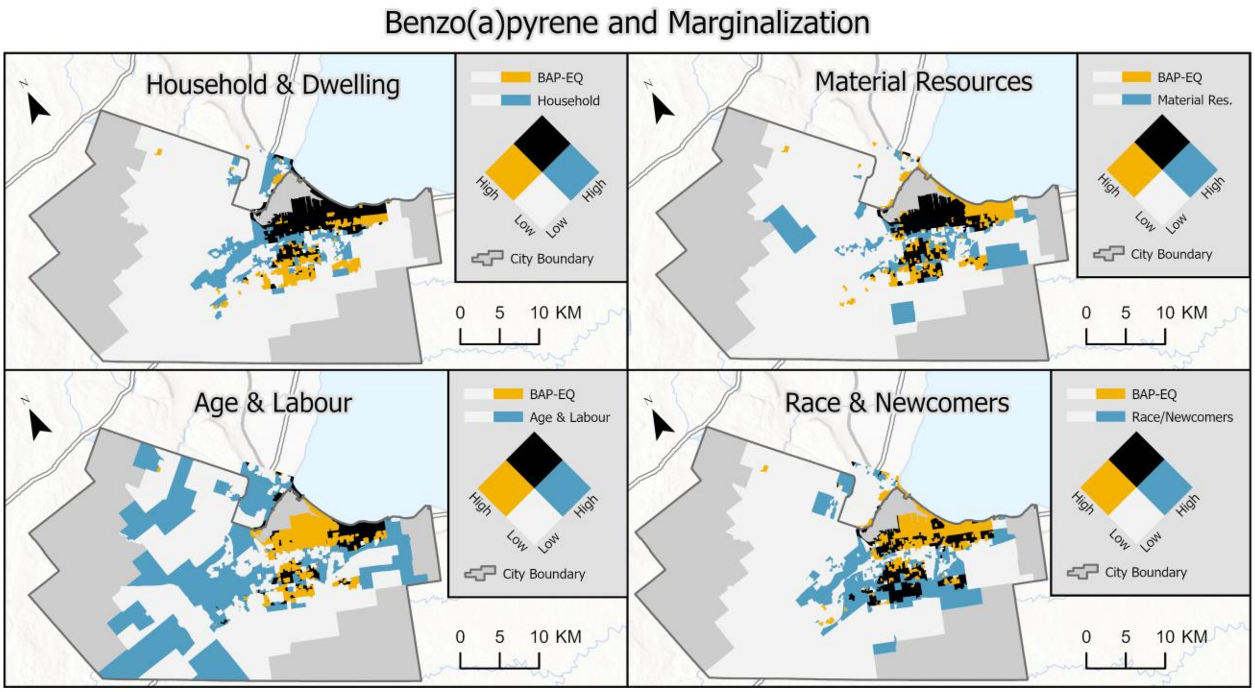

Figure 3.11: Highest and lowest 50th percentiles of benzo[a]pyrene equivalency and marginalization factors in Hamilton and western Burlington, Canada.

The linear regression models for all relationships did not meet the statistical model's assumptions, and spatial regression models were required; however, only one spatial model did identify a significant relationship, which was a negative relationship between Material Resources (coefficient -0.35, $p < 0.001$) and ozone. This relationship suggests that as ozone concentrations increased, the level of marginalization was reduced.

Further analysis suggests a more nuanced relationship between marginalization and air pollution, which is demonstrated in Figures 3.12 (NO_2), 3.13 (O_3), and 3.14 (BaP-Eq). Nitrogen dioxide demonstrated a pattern where all marginalization levels were exposed to high concentrations; however, only areas with low marginalization occurred in areas with low air pollution. This phenomenon occurred with NO_2 and all four marginalization measures. Benzo[a]pyrene demonstrated this effect to a lesser degree. Ozone did not demonstrate such an effect.

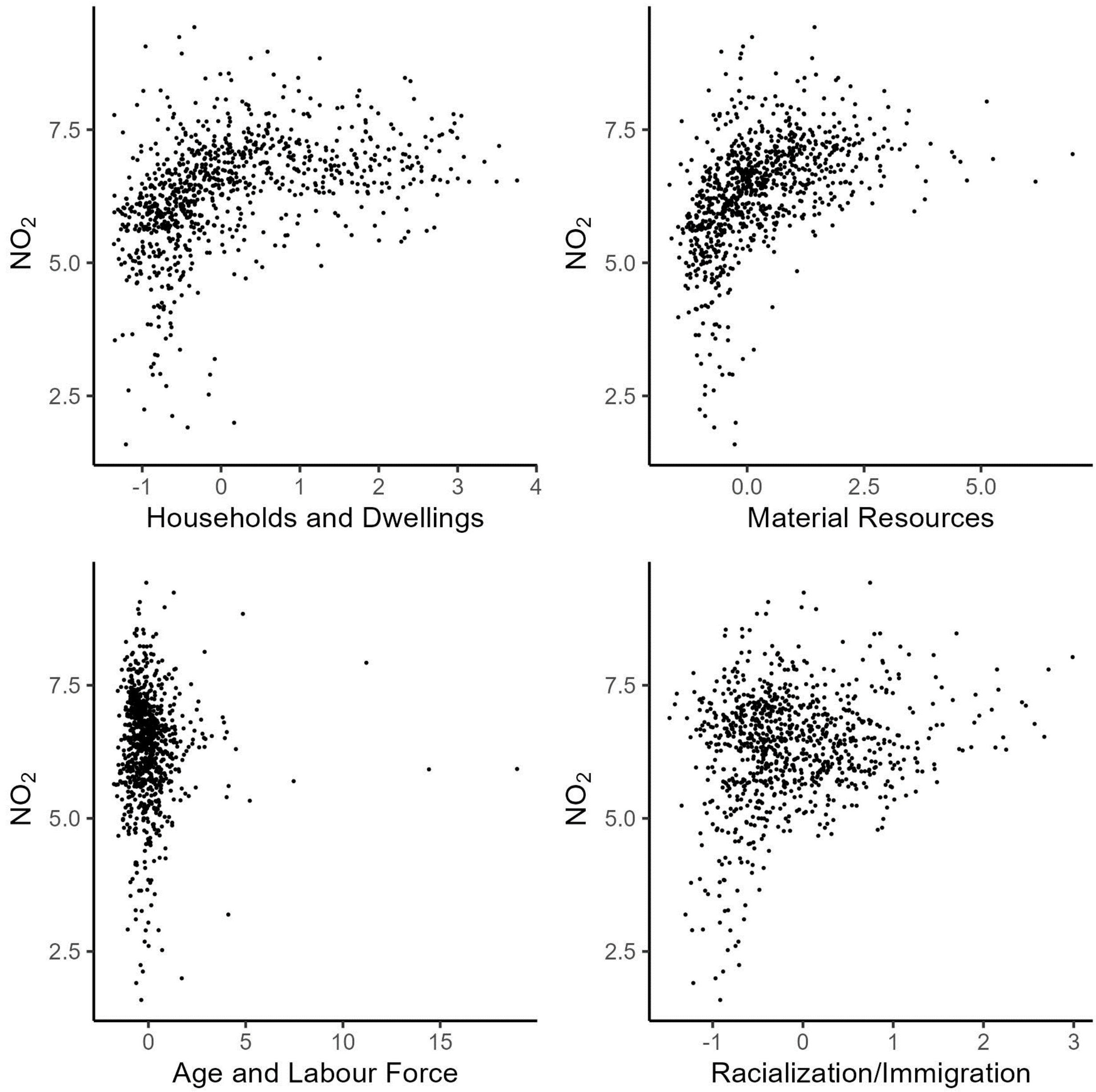

Figure 3.12: Nitrogen dioxide air pollution and the dimensions of the Ontario Marginalization Index.

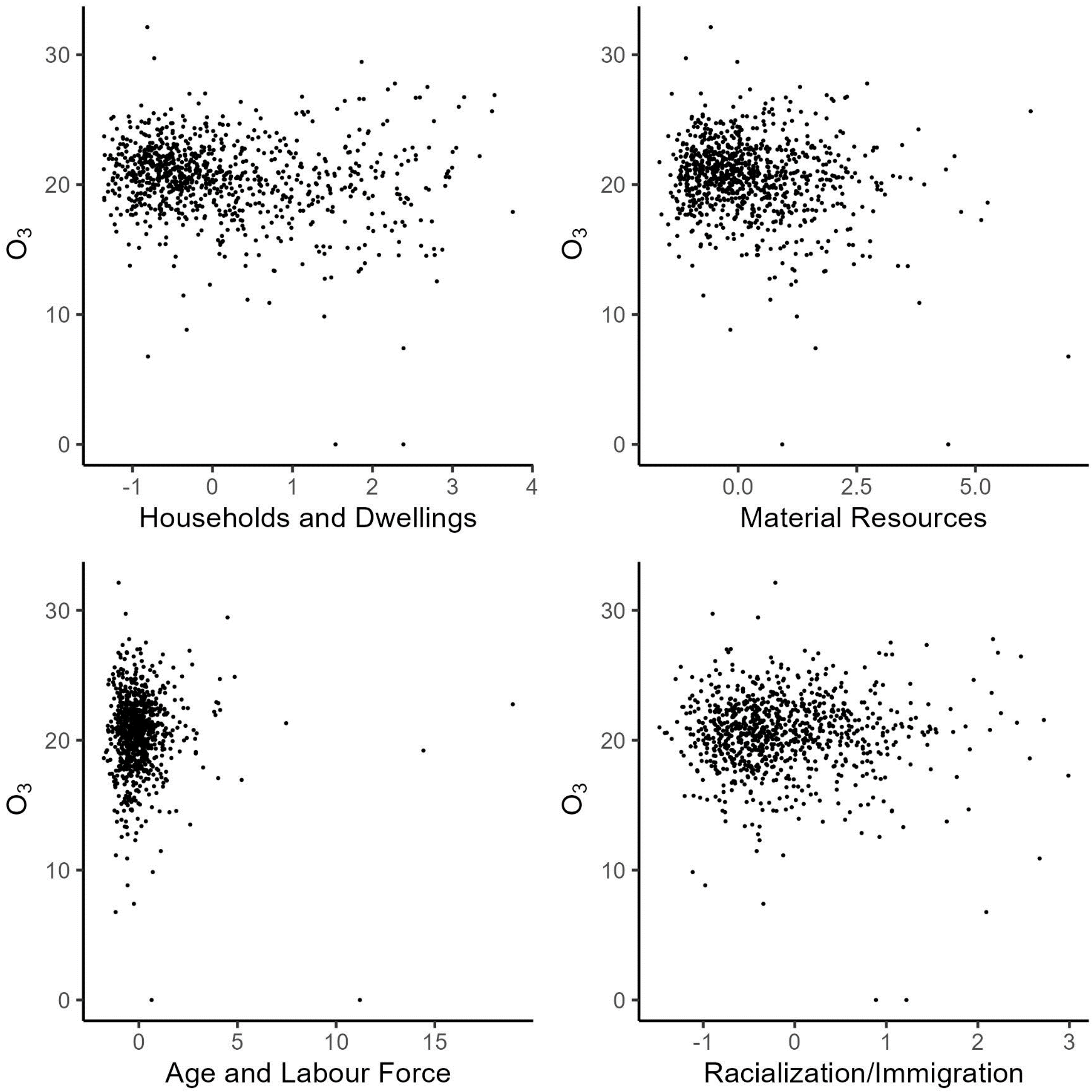

Figure 3.13: Ozone air pollution and the dimensions of the Ontario Marginalization Index.

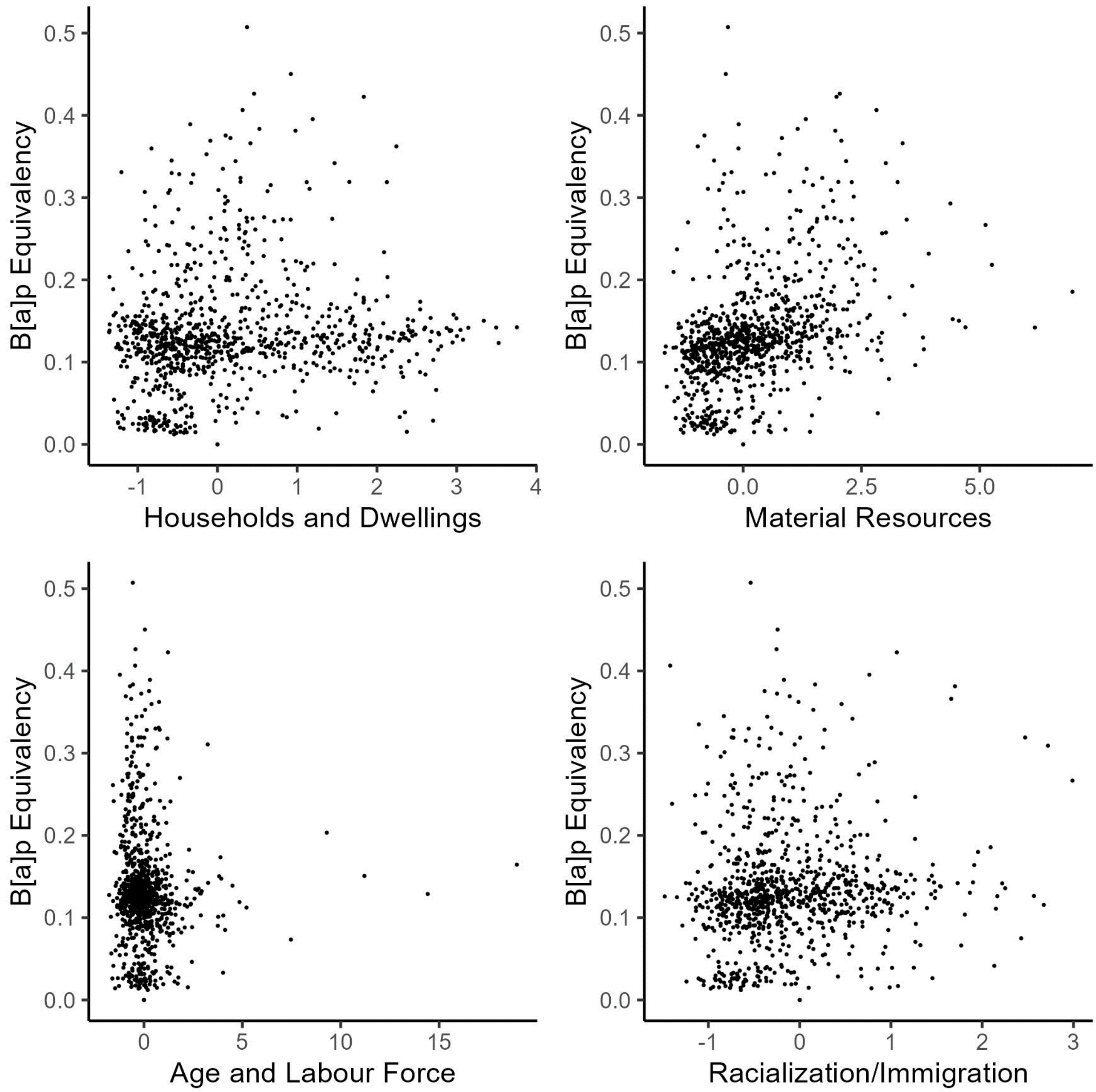

Figure 3.14: Benzo[a]pyrene equivalency and dimesnions of the Ontario Marginalization Index .

4. Challenges/Limitations

In the case of SO_2, ambient concentrations in the city were often below detection limits to develop land use regression models; however, the areas near the industrial core demonstrated high concentrations.

Concerning the PAH concentrations, this study only measured summer concentrations; the concentration estimates are not adjusted for different seasons. Previous research has indicated that slightly higher PAH concentrations occur in winter than in summer, suggesting that these values likely represent a conservative estimate for annual concentrations (Anastasopoulos et al., 2012).

Many samples had PAH concentrations below the method quantification limit, indicating that their levels might be too low to be effectively measured within two months. Extending the sampling duration could potentially provide more accurate estimates of PAH exposure in the future.

Due to the fewer PAH samples collected, only three sites with duplicates were implemented, and samples were successfully measured. Interpreting extreme values becomes complex in such cases. For instance, a downtown sample exhibited significantly higher concentrations, exceeding five times the standard deviation for several PAH measures. Without a duplicate, it is difficult to determine if this is due to measurement uncertainties or a local source anomaly. This challenge persists when dealing with very high benzo[a]pyrene equivalency (0.39 ng/m^3) measured in the northwestern area of Hamilton, far from the other high concentrations observed in the industrial core. Understanding the origins of such anomalies is also challenging without duplicate measurements.

Environmental justice studies rely on community-level measures, which may lead to ecological fallacy issues, where individual-level characteristics are based solely on aggregate-level data. In other words, it involves making incorrect inferences about individuals based on group-level data. This fallacy arises when there is a failure to recognize or account for group variability.

5. Potential Implications for Health

The objective of this study was not to calculate the health effects of the exposure, which should occur in a future analysis. However, in this section, we draw upon previous health effects studies to provide a sense of Hamilton's variation in health risks.

Nitrogen dioxide was estimated to range from a low value of 1 ppb up to 16 ppb, a range of 15 ppb. We can use this range to estimate the potential increase in health effects between living in the lowest and highest air pollution areas, which would assume all other risk factors for an individual to be equal. When an effect was present as an odds ratio, we converted the value directly to a relative risk under the "rare disease assumption", which is appropriate given the very low overall rates of the following diseases (Orellano et al., 2020).

The variation in risks is expressed as a percentage increase in risk between the lowest and the highest polluted areas within Hamilton; however, it is essential to recognize that the increased risk is not the rate in the population. Unfortunately, we do not have disease rates for this study at baseline conditions, but current rates for many of the outcomes presented are included to establish the overall risk. If the base rate for a disease were 1,000 cases per 100,000 people in the least polluted regions and air pollution in the highest polluted areas increased risk by 10%, then in the highest polluted areas we would expect 1,000 (base rate) + 1,000 * 10% (increased risk) = 1,100 per 100,000.

5.1 Nitrogen Dioxide

Lung Cancer: A meta-analysis of lung cancer indicated that for a 10 ppb increase in NO_2, lung cancer increased by 4% [95% CI: 1%, 8%] (Hamra et al., 2015). Given all other lung cancer risk factors being equal, living in the highest NO_2 area compared to the lowest in Hamilton would increase lung cancer rates by 6%.

Bronchus and lung cancer between 2013 and 2015 in Hamilton occurred at an annual rate of 70.4 cases per 100,000 people, which is less than 0.07% (Government of Canada, 2017).

Asthma: A meta-analysis indicated that an increment of 10 ppb increase in NO_2 is associated with a 13.5% (95% CI: 3.1%–25.1%) increase in asthma development of children aged 0-18 years of age (Takenoue et al., 2012). Given all other asthma development risk factors being equal, living in the highest NO_2 areas compared to the lowest in Hamilton would increase the risk of asthma development by 20.1%.

Asthma in 2017 was responsible for 38.60 hospitalizations per 100,000 people in Hamilton (Epidemiology and Evaluation Healthy and Safe Communities City of Hamilton, 2018).

Chronic obstructive pulmonary disease (COPD): A meta-analysis indicated a 5.3 ppb increase in NO_2, COPD hospitalizations increased by 1.3% (95% CI: 0.5%, 2.1%), COPD Mortality increased by 2.6% (95% CI: 1.7%, 3.5%) and COPD prevalence increased by 17% (95% CI: 4.6%, 30.8%). Assuming an equality of all other risk factors in Hamilton, this may result in an increased risk of 3.7% for COPD hospitalizations, a 7.5% increase in COPD Mortality, and a 55% increase in COPD prevalence.

COPD was responsible for 237.93 hospitalizations per 100,000 people in 2017 in Hamilton. The mortality rate due to COPD in Hamilton was 30.14 per 100,000 people (Epidemiology and Evaluation Healthy and Safe Communities City of Hamilton, 2018).

5.2 Ozone

The identified health effects of O_3 exposure are short-term exposures during peak events, which cannot be calculated from our long-term measurements.

5.3 PAHs

An estimate for excess lifetime cancer risk was calculated using Equation 1 following the method described in (Irvine et al., 2014), where excess cancer risk was calculated for the lowest predicted BaP equivalent value (0.01 ng / m^3) and the highest (0.51 ng / m^3).

$$Risk = \frac{CA \times ET \times EF \times ED}{AT} \times IUR \qquad (1)$$

Where CA is the concentration of BaP equivalent in air (ng/m^3); ET is the exposure time (24 hours/day); EF is the exposure frequency (365 days/year); ED is the exposure duration (70 years); AT is the averaging time (613200 hours) and IUR is the inhalation unit risk, which was 0.6 (ng / m^3) and obtained from the Ontario Air Standards for benzo[a]pyrene as a surrogate for polycylic aromatic hydrocarbons (Standards Development Branch Ontario Ministry of the Environment, 2011).

The lowest value from our model output is 0.01 ng / m^3, which is a 1 in 1,000,000 cancer risk. The highest concentration from the model is 0.51 ng / m3, which suggests a 44 in 1,000,000 cancer risk.

6. Recommendations/Next Steps

The following recommendations are based on the findings in this report:

1. Long-term ozone concentrations demonstrate higher concentrations in rural communities where real-time measurements do not occur. Real-time air pollution measurements should be conducted during the summer, when short-term ozone peak concentrations are expected, to evaluate if the same concentration gradient occurs during short-term elevated events.
2. Comprehensive health effects study. Some health effects estimates were included in this report to provide some context; however, a more comprehensive evaluation should be conducted to examine how Hamilton's specific conditions result in health effects.
3. An education program should be implemented in communities, emphasizing communities that face a double burden (high pollution and high marginalization) to understand how tools such as the Air Quality Health Index can be used to reduce personal risk during high air pollution events.

7. Conclusions

This study conducted a comprehensive assessment of air pollution in Hamilton, Ontario, and several key findings emerged. The project identified an association between higher wealth and higher O_3 exposure, but no significant association was found for the other pollutants. A noticeable pattern of only lower exposure experienced by the least marginalized was qualitatively observed NO_2 and, to a lesser extent PAHs, both pollutants demonstrated higher concentrations near the industrial core. Nitrogen dioxide also demonstrated higher concentrations near the major road in Hamilton. The project has provided an improved understanding of air quality dynamics within the city, both spatially and temporally (seasonal dynamics). The data will be critical for future studies assessing exposure patterns, validating other pollution models, and health research. The project supported public awareness through public meetings and significant media attention. Overall, the project supports Hamilton as a leader in understanding its local airshed.

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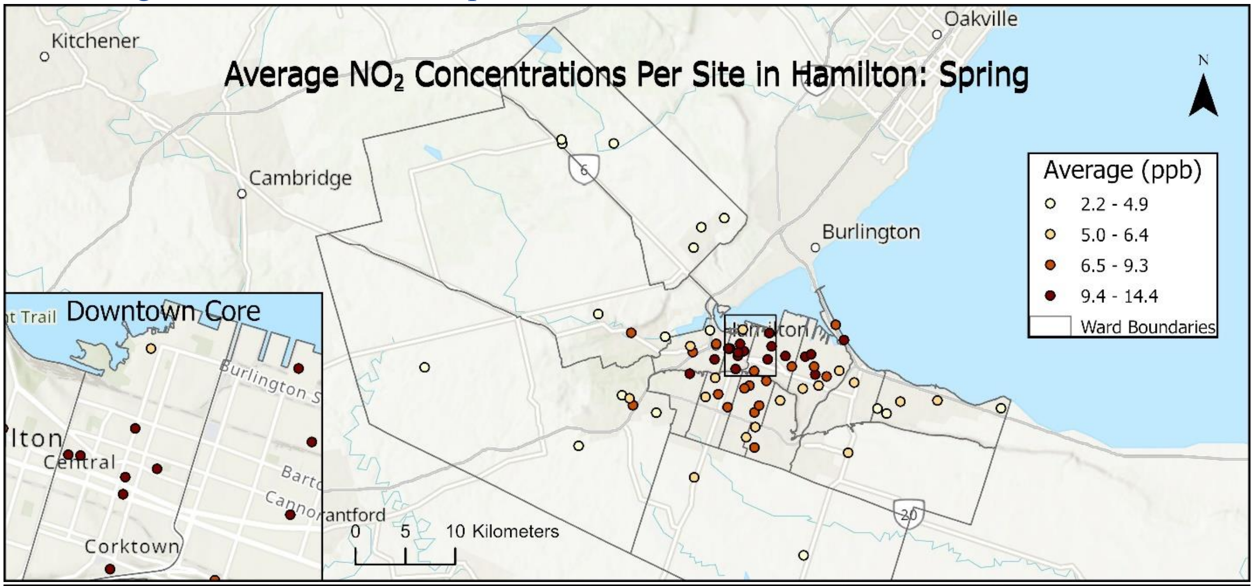
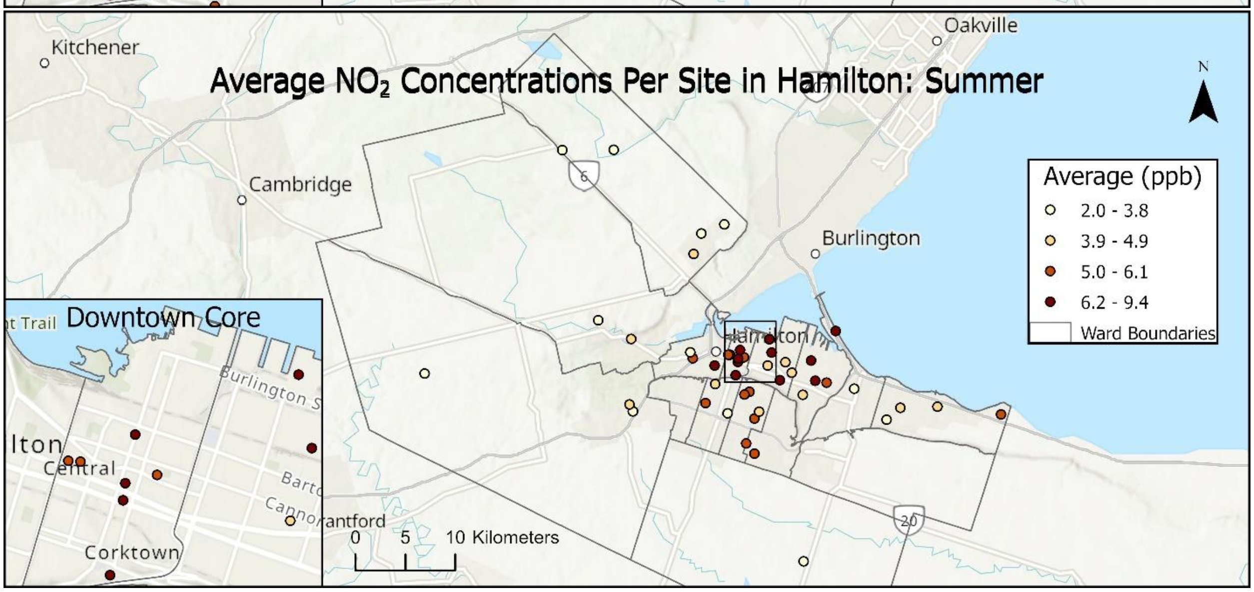
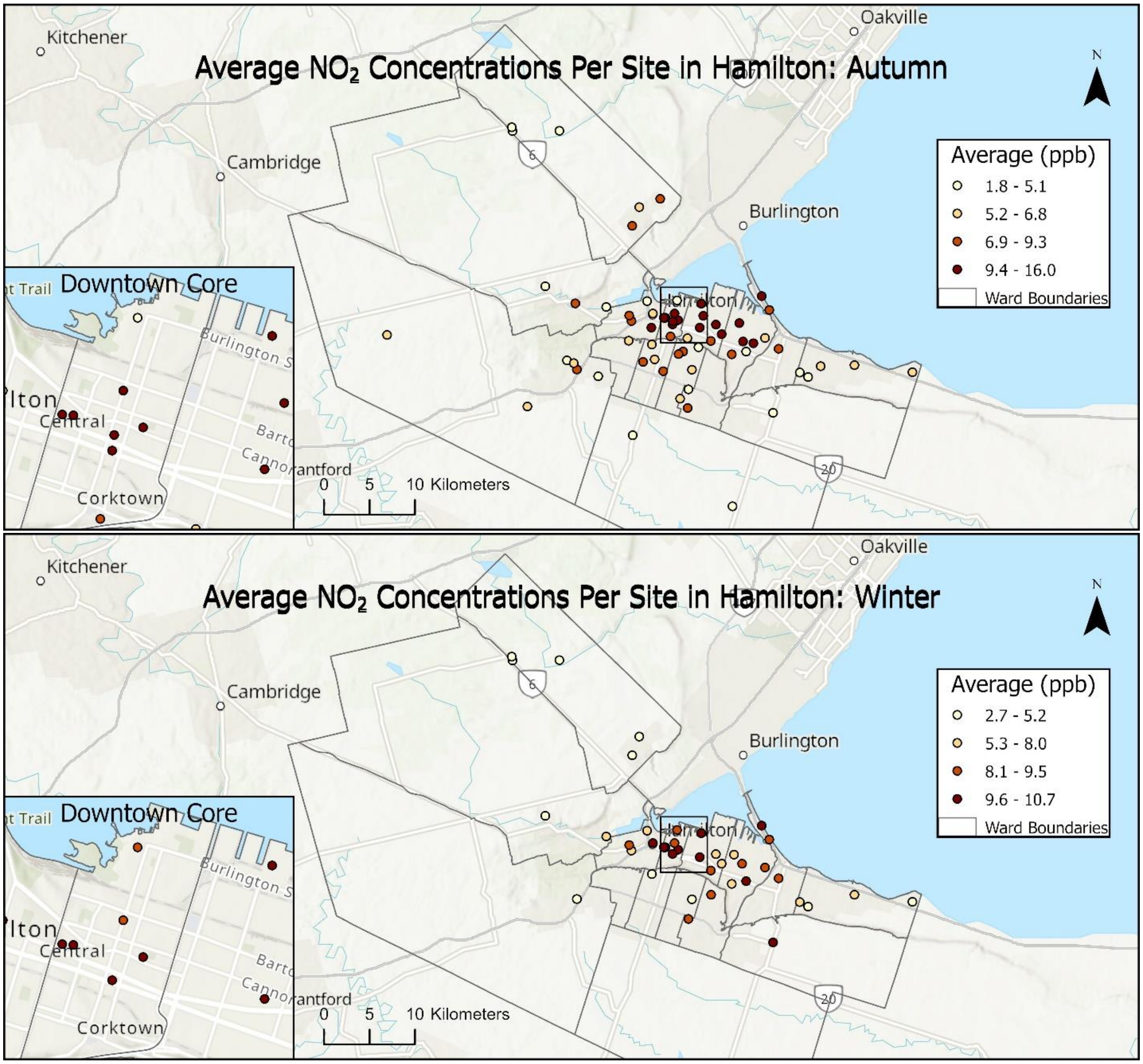
Appendix A

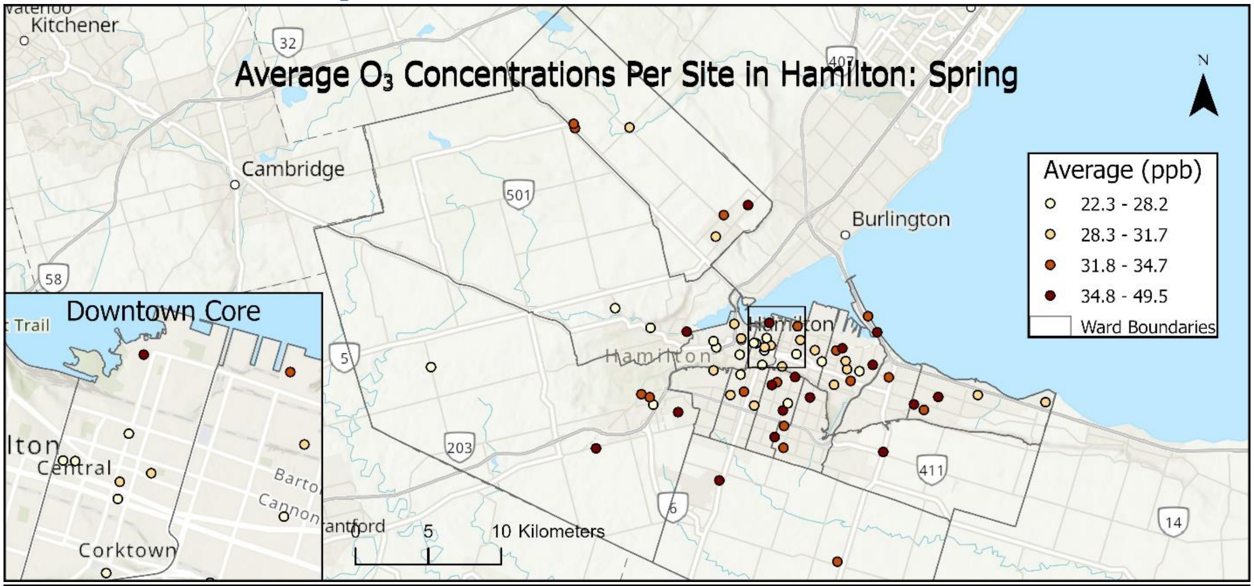
A.1 Nitrogen Dioxide Season Maps

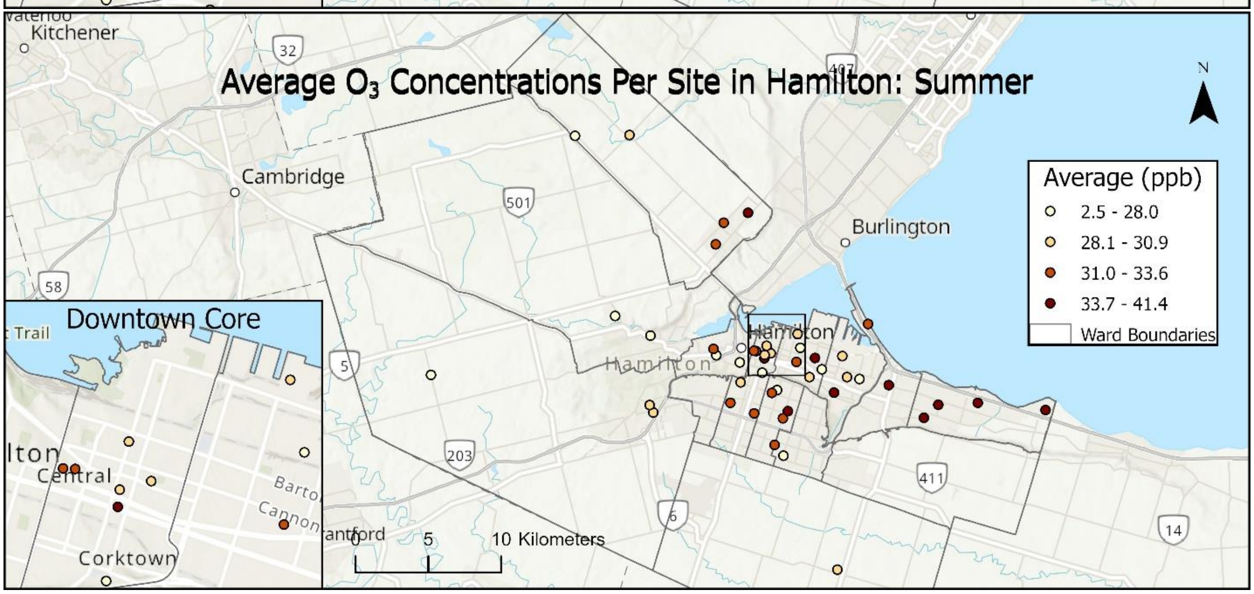


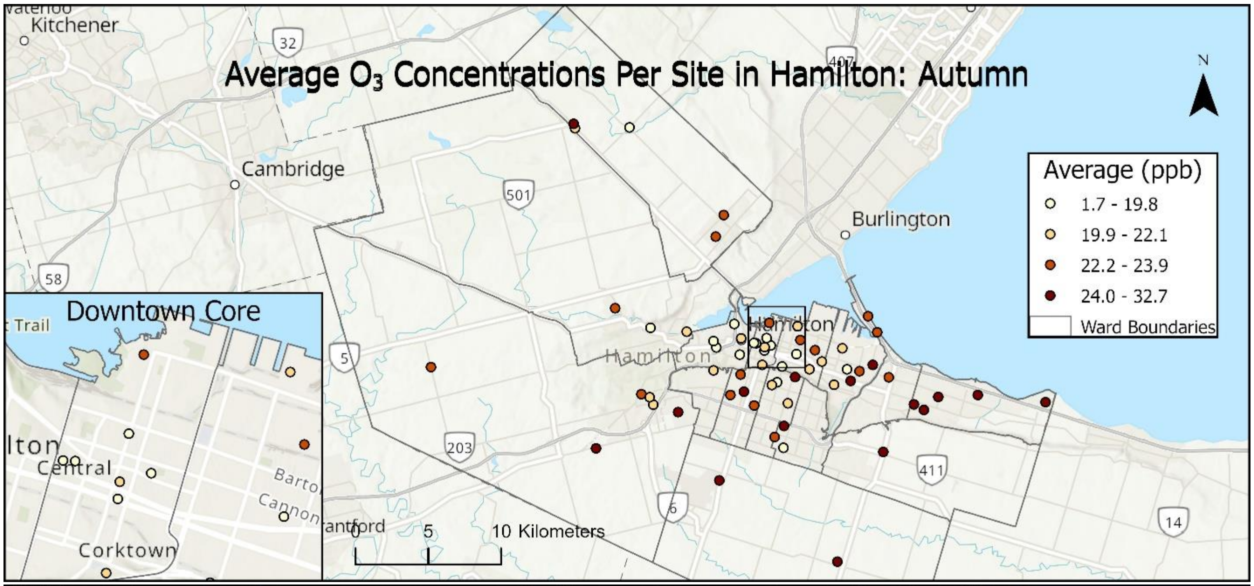


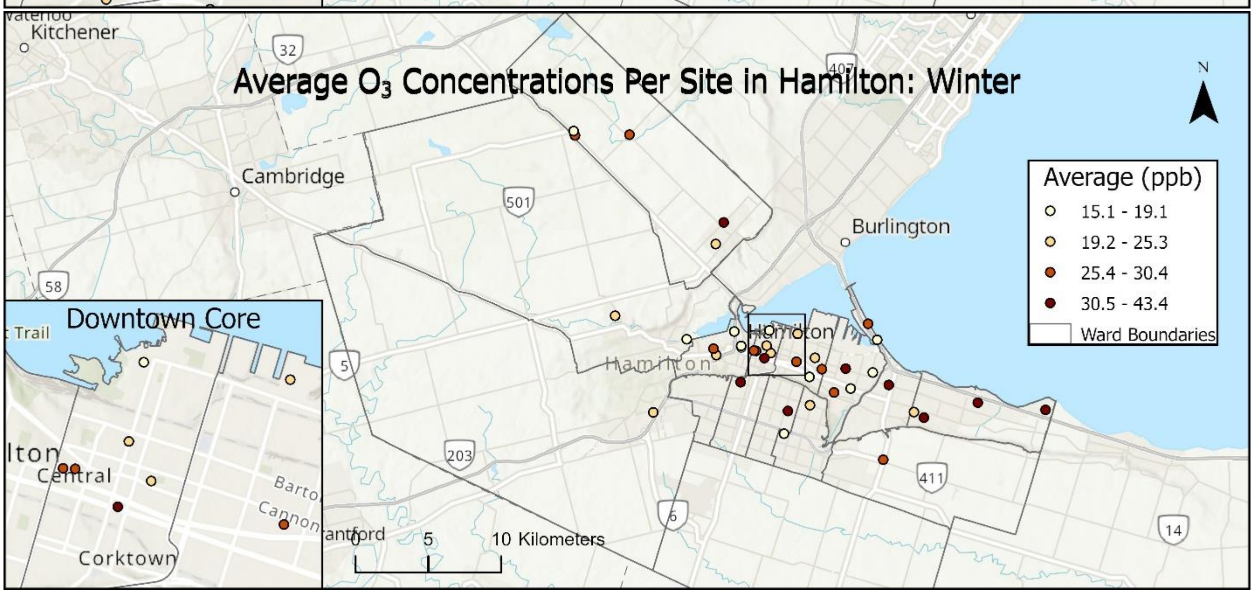

Average NO₂ Concentrations Per Site in Hamilton: Autumn
Average (ppb)
1.8 - 5.1
5.2 - 6.8
6.9 - 9.3
9.4 - 16.0
Ward Boundaries
Downtown Core
0 5 10 Kilometers
Kitchener
Cambridge
Burlington
Oakville
Average NO₂ Concentrations Per Site in Hamilton: Winter
Average (ppb)
2.7 - 5.2
5.3 - 8.0
8.1 - 9.5
9.6 - 10.7
Ward Boundaries
Downtown Core
0 5 10 Kilometers
Kitchener
Cambridge
Burlington
Oakville

A.2 Ozone Seasonal Maps

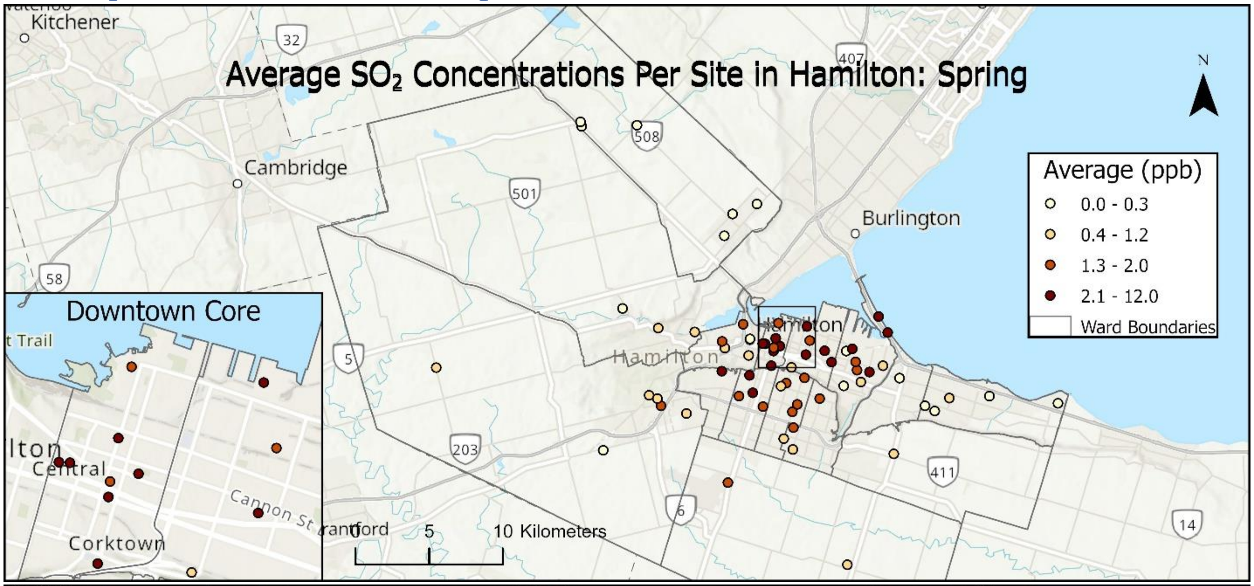


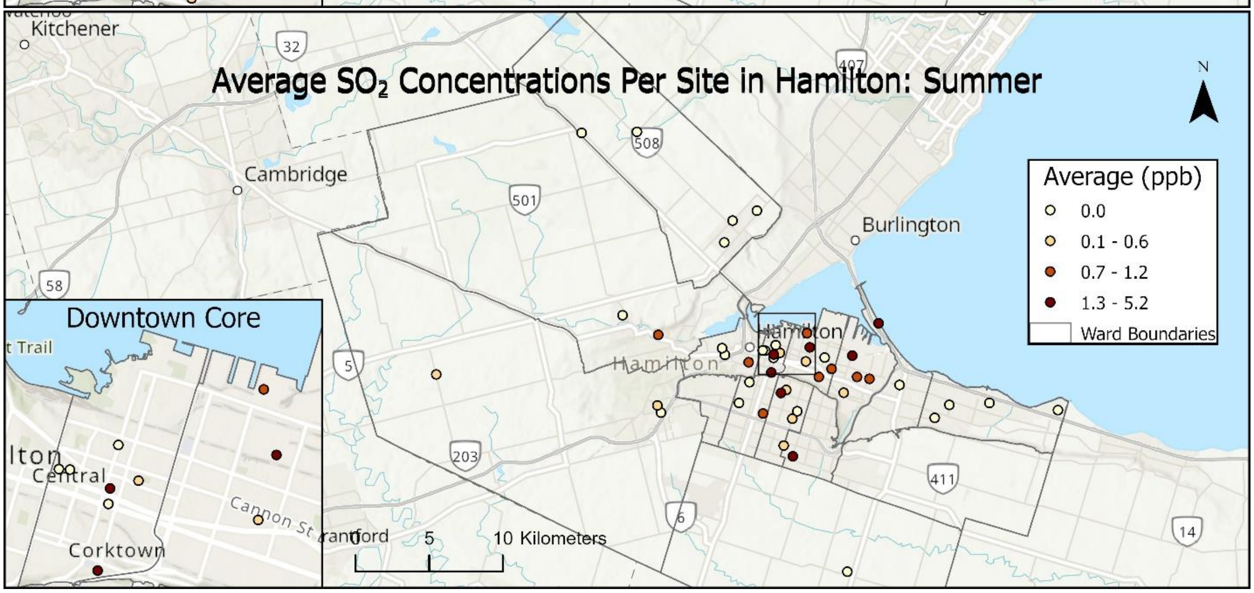


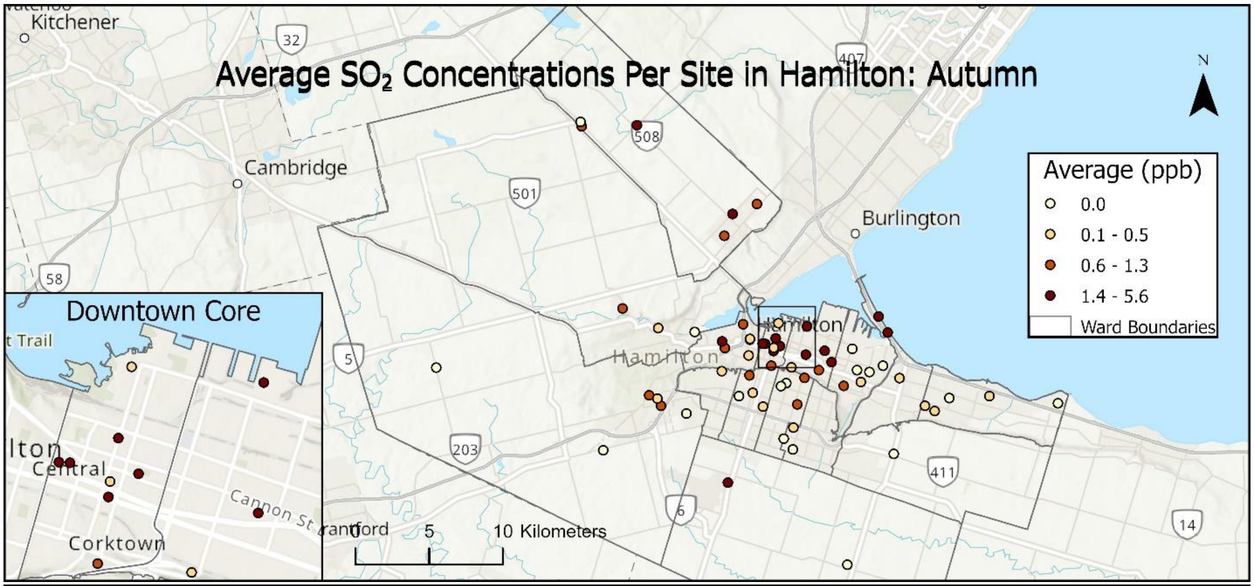

Average O3 Concentrations Per Site in Hamilton: Autumn
Average (ppb)
1.7 - 19.8
19.9 - 22.1
22.2 - 23.9
24.0 - 32.7
Ward Boundaries
Downtown Core
0 5 10 Kilometers
Kitchener
Cambridge
Burlington
Hamilton
Central
Corktown

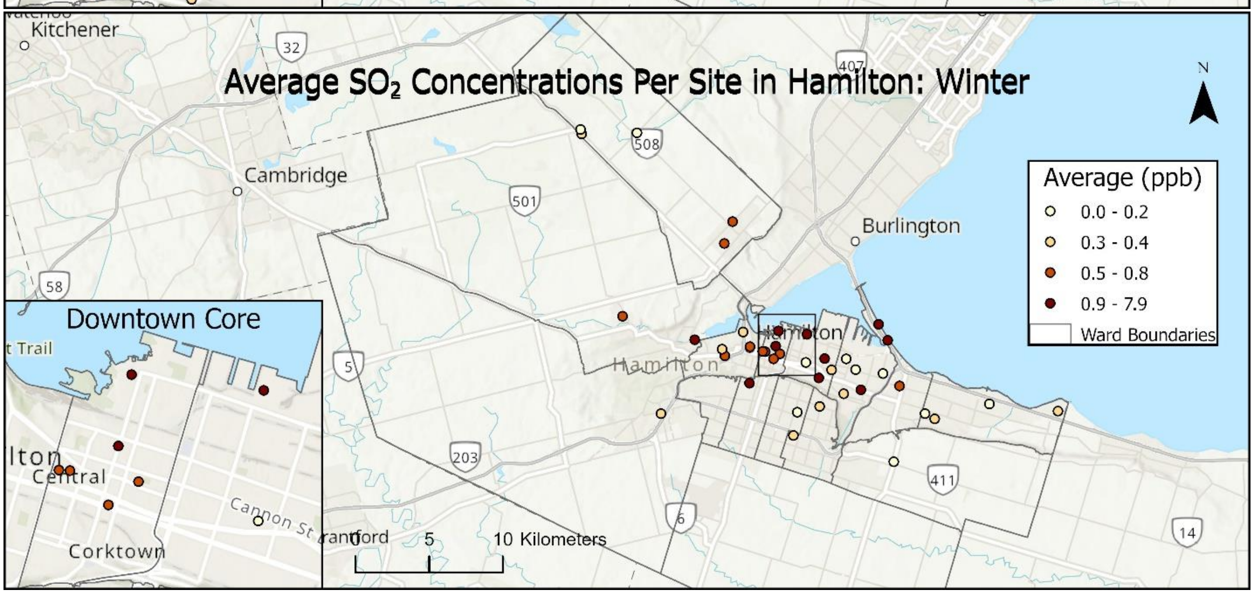

Average O3 Concentrations Per Site in Hamilton: Winter
Average (ppb)
15.1 - 19.1
19.2 - 25.3
25.4 - 30.4
30.5 - 43.4
Ward Boundaries
Downtown Core
0 5 10 Kilometers
Kitchener
Cambridge
Burlington
Hamilton
Central
Corktown

A.3 Sulphur Dioxide Seasonal Maps






Average SO2 Concentrations Per Site in Hamilton: Autumn
Average (ppb)
0.0
0.1 - 0.5
0.6 - 1.3
1.4 - 5.6
Ward Boundaries
Downtown Core
Kitchener
Cambridge
Burlington
Hamilton
Central
Corktown
Cannon St
0
5
10 Kilometers


Average SO2 Concentrations Per Site in Hamilton: Winter
Average (ppb)
0.0 - 0.2
0.3 - 0.4
0.5 - 0.8
0.9 - 7.9
Ward Boundaries
Downtown Core
Kitchener
Cambridge
Burlington
Hamilton
Central
Corktown
Cannon St
0
5
10 Kilometers

Appendix B: PAH Concentrations by Sample Location

Concentrations of measured PAHs in Hamilton and Western Burlington in the summer of 2022 in ng/m³. 0.00 indicated below detection limits.

Site ID	Longitude	Latitude	Deployment Time (days)	Average Temp. (°C)	Acenaphthylene	Acenaphthene	Fluorene	Dibenzothiophene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Retene
901	-79.9652	43.2608	63	21.32	0.00	0.35	0.73	0.18	2.63	0.06	1.19	0.61	0.12
902	-79.8809	43.2520	61	21.23	0.00	0.82	1.68	0.63	10.03	0.30	5.31	3.07	0.25
903	-79.8962	43.2621	61	21.13	0.00	1.21	1.46	0.45	6.89	0.15	3.47	1.69	0.17
904	-79.8633	43.2666	61	21.08	0.00	4.94	4.07	1.01	15.97	0.51	7.94	4.02	0.20
905	-79.8309	43.2559	63	21.64	0.01	2.76	2.67	0.87	14.21	0.86	8.67	6.04	0.38
906	-79.8465	43.2482	63	21.64	0.00	1.95	2.87	0.54	10.84	0.16	4.14	2.08	0.21
907	-79.7559	43.2484	62	21.68	0.00	0.50	0.80	0.23	3.99	0.09	2.27	1.43	0.21
908	-79.7870	43.2845	62	21.69	0.14	2.23	3.14	0.94	14.54	0.77	7.81	4.79	0.35
909	-79.8064	43.2553	62	21.61	0.01	4.92	4.59	1.19	16.64	0.46	5.07	2.95	0.44
910	-79.8167	43.2447	63	21.64	0.00	1.71	1.53	0.48	7.92	0.11	2.38	1.22	0.20
911	-79.7757	43.2573	63	21.64	0.10	4.03	2.40	0.62	12.54	0.34	5.31	3.22	0.33
914	-80.0706	43.2901	62	21.32	0.00	0.15	0.66	0.41	4.24	0.04	1.53	0.71	0.34
917	-80.1070	43.1992	62	20.49	0.00	2.15	2.04	0.60	13.98	0.24	4.49	0.94	0.94
918	-79.8974	43.2318	62	21.32	0.00	0.74	1.08	0.55	13.13	0.15	6.43	2.04	0.29
919	-79.9470	43.2330	63	20.43	0.00	1.37	0.89	0.23	4.02	0.05	2.07	1.05	0.19
920	-79.9481	43.1640	63	20.49	0.00	0.23	0.59	0.14	2.77	0.05	1.26	0.69	0.24
922	-79.7618	43.2192	62	21.67	0.00	0.56	0.64	0.23	4.05	0.02	1.78	0.73	0.21
923	-79.8110	43.1993	62	20.45	0.03	0.92	1.66	0.01	0.94	0.00	0.42	0.09	0.01
924	-79.6897	43.2310	62	21.67	0.00	0.99	0.67	0.14	3.00	0.04	1.85	0.93	0.12
926	-79.7760	43.2672	62	21.69	0.34	5.15	3.75	1.10	19.29	0.71	10.21	7.12	0.35
927	-79.8551	43.3017	62	21.08	0.00	0.97	0.90	0.22	4.62	0.04	3.05	1.25	0.16
928	-79.8075	43.3130	63	21.64	0.00	0.67	0.70	0.17	2.72	0.03	1.35	0.62	0.10
929	-79.8325	43.3440	64	21.68	0.00	0.00	0.43	0.20	3.67	0.04	1.92	0.75	0.11
930	-79.8917	43.2957	62	21.08	0.00	3.63	2.16	0.53	10.23	0.17	5.68	1.36	0.26
931	-79.8962	43.1775	63	20.49	0.00	0.13	0.49	0.13	2.23	0.04	1.24	0.65	0.23
932	-79.8173	43.2283	62	21.66	0.00	0.45	0.88	0.19	3.79	0.05	1.72	0.83	0.24
933	-79.9787	43.3971	62	21.66	0.00	0.18	0.59	0.29	6.19	0.06	4.19	1.78	0.49
Detection limit from field blank, if applicable, otherwise from instrument detection limit			Average: 62	Average: 21.26	0.06	0.40	0.03	0.02	0.06	0.01	0.03	0.02	0.01

Row	Longitude	Latitude	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(e) pyrene	Benzo[a] pyrene	Perylene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene	Benzo[a]pyrene Equivalency
901	-79.9652	43.2608	0.04	0.08	0.06	0.02	0.04	0.04	0.00	0.02	0.00	0.04	0.06
902	-79.8809	43.2520	0.32	0.49	0.37	0.13	0.19	0.09	0.02	0.09	0.00	0.15	0.20
903	-79.8962	43.2621	0.10	0.19	0.15	0.05	0.08	0.06	0.01	0.04	0.00	0.09	0.11
904	-79.8633	43.2666	0.27	0.42	0.23	0.07	0.10	0.06	0.01	0.04	0.00	0.07	0.15
905	-79.8309	43.2559	2.02	1.92	2.36	0.99	1.22	1.88	1.80	0.86	0.37	1.14	2.93
906	-79.8465	43.2482	0.13	0.23	0.18	0.07	0.09	0.08	0.01	0.05	0.00	0.08	0.14
907	-79.7559	43.2484	0.11	0.20	0.20	0.06	0.13	0.08	0.02	0.07	0.02	0.17	0.16
908	-79.7870	43.2845	0.73	0.99	0.68	0.23	0.34	0.18	0.09	0.14	0.05	0.21	0.44
909	-79.8064	43.2553	0.19	0.26	0.21	0.07	0.12	0.09	0.02	0.06	0.00	0.10	0.17
910	-79.8167	43.2447	0.07	0.16	0.11	0.04	0.06	0.06	0.01	0.03	0.00	0.06	0.10
911	-79.7757	43.2573	0.34	0.46	0.39	0.13	0.22	0.19	0.15	0.11	0.00	0.18	0.31
914	-80.0706	43.2901	0.02	0.05	0.04	0.01	0.02	0.00	0.00	0.01	0.00	0.03	0.01
917	-80.1070	43.1992	0.02	0.05	0.03	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.03
918	-79.8974	43.2318	0.08	0.18	0.10	0.03	0.05	0.04	0.01	0.02	0.00	0.04	0.09
919	-79.9470	43.2330	0.07	0.12	0.10	0.03	0.06	0.00	0.03	0.02	0.00	0.07	0.03
920	-79.9481	43.1640	0.05	0.08	0.05	0.02	0.03	0.02	0.00	0.01	0.00	0.03	0.03
922	-79.7618	43.2192	0.04	0.09	0.06	0.02	0.03	0.03	0.01	0.02	0.00	0.03	0.05
923	-79.8110	43.1993	0.02	0.02	0.03	0.01	0.02	0.02	0.00	0.01	0.00	0.02	0.03
924	-79.6897	43.2310	0.07	0.11	0.10	0.03	0.05	0.05	0.02	0.03	0.00	0.05	0.08
926	-79.7760	43.2672	0.96	1.26	0.98	0.36	0.56	0.32	0.27	0.25	0.00	0.42	0.63
927	-79.8551	43.3017	0.04	0.10	0.08	0.03	0.04	0.05	0.03	0.02	0.00	0.04	0.08
928	-79.8075	43.3130	0.05	0.08	0.08	0.03	0.05	0.11	0.01	0.03	0.00	0.05	0.13
929	-79.8325	43.3440	0.02	0.05	0.04	0.01	0.02	0.02	0.00	0.01	0.00	0.03	0.04
930	-79.8917	43.2957	0.03	0.08	0.05	0.00	0.00	0.00	0.03	0.01	0.00	0.03	0.03
931	-79.8962	43.1775	0.05	0.08	0.06	0.02	0.03	0.03	0.00	0.01	0.00	0.03	0.05
932	-79.8173	43.2283	0.05	0.09	0.06	0.02	0.04	0.04	0.02	0.02	0.00	0.03	0.06
933	-79.9787	43.3971	0.19	0.32	0.36	0.13	0.20	0.30	0.24	0.13	0.00	0.19	0.39
Detection limit from field blank, if applicable, otherwise from instrument detection limit			0.05	0.01	0.01	0.02	0.02	0.05	0.01	0.02	0.04	0.003	

Appendix C: Environment Hamilton Comments on Public Engagement

Through the project we hosted four public information sessions, which were held virtually on December 15th 2021, April 12th 2022, January 30th 2023, and July 11th 2023. These sessions were hosted via Zoom and saw a range of attendees at each session.

Each session was reasonably well attended, with 95 registrations and 36 attendees at our third webinar which was a presentation of preliminary data. For the final webinar there was significant media interest leading up to the meeting - we saw 254 registrations and peaked around 120 or so attendees. Through the project we also had a static sign up page that residents could use to stay up to date with the project - 158 residents registered for this. Information was also shared regularly with Environment Hamilton's general membership, and information was distributed via social media and through media reports.

Throughout the project we received a variety of questions and received feedback from the public. The status of Hamilton's air quality prior to this project was already of public interest, so early on in the project questions and feedback were focused on how the project would be set up, methodology, and where the monitors would be located. Through the project there was further feedback and questions about what would be done with the data when the project was complete - residents had interest in any detailed information about air quality in their own localized neighbourhoods within the City certainly, but the most consistent theme of query has been what the results of the study (political and/or regulatory) will be.

From the final community webinar, the media attention it received, and feedback we have received as well as observed on social media platforms there have been some prevalent themes of query. The top concern or line of questioning from residents is related to the strong trend we saw at the beginning, which were questions of local air quality and what potential health impacts of poor air quality could be on individuals and the population - and the potential difference in impacts between different pollutants in the air (for example, asking if sulfur dioxide is more dangerous than benzo(a)pyrene). The second most prevalent theme was to do with political or regulatory responses to the information they were learning - and within this theme two easily identifiable camps exist. The first being residents asking what the city, provincial government, federal government will or can do to improve the air quality in the City of Hamilton. This camp would best describe the majority of residents who attended the webinars, engaged with the project directly, or have an existing relationship with Environment Hamilton already. The second camp was less engaged and more cynical - we did receive some direct feedback that lamented the perception that some or all of the levels of government do not care about the issue, or are incapable of doing something about it. The majority of these sentiments were observed on social media platforms where media coverage of the platform was shared or information was directly shared by Environment Hamilton to the public. While this second more cynical response was not as common, it was observed enough to be noteworthy.

It is worth stressing that the majority of residents who engaged with the project directly were very interested in not just learning about the results of the project - but specifically what can be done to improve the air quality that does not result in the shutting down or loss of local industry.

There was strong interest from some attendees in how local industry can be held accountable for the pollution they generate - but queries about the closure of industry were rare. It is likely this is a result of ongoing outreach efforts (including our second webinar) by Environment Hamilton and the MECP about regulatory frameworks and enforcement - and the general knowledge that other districts in the world with similar industries do not face the same air quality challenges that the City of Hamilton does.

Of note, concerns about air quality impacts on individuals' health did generate discussion both within our final webinar as well as on social media platforms about the relative safety of continuing to live in the City of Hamilton, or particular neighbourhoods in the City. Members of the project explicitly stated at times that they lived in the City themselves and had no intention of moving - and successes in improving air quality locally in the past were indicated as evidence that further improvements can be made in the future. In the experience of Environment Hamilton these concerns are not new in Hamilton, but around the time of our final webinar we did see an increase in concerns about this in response to the various media stories that were written about the project.

Appendix D: Ozone Passive Sampling Concentration Data

NA values in the concentration field represent values below the detection limit.

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
0	-79.97277	43.22930	31	2022-03-28 12:05:00	2022-04-11 10:32:00
0	-79.97277	43.22930	31	2022-03-28 12:09:00	2022-04-11 10:31:00
0	-79.97277	43.22930	23	2022-09-01 11:18:00	2022-09-15 11:01:00
0	-79.97277	43.22930	22	2022-09-01 11:21:00	2022-09-15 11:02:00
0	-79.97277	43.22930	33	2023-04-07 16:13:00	2023-04-21 11:08:00
0	-79.97277	43.22930	33	2023-04-07 16:10:00	2023-04-21 11:05:00
1	-79.96449	43.27027	30	2022-03-01 09:56:00	2022-03-15 09:50:00
1	-79.96449	43.27027	24	2022-08-11 10:42:00	2022-08-25 10:15:00
1	-79.96449	43.27027	19	2022-11-14 09:43:00	2022-11-28 09:57:00
1	-79.96449	43.27027	26	2023-03-02 12:01:00	2023-03-15 11:22:00
2	-79.93388	43.26768	36	2022-03-28 11:16:00	2022-04-11 10:10:00
2	-79.93388	43.26768	22	2022-09-01 10:56:00	2022-09-15 10:41:00
2	-79.93388	43.26768	18	2022-12-06 10:10:00	2022-12-20 10:43:00
2	-79.93388	43.26768	43	2023-04-06 11:47:00	2023-04-20 10:49:00
3	-79.90811	43.32617	32	2022-07-21 10:40:00	2022-08-04 11:17:00
3	-79.90811	43.32617	24	2022-10-12 09:52:00	2022-10-26 09:42:00
3	-79.90811	43.32617	24	2023-01-20 10:54:00	2023-02-10 09:50:00
3	-79.90811	43.32617	29	2023-05-16 11:41:00	2023-05-30 16:21:00
4	-79.86379	43.27244	32	2022-03-28 13:45:00	2022-04-11 11:56:00
4	-79.86379	43.27244	24	2022-09-02 11:58:16	2022-09-16 14:15:00
4	-79.86379	43.27244	17	2022-12-06 11:52:00	2022-12-19 12:44:00
4	-79.86379	43.27244	38	2023-04-06 15:05:00	2023-04-20 12:40:00
5	-79.91126	43.26163	33	2022-02-07 12:08:00	2022-02-21 10:58:00
5	-79.91126	43.26163	33	2022-07-21 12:35:27	2022-08-04 13:42:00
5	-79.91126	43.26163	16	2022-10-13 13:08:15	2022-10-27 08:48:00
5	-79.91126	43.26163	20	2023-01-20 13:11:06	2023-02-10 11:42:00
5	-79.91126	43.26163	25	2023-05-17 16:26:00	2023-05-31 16:00:00
6	-79.90107	43.33951	51	2022-02-07 09:42:00	2022-02-21 09:47:00
6	-79.90107	43.33951	33	2022-07-21 10:23:00	2022-08-04 11:06:00
6	-79.90107	43.33951	23	2022-10-12 09:39:00	2022-10-26 09:30:00
6	-79.90107	43.33951	31	2023-01-20 10:34:00	2023-02-10 09:33:00
6	-79.90107	43.33951	33	2023-05-16 11:07:00	2023-05-30 16:00:00
7	-79.88915	43.25292	28	2022-03-02 08:49:00	2022-03-16 10:50:00
7	-79.88915	43.25292	24	2022-08-12 14:06:41	2022-08-26 11:54:00
7	-79.88915	43.25292	18	2022-11-15 09:40:00	2022-11-29 11:12:00
7	-79.88915	43.25292	27	2023-03-02 16:37:00	2023-03-15 13:55:00
8	-79.89347	43.27198	30	2022-03-28 10:56:00	2022-04-11 09:33:00
8	-79.89347	43.27198	19	2022-09-01 10:30:00	2022-09-15 10:19:00
8	-79.89347	43.27198	16	2022-12-06 11:08:00	2022-12-20 10:10:00
8	-79.89347	43.27198	33	2023-04-06 12:28:00	2023-04-20 11:18:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
9	-79.84130	43.25292	32	2022-02-08 10:33:00	2022-02-21 16:17:00
9	-79.84130	43.25292	34	2022-07-22 13:12:00	2022-08-05 13:58:00
9	-79.84130	43.25292	18	2022-10-13 10:49:01	2022-10-27 13:11:49
9	-79.84130	43.25292	24	2023-01-21 13:08:25	2023-02-11 13:54:00
9	-79.84130	43.25292	25	2023-05-17 13:23:00	2023-05-31 13:11:00
10	-79.81977	43.24809	36	2022-02-08 12:21:00	2022-02-21 15:59:00
10	-79.81977	43.24809	2	2022-07-21 16:58:01	2022-08-05 14:26:00
10	-79.81977	43.24809	20	2022-10-12 15:07:00	2022-10-27 12:49:00
10	-79.81977	43.24809	23	2023-01-21 12:30:00	2023-02-11 13:19:00
10	-79.81977	43.24809	28	2023-05-17 11:55:00	2023-05-31 11:50:00
11	-79.87039	43.24652	31	2022-03-02 10:20:00	2022-03-16 10:38:00
11	-79.87039	43.24652	25	2022-08-12 12:15:00	2022-08-26 11:37:00
11	-79.87039	43.24652	28	2022-08-12 12:13:13	2022-08-26 11:39:00
11	-79.87039	43.24652	22	2022-11-15 09:59:00	2022-11-29 11:26:00
11	-79.87039	43.24652	21	2022-11-15 10:01:00	2022-11-29 11:27:00
11	-79.87039	43.24652	25	2023-03-02 17:59:00	2023-03-15 14:57:00
11	-79.87039	43.24652	26	2023-03-02 18:03:00	2023-03-15 15:03:00
12	-79.86280	43.25830	32	2022-02-08 09:44:00	2022-02-21 17:10:00
12	-79.86280	43.25830	31	2022-03-02 09:27:00	2022-03-16 09:58:00
12	-79.86280	43.25830	29	2022-03-28 14:00:00	2022-04-11 11:46:00
12	-79.86280	43.25830	33	2022-07-22 12:57:00	2022-08-05 13:25:00
12	-79.86280	43.25830	27	2022-08-12 13:12:00	2022-08-26 11:59:00
12	-79.86280	43.25830	23	2022-09-02 10:11:31	2022-09-16 15:29:00
12	-79.86280	43.25830	15	2022-10-13 11:02:39	2022-10-27 13:36:10
12	-79.86280	43.25830	20	2022-11-15 11:39:00	2022-11-29 12:55:00
12	-79.86280	43.25830	14	2022-12-06 12:05:00	2022-12-19 11:37:00
12	-79.86280	43.25830	25	2023-01-21 15:55:00	2023-02-10 13:25:00
12	-79.86280	43.25830	26	2023-03-02 17:32:00	2023-03-15 14:40:00
12	-79.86280	43.25830	35	2023-04-06 14:12:00	2023-04-20 12:23:00
12	-79.86280	43.25830	25	2023-05-17 14:09:00	2023-05-31 13:54:00
13	-79.88769	43.26304	28	2022-03-28 13:25:00	2022-04-11 11:33:00
13	-79.88769	43.26304	20	2022-09-01 10:13:00	2022-09-15 10:10:00
13	-79.88769	43.26304	15	2022-12-06 11:22:00	2022-12-19 11:50:00
13	-79.88769	43.26304	31	2023-04-06 13:21:00	2023-04-20 12:03:00
14	-79.87515	43.25988	33	2022-02-08 08:48:00	2022-02-21 17:21:00
14	-79.87515	43.25988	33	2022-07-22 12:28:13	2022-08-05 13:04:00
14	-79.87515	43.25988	17	2022-10-13 11:52:59	2022-10-27 14:20:59
14	-79.87515	43.25988	24	2023-01-20 14:01:18	2023-02-10 12:58:00
14	-79.87515	43.25988	23	2023-05-17 15:18:00	2023-05-31 15:07:00
15	-79.85348	43.24520	32	2022-03-28 14:19:00	2022-04-11 12:27:00
15	-79.85348	43.24520	19	2022-09-02 10:34:03	2022-09-16 15:12:00
15	-79.85348	43.24520	31	2023-04-06 15:56:00	2023-04-20 13:13:00
16	-79.76332	43.23767	38	2022-02-07 16:05:00	2022-02-21 14:36:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
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16	-79.76332	43.23767	23	2022-10-12 14:22:00	2022-10-27 11:29:00
16	-79.76332	43.23767	32	2023-01-21 09:57:00	2023-02-11 10:13:00
16	-79.76332	43.23767	32	2023-05-16 16:09:00	2023-05-30 20:32:00
17	-79.77257	43.26563	31	2022-03-28 16:48:00	2022-04-11 14:11:00
17	-79.77257	43.26563	22	2022-09-01 16:17:00	2022-09-15 15:06:00
17	-79.77257	43.26563	18	2022-12-06 13:23:00	2022-12-19 09:32:00
17	-79.77257	43.26563	41	2023-04-07 09:56:00	2023-04-20 14:17:00
18	-79.90889	43.25761	30	2022-02-07 12:36:43	2022-02-21 11:09:00
18	-79.90889	43.25761	28	2022-03-01 10:23:00	2022-03-15 10:07:00
18	-79.90889	43.25761	29	2022-03-28 10:42:00	2022-04-11 10:01:00
18	-79.90889	43.25761	29	2022-07-21 12:15:39	2022-08-04 13:49:00
18	-79.90889	43.25761	23	2022-08-11 11:32:17	2022-08-25 10:32:00
18	-79.90889	43.25761	19	2022-09-01 10:43:00	2022-09-15 10:30:00
18	-79.90889	43.25761	16	2022-10-13 13:15:09	2022-10-27 09:02:03
18	-79.90889	43.25761	20	2022-11-15 09:27:00	2022-11-29 10:59:00
18	-79.90889	43.25761	15	2022-12-06 10:30:00	2022-12-20 10:26:00
18	-79.90889	43.25761	22	2023-01-20 13:29:00	2023-02-10 11:55:00
18	-79.90889	43.25761	26	2023-03-02 16:01:00	2023-03-15 13:02:00
18	-79.90889	43.25761	33	2023-04-06 12:09:00	2023-04-20 11:05:00
18	-79.90889	43.25761	22	2023-05-17 16:12:00	2023-05-31 15:46:00
19	-79.78008	43.27556	37	2022-03-01 16:21:34	2022-03-15 14:10:00
19	-79.78008	43.27556	32	2022-03-28 16:38:00	2022-04-11 14:20:00
19	-79.78008	43.27556	34	2022-07-21 15:59:58	2022-08-04 16:46:00
19	-79.78008	43.27556	31	2022-08-11 16:12:24	2022-08-25 14:45:00
19	-79.78008	43.27556	25	2022-09-01 16:25:00	2022-09-15 15:13:00
19	-79.78008	43.27556	22	2022-10-13 10:07:58	2022-10-27 11:43:03
19	-79.78008	43.27556	21	2022-11-14 15:53:00	2022-11-28 15:13:00
19	-79.78008	43.27556	23	2022-12-05 09:36:00	2022-12-19 09:23:00
19	-79.78008	43.27556	28	2023-01-21 09:36:00	2023-02-10 14:14:00
19	-79.78008	43.27556	34	2023-03-03 09:24:00	2023-03-16 09:55:00
19	-79.78008	43.27556	37	2023-04-07 09:35:00	2023-04-20 14:07:00
19	-79.78008	43.27556	32	2023-05-17 09:45:00	2023-05-31 10:09:00
20	-79.80758	43.25468	37	2022-03-02 11:37:00	2022-03-16 11:44:00
20	-79.80758	43.25468	32	2022-03-28 14:50:00	2022-04-11 13:21:00
21	-79.83783	43.26147	30	2022-03-02 10:55:00	2022-03-16 11:24:00
21	-79.83783	43.26147	27	2022-08-12 13:38:00	2022-08-26 10:33:00
21	-79.83783	43.26147	22	2022-11-15 11:24:00	2022-11-29 12:25:00
21	-79.83783	43.26147	30	2023-03-03 12:28:00	2023-03-16 12:01:00
22	-79.82556	43.25508	31	2022-03-02 11:20:00	2022-03-16 11:34:00
22	-79.82556	43.25508	36	2022-07-22 13:58:00	2022-08-05 14:15:00
22	-79.82556	43.25508	22	2022-10-12 15:29:00	2022-10-27 12:59:05
22	-79.82556	43.25508	23	2022-10-12 15:24:00	2022-10-27 12:57:05

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
22	-79.82556	43.25508	25	2023-01-21 12:50:47	2023-02-11 13:39:00
22	-79.82556	43.25508	30	2023-05-17 12:13:00	2023-05-31 12:54:00
23	-79.83996	43.27012	31	2022-02-08 10:12:00	2022-02-21 16:31:00
23	-79.83996	43.27012	35	2022-03-02 10:44:00	2022-03-16 11:15:00
23	-79.83996	43.27012	28	2022-03-28 14:36:00	2022-04-11 12:11:00
23	-79.83996	43.27012	31	2022-07-22 13:27:00	2022-08-05 13:49:00
23	-79.83996	43.27012	28	2022-08-12 13:28:00	2022-08-26 10:42:00
23	-79.83996	43.27012	22	2022-09-02 11:46:41	2022-09-16 14:24:00
23	-79.83996	43.27012	19	2022-10-13 10:27:00	2022-10-27 13:24:00
23	-79.83996	43.27012	19	2022-11-15 11:07:21	2022-11-29 12:25:00
23	-79.83996	43.27012	16	2022-12-05 11:56:00	2022-12-19 12:56:00
23	-79.83996	43.27012	22	2023-01-21 13:49:41	2023-02-10 13:52:00
23	-79.83996	43.27012	32	2023-03-03 12:47:00	2023-03-16 12:19:00
23	-79.83996	43.27012	33	2023-04-06 15:22:00	2023-04-20 12:54:00
23	-79.83996	43.27012	31	2023-05-17 13:42:00	2023-05-31 13:28:00
24	-79.80987	43.23355	35	2022-02-08 11:05:00	2022-02-21 15:37:00
24	-79.80987	43.23355	35	2022-02-08 11:07:00	2022-02-21 15:39:00
24	-79.80987	43.23355	37	2022-07-21 16:33:39	2022-08-04 17:07:00
24	-79.80987	43.23355	36	2022-07-21 16:29:50	2022-08-04 17:05:00
24	-79.80987	43.23355	22	2022-10-12 14:41:00	2022-10-27 12:32:00
24	-79.80987	43.23355	26	2023-01-21 11:56:24	2023-02-11 11:58:00
24	-79.80987	43.23355	25	2023-01-21 11:51:00	2023-02-11 11:52:00
24	-79.80987	43.23355	34	2023-05-17 11:33:00	2023-05-31 11:25:00
24	-79.80987	43.23355	29	2023-05-17 11:28:00	2023-05-31 11:23:00
25	-79.79859	43.24293	28	2022-03-02 15:12:48	2022-03-16 12:10:00
25	-79.79859	43.24293	31	2022-08-12 11:13:15	2022-08-26 10:06:00
25	-79.79859	43.24293	20	2022-11-14 15:16:00	2022-11-28 14:35:00
25	-79.79859	43.24293	19	2022-11-14 15:17:00	2022-11-28 14:36:00
25	-79.79859	43.24293	30	2023-03-03 10:54:00	2023-03-16 11:17:00
26	-79.79966	43.24815	34	2022-02-08 11:33:00	2022-02-21 15:26:00
26	-79.79966	43.24815	34	2022-03-02 11:50:00	2022-03-16 12:02:00
26	-79.79966	43.24815	30	2022-03-28 15:02:00	2022-04-11 13:29:00
27	-79.80232	43.25612	35	2022-03-02 14:50:56	2022-03-16 11:52:00
27	-79.80232	43.25612	30	2022-08-12 11:27:00	2022-08-26 09:55:00
27	-79.80232	43.25612	21	2022-11-14 15:38:00	2022-11-28 14:52:00
27	-79.80232	43.25612	34	2023-03-03 12:05:00	2023-03-16 11:37:00
28	-79.91160	43.24346	29	2022-03-29 10:00:00	2022-04-12 10:22:00
28	-79.91160	43.24346	20	2022-09-01 13:43:00	2022-09-15 12:18:00
28	-79.91160	43.24346	34	2023-04-07 15:09:00	2023-04-21 10:27:00
29	-79.85793	43.23566	36	2022-03-01 12:00:00	2022-03-15 12:01:00
29	-79.85793	43.23566	27	2022-08-11 12:48:00	2022-08-25 11:38:00
29	-79.85793	43.23566	3	2022-11-14 12:07:00	2022-11-28 12:07:00
29	-79.85793	43.23566	30	2023-03-03 13:20:00	2023-03-16 13:35:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
30	-79.86243	43.23386	41	2022-03-01 11:47:03	2022-03-15 11:06:00
30	-79.86243	43.23386	33	2022-08-11 12:38:05	2022-08-25 11:31:00
30	-79.86243	43.23386	22	2022-11-14 11:53:00	2022-11-28 23:57:00
30	-79.86243	43.23386	29	2023-03-05 13:16:00	2023-03-16 13:52:00
31	-79.78822	43.24164	6	2022-03-01 15:58:00	2022-03-15 13:54:00
31	-79.78822	43.24164	31	2022-03-01 16:00:18	2022-03-15 13:56:00
31	-79.78822	43.24164	27	2022-08-11 15:48:00	2022-08-25 14:26:00
31	-79.78822	43.24164	29	2022-08-11 15:50:00	2022-08-25 14:28:00
31	-79.78822	43.24164	23	2022-11-14 15:00:00	2022-11-28 14:26:00
31	-79.78822	43.24164	31	2023-03-03 10:26:00	2023-03-16 10:51:00
31	-79.78822	43.24164	32	2023-03-03 10:29:00	2023-03-16 10:59:00
32	-79.79567	43.23573	31	2022-03-28 15:32:00	2022-04-11 13:44:00
32	-79.79567	43.23573	33	2022-03-28 15:23:00	2022-04-11 13:40:00
32	-79.79567	43.23573	27	2022-09-02 11:11:07	2022-09-16 14:44:00
32	-79.79567	43.23573	25	2022-09-02 11:14:04	2022-09-16 14:45:00
32	-79.79567	43.23573	16	2022-12-05 11:25:00	2022-12-19 10:04:00
32	-79.79567	43.23573	37	2023-04-06 17:23:00	2023-04-20 13:37:00
32	-79.79567	43.23573	38	2023-04-06 17:19:00	2023-04-20 13:36:00
33	-79.87714	43.25998	33	2022-02-08 09:02:00	2022-02-21 17:35:00
33	-79.87714	43.25998	33	2022-07-22 12:14:00	2022-08-05 12:51:00
33	-79.87714	43.25998	19	2022-10-13 12:50:58	2022-10-27 14:11:00
33	-79.87714	43.25998	22	2023-01-20 13:48:00	2023-02-10 12:12:00
33	-79.87714	43.25998	24	2023-05-17 15:35:00	2023-05-31 15:22:00
34	-79.77688	43.24551	31	2022-03-28 16:21:00	2022-04-11 13:59:00
34	-79.77688	43.24551	25	2022-09-02 11:28:25	2022-09-16 15:56:00
34	-79.77688	43.24551	18	2022-12-05 12:23:00	2022-12-19 09:50:00
34	-79.77688	43.24551	18	2022-12-05 12:26:00	2022-12-19 09:51:00
34	-79.77688	43.24551	47	2023-04-06 17:53:00	2023-04-20 13:54:00
35	-79.85331	43.19501	41	2022-03-01 14:15:00	2022-03-15 12:48:00
35	-79.85331	43.19501	27	2022-08-11 14:23:00	2022-08-25 13:09:00
35	-79.85331	43.19501	2	2022-11-14 13:39:00	2022-11-28 12:39:00
35	-79.85331	43.19501	28	2023-03-05 14:08:00	2023-03-16 15:52:00
36	-79.85331	43.21803	47	2022-03-01 12:43:00	2022-03-15 12:26:00
36	-79.85331	43.21803	32	2022-08-11 13:58:57	2022-08-25 12:52:00
36	-79.85331	43.21803	33	2023-03-03 14:00:00	2023-03-16 14:15:00
37	-79.83018	43.22586	22	2022-12-06 14:11:00	2022-12-20 14:15:00
37	-79.83018	43.22586	41	2023-04-07 13:33:00	2023-04-20 16:41:00
38	-79.85261	43.20847	30	2022-03-29 11:46:00	2022-04-12 11:33:00
38	-79.85261	43.20847	24	2022-09-01 14:55:00	2022-09-15 13:57:00
38	-79.85261	43.20847	17	2022-12-06 13:54:00	2022-12-20 14:28:00
38	-79.85261	43.20847	35	2023-04-07 13:03:00	2023-04-20 15:32:00
39	-79.84907	43.22251	44	2022-02-07 14:15:00	2022-02-21 12:18:00
39	-79.84907	43.22251	34	2022-07-21 14:08:00	2022-08-04 14:31:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
39	-79.84907	43.22251	22	2022-10-12 12:08:24	2022-10-27 09:51:00
39	-79.84907	43.22251	22	2022-10-12 12:09:00	2022-10-27 09:53:44
39	-79.84907	43.22251	28	2023-01-21 14:16:07	2023-02-11 14:19:00
39	-79.84907	43.22251	25	2023-05-16 15:35:00	2023-05-30 20:08:00
40	-79.84268	43.23868	31	2022-03-29 11:02:00	2022-04-12 11:03:00
40	-79.84268	43.23868	25	2022-09-01 14:26:00	2022-09-15 13:34:00
40	-79.84268	43.23868	40	2023-04-07 13:50:00	2023-04-20 17:00:00
41	-79.88866	43.24066	44	2022-02-07 13:52:00	2022-02-21 12:02:00
41	-79.88866	43.24066	47	2022-03-01 11:32:00	2022-03-15 10:57:00
41	-79.88866	43.24066	34	2022-03-29 10:14:00	2022-04-12 10:33:00
41	-79.88866	43.24066	31	2022-07-21 13:48:52	2022-08-04 14:19:00
41	-79.88866	43.24066	28	2022-08-11 12:23:16	2022-08-25 11:23:00
41	-79.88866	43.24066	23	2022-09-01 13:53:00	2022-09-15 12:29:00
41	-79.88866	43.24066	23	2022-10-12 11:49:00	2022-10-27 09:39:13
41	-79.88866	43.24066	25	2022-11-14 11:39:59	2022-11-28 11:45:00
41	-79.88866	43.24066	28	2023-01-21 14:34:27	2023-02-11 14:45:00
41	-79.88866	43.24066	31	2023-03-05 10:56:00	2023-03-16 14:38:00
41	-79.88866	43.24066	NA	2023-04-07 15:25:00	2023-04-21 10:14:00
41	-79.88866	43.24066	28	2023-05-16 15:09:00	2023-05-30 19:50:00
42	-79.87756	43.22143	34	2022-03-01 12:19:00	2022-03-15 12:13:00
42	-79.87756	43.22143	33	2022-08-11 13:02:00	2022-08-25 11:50:00
42	-79.87756	43.22143	23	2022-11-15 10:23:00	2022-11-29 11:43:00
42	-79.87756	43.22143	29	2023-03-05 12:08:00	2023-03-16 15:15:00
43	-79.86076	43.20169	41	2022-03-01 13:06:00	2022-03-15 12:38:00
43	-79.86076	43.20169	32	2022-08-11 14:12:06	2022-08-25 13:01:00
43	-79.86076	43.20169	23	2022-11-14 13:24:00	2022-11-28 12:28:00
43	-79.86076	43.20169	31	2023-03-05 13:42:00	2023-03-16 15:36:00
44	-80.15050	43.24760	47	2022-03-01 09:19:00	2022-03-15 09:18:00
44	-80.15050	43.24760	28	2022-08-11 10:14:00	2022-08-25 10:14:00
44	-80.15050	43.24760	24	2022-11-14 10:47:00	2022-11-28 10:24:00
44	-80.15050	43.24760	NA	2023-03-02 13:26:00	2023-03-15 11:55:00
45	-79.99404	43.28260	34	2022-02-07 11:25:00	2022-02-21 08:50:00
45	-79.99404	43.28260	26	2022-07-21 11:50:00	2022-08-04 12:08:00
45	-79.99404	43.28260	23	2022-10-12 10:58:00	2022-10-26 10:42:00
45	-79.99404	43.28260	12	2023-01-20 12:10:00	2023-02-10 11:16:00
45	-79.99404	43.28260	28	2023-05-16 13:53:00	2023-05-30 17:49:00
46	-80.02639	43.39417	35	2022-02-07 10:37:54	2022-02-21 10:27:00
46	-80.02639	43.39417	27	2022-07-21 11:24:20	2022-08-04 11:47:00
46	-80.02639	43.39417	22	2022-10-12 10:31:00	2022-10-26 10:17:00
46	-80.02639	43.39417	26	2023-01-20 11:41:00	2023-02-10 10:39:00
46	-80.02639	43.39417	32	2023-05-16 12:40:00	2023-05-30 17:20:00
47	-79.89756	43.22818	35	2022-03-01 11:12:00	2022-03-15 10:43:00
47	-79.89756	43.22818	32	2022-08-11 12:13:01	2022-08-25 11:04:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
47	-79.89756	43.22818	23	2022-11-14 11:24:00	2022-11-28 11:22:00
47	-79.89756	43.22818	28	2023-03-05 11:41:00	2023-03-16 14:54:00
48	-79.90779	43.17532	46	2022-03-29 12:11:00	2022-04-12 12:01:00
48	-79.90779	43.17532	33	2022-09-01 12:04:00	2022-09-15 11:47:00
48	-79.90779	43.17532	53	2023-04-07 12:02:00	2023-04-20 16:14:00
49	-79.98018	43.39443	34	2022-02-07 10:11:00	2022-02-21 10:06:00
49	-79.98018	43.39443	29	2022-07-21 11:05:00	2022-08-04 11:34:00
49	-79.98018	43.39443	20	2022-10-12 10:15:00	2022-10-26 10:01:00
49	-79.98018	43.39443	24	2023-01-20 11:19:08	2023-02-10 10:18:00
49	-79.98018	43.39443	28	2023-05-16 12:14:00	2023-05-30 16:56:00
50	-80.02733	43.39694	34	2022-03-28 10:06:00	2022-04-11 08:56:00
50	-80.02733	43.39694	26	2022-09-01 09:44:00	2022-09-15 09:44:00
50	-80.02733	43.39694	18	2022-12-06 09:31:00	2022-12-20 09:38:00
50	-80.02733	43.39694	35	2023-04-06 11:00:00	2023-04-20 10:12:00
51	-80.01173	43.19608	40	2022-03-28 12:34:00	2022-04-11 10:56:00
51	-80.01173	43.19608	25	2022-09-01 11:42:00	2022-09-15 11:23:00
51	-80.01173	43.19608	39	2023-04-07 16:55:00	2023-04-21 11:32:00
52	-79.88608	43.23003	32	2022-03-29 10:33:00	2022-04-12 10:43:00
52	-79.88608	43.23003	30	2022-09-01 14:04:00	2022-09-15 12:38:00
52	-79.88608	43.23003	35	2023-04-07 14:34:00	2023-04-21 10:00:00
53	-79.74238	43.22062	51	2022-03-29 13:13:00	2022-04-12 12:51:00
53	-79.74238	43.22062	27	2022-09-01 15:53:00	2022-09-15 14:50:00
53	-79.74238	43.22062	21	2022-12-05 10:22:00	2022-12-19 10:20:00
53	-79.74238	43.22062	39	2023-04-07 10:35:00	2023-04-20 14:36:00
54	-79.76893	43.19156	37	2022-03-29 12:44:00	2022-04-12 12:28:00
54	-79.76893	43.19156	35	2022-03-29 12:46:00	2022-04-12 12:31:00
54	-79.76893	43.19156	27	2022-09-01 15:25:00	2022-09-15 14:20:00
54	-79.76893	43.19156	25	2022-09-01 15:27:00	2022-09-15 14:22:00
54	-79.76893	43.19156	27	2022-12-05 11:08:00	2022-12-19 10:37:00
54	-79.76893	43.19156	25	2022-12-05 11:00:00	2022-12-19 10:39:00
54	-79.76893	43.19156	43	2023-04-07 11:02:00	2023-04-20 15:05:00
54	-79.76893	43.19156	44	2023-04-07 11:05:00	2023-04-20 15:02:00
55	-79.86829	43.25531	33	2022-02-08 08:23:00	2022-02-21 17:56:00
55	-79.86829	43.25531	34	2022-07-22 12:47:00	2022-08-05 13:14:00
55	-79.86829	43.25531	19	2022-10-13 11:32:14	2022-10-27 14:03:00
55	-79.86829	43.25531	25	2023-05-17 14:30:00	2023-05-31 14:20:00
56	-79.96290	43.22282	31	2022-07-21 13:27:00	2022-08-04 14:01:00
56	-79.96290	43.22282	20	2022-10-12 11:28:41	2022-10-27 09:20:00
56	-79.96290	43.22282	25	2023-01-21 15:17:00	2023-02-11 15:12:00
56	-79.96290	43.22282	26	2023-01-21 15:13:00	2023-02-11 15:10:00
56	-79.96290	43.22282	24	2023-05-16 14:40:00	2023-05-30 18:33:00
56	-79.96290	43.22282	25	2023-05-16 14:33:00	2023-05-30 18:29:00
57	-79.80905	43.12410	36	2022-03-01 14:49:00	2022-03-15 13:12:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
57	-79.80905	43.12410	31	2022-08-11 14:49:08	2022-08-25 13:36:00
57	-79.80905	43.12410	25	2022-11-14 14:06:00	2022-11-28 13:35:00
57	-79.80905	43.12410	33	2023-03-05 15:38:00	2023-03-16 16:21:00
58	-79.96591	43.22730	39	2022-03-01 10:23:00	2022-03-15 10:23:00
58	-79.96591	43.22730	36	2022-03-01 10:46:00	2022-03-15 10:25:00
58	-79.96591	43.22730	30	2022-08-11 11:53:35	2022-08-25 10:46:00
58	-79.96591	43.22730	29	2022-08-11 11:57:00	2022-08-25 10:47:00
58	-79.96591	43.22730	22	2022-11-14 10:10:58	2022-11-28 10:57:00
58	-79.96591	43.22730	21	2022-11-14 10:06:00	2022-11-28 10:58:00
58	-79.96591	43.22730	28	2023-03-02 15:08:00	2023-03-15 12:35:00
58	-79.96591	43.22730	30	2023-03-02 15:02:00	2023-03-15 12:32:00
59	-79.63123	43.22078	61	2022-02-07 15:14:00	2022-02-21 13:50:00
59	-79.63123	43.22078	35	2022-07-21 15:37:00	2022-08-04 16:09:00
59	-79.63123	43.22078	24	2022-10-12 13:57:00	2022-10-27 10:49:00
59	-79.63123	43.22078	26	2023-01-21 10:42:07	2023-02-11 10:54:00
59	-79.63123	43.22078	29	2023-05-17 10:36:00	2023-05-31 10:57:00
60	-79.94183	43.21791	38	2022-03-28 12:59:00	2022-04-11 11:14:00
60	-79.94183	43.21791	25	2022-09-01 12:24:00	2022-09-15 12:04:00
60	-79.94183	43.21791	49	2023-04-07 15:48:00	2023-04-21 10:47:00
61	-79.72187	43.22515	39	2022-03-01 15:26:00	2022-03-15 13:37:00
61	-79.72187	43.22515	34	2022-08-11 15:20:08	2022-08-25 14:08:00
61	-79.72187	43.22515	25	2022-11-14 14:36:00	2022-11-28 14:05:00
61	-79.72187	43.22515	33	2023-03-03 09:55:00	2023-03-16 10:22:00
62	-79.68842	43.22587	45	2022-02-07 15:36:00	2022-02-21 14:08:00
62	-79.68842	43.22587	39	2022-07-21 15:10:39	2022-08-04 16:22:00
62	-79.68842	43.22587	42	2022-07-21 15:14:44	2022-08-04 16:24:00
62	-79.68842	43.22587	25	2022-10-12 13:40:00	2022-10-27 11:08:09
62	-79.68842	43.22587	26	2023-01-21 10:22:00	2023-02-11 10:32:00
62	-79.68842	43.22587	26	2023-01-21 10:22:47	2023-02-11 10:32:00
62	-79.68842	43.22587	30	2023-05-17 10:13:00	2023-05-31 10:33:00
63	-79.73423	43.21724	43	2022-02-07 14:48:00	2022-02-21 12:46:00
63	-79.73423	43.21724	41	2022-07-21 14:51:17	2022-08-04 14:54:00
63	-79.73423	43.21724	26	2022-10-12 13:24:00	2022-10-27 10:28:04
63	-79.73423	43.21724	28	2023-01-21 11:11:29	2023-02-11 11:24:00
63	-79.73423	43.21724	32	2023-05-16 16:30:00	2023-05-30 20:57:00
64	-79.86795	43.25734	30	2022-03-02 09:58:00	2022-03-16 10:12:00
64	-79.86795	43.25734	31	2022-08-12 12:55:00	2022-08-26 11:15:00
64	-79.86795	43.25734	20	2022-11-15 11:51:00	2022-11-29 13:10:00
64	-79.86795	43.25734	30	2023-03-02 17:10:00	2023-03-15 14:24:00
65	-79.86636	43.26305	27	2022-02-08 09:24:00	2022-02-21 16:46:00
65	-79.86636	43.26305	28	2022-02-08 09:27:00	2022-02-21 16:50:00
65	-79.86636	43.26305	29	2022-07-22 14:29:00	2022-08-05 13:34:00
65	-79.86636	43.26305	29	2022-07-22 14:35:00	2022-08-05 13:36:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
65	-79.86636	43.26305	16	2022-10-13 11:14:00	2022-10-27 13:45:00
65	-79.86636	43.26305	16	2022-10-13 11:16:24	2022-10-27 13:46:59
65	-79.86636	43.26305	13	2023-01-21 16:15:27	2023-02-11 15:48:00
65	-79.86636	43.26305	19	2023-01-21 16:11:00	2023-02-11 15:51:00
65	-79.86636	43.26305	23	2023-05-17 14:57:00	2023-05-31 14:48:00
65	-79.86636	43.26305	22	2023-05-17 14:51:00	2023-05-31 14:50:00
66	-79.88054	43.34545	35	2022-03-01 08:34:00	2022-03-15 08:39:00
66	-79.88054	43.34545	34	2022-08-11 09:35:00	2022-08-25 09:17:00
66	-79.88054	43.34545	36	2023-03-02 11:03:00	2023-03-15 10:49:00
69	-79.83052	43.24328	32	2022-07-21 17:15:00	2022-08-05 14:08:00
69	-79.83052	43.24328	27	2022-08-12 11:53:03	2022-08-26 10:20:00
69	-79.83052	43.24328	23	2022-09-02 10:53:03	2022-09-16 15:02:00
69	-79.83052	43.24328	20	2022-10-12 14:55:00	2022-10-27 12:42:00
69	-79.83052	43.24328	21	2022-11-15 10:48:00	2022-11-29 12:09:00
69	-79.83052	43.24328	14	2022-12-05 11:43:00	2022-12-19 11:07:00
69	-79.83052	43.24328	24	2023-01-21 12:12:23	2023-02-11 13:05:00

Appendix E: Nitrogen Dioxide Passive Sampling Concentration Data

NA values in the concentration field represent values below the detection limit.

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
0	-79.97277	43.22930	7	2022-03-28 12:04:00	2022-04-11 10:32:00
0	-79.97277	43.22930	4	2022-03-28 12:08:00	2022-04-11 10:34:00
0	-79.97277	43.22930	4	2022-09-01 11:18:00	2022-09-15 11:00:00
0	-79.97277	43.22930	3	2022-09-01 11:21:00	2022-09-15 11:02:00
0	-79.97277	43.22930	5	2023-04-07 16:12:00	2023-04-21 11:07:00
0	-79.97277	43.22930	4	2023-04-07 16:09:00	2023-04-21 11:05:00
1	-79.96449	43.27027	7	2022-03-01 09:56:00	2022-03-15 09:50:00
1	-79.96449	43.27027	4	2022-08-11 10:42:00	2022-08-25 10:14:00
1	-79.96449	43.27027	8	2022-11-14 09:43:00	2022-11-28 09:57:00
1	-79.96449	43.27027	8	2023-03-02 12:00:00	2023-03-15 11:21:00
2	-79.93388	43.26768	5	2022-03-28 11:15:00	2022-04-11 10:10:00
2	-79.93388	43.26768	3	2022-09-01 10:55:00	2022-09-15 10:41:00
2	-79.93388	43.26768	7	2022-12-06 10:08:00	2022-12-20 10:43:00
2	-79.93388	43.26768	3	2023-04-06 11:47:00	2023-04-20 10:47:00
3	-79.90811	43.32617	5	2022-02-07 09:22:00	2022-02-21 09:29:00
3	-79.90811	43.32617	4	2022-07-21 10:40:00	2022-08-04 11:17:00
3	-79.90811	43.32617	8	2022-10-12 09:52:00	2022-10-26 09:42:00
3	-79.90811	43.32617	5	2023-01-20 10:53:00	2023-02-10 09:49:00
3	-79.90811	43.32617	5	2023-05-16 11:41:00	2023-05-30 16:20:00
4	-79.86379	43.27244	7	2022-03-28 13:45:00	2022-04-11 11:56:00
4	-79.86379	43.27244	5	2022-09-02 11:56:16	2022-09-16 14:15:00
4	-79.86379	43.27244	9	2022-12-06 11:52:00	2022-12-19 12:44:00
4	-79.86379	43.27244	5	2023-04-06 15:04:00	2023-04-20 12:39:00
5	-79.91126	43.26163	8	2022-02-07 12:07:00	2022-02-21 10:57:00
5	-79.91126	43.26163	3	2022-07-21 12:35:00	2022-08-04 13:42:00
5	-79.91126	43.26163	9	2022-10-13 13:08:01	2022-10-27 08:48:00
5	-79.91126	43.26163	8	2023-01-20 13:10:00	2023-02-10 11:42:00
5	-79.91126	43.26163	6	2023-05-17 16:25:00	2023-05-31 16:00:00
6	-79.90107	43.33951	5	2022-02-07 09:42:00	2022-02-21 09:45:00
6	-79.90107	43.33951	3	2022-07-21 10:23:00	2022-08-04 11:06:00
6	-79.90107	43.33951	5	2022-10-12 09:39:00	2022-10-26 09:30:00
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6	-79.90107	43.33951	3	2023-05-16 11:03:00	2023-05-30 15:59:00
7	-79.88915	43.25292	12	2022-03-02 08:47:00	2022-03-16 10:49:00
7	-79.88915	43.25292	8	2022-08-12 14:06:00	2022-08-26 11:53:00
7	-79.88915	43.25292	13	2022-11-15 09:39:00	2022-11-29 11:12:00
7	-79.88915	43.25292	12	2023-03-02 16:36:00	2023-03-15 13:55:00
8	-79.89347	43.27198	5	2022-03-28 10:55:00	2022-04-11 09:32:00
8	-79.89347	43.27198	4	2022-09-01 10:30:00	2022-09-15 10:19:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
8	-79.89347	43.27198	7	2022-12-06 11:08:00	2022-12-20 10:09:00
8	-79.89347	43.27198	2	2023-04-06 12:27:00	2023-04-20 11:18:00
9	-79.84130	43.25292	11	2022-02-08 10:29:52	2022-02-21 16:17:00
9	-79.84130	43.25292	5	2022-07-22 13:12:00	2022-08-05 13:58:00
9	-79.84130	43.25292	11	2022-10-13 10:48:00	2022-10-27 13:11:00
9	-79.84130	43.25292	10	2023-01-21 13:08:00	2023-02-11 13:53:00
9	-79.84130	43.25292	11	2023-05-17 13:23:00	2023-05-31 13:10:00
10	-79.81977	43.24809	5	2022-07-21 16:57:00	2022-08-05 14:25:00
10	-79.81977	43.24809	11	2022-10-12 15:06:00	2022-10-27 12:48:00
10	-79.81977	43.24809	8	2023-01-21 12:30:29	2023-02-11 13:18:00
10	-79.81977	43.24809	9	2023-05-17 11:54:00	2023-05-31 11:50:00
11	-79.87039	43.24652	9	2022-03-02 10:18:40	2022-03-16 10:38:00
11	-79.87039	43.24652	7	2022-08-12 12:15:00	2022-08-26 11:37:00
11	-79.87039	43.24652	7	2022-08-12 12:12:00	2022-08-26 11:38:00
11	-79.87039	43.24652	9	2022-11-15 09:59:00	2022-11-29 11:25:00
11	-79.87039	43.24652	9	2022-11-15 10:01:00	2022-11-29 11:26:00
11	-79.87039	43.24652	9	2023-03-02 17:58:00	2023-03-15 14:57:00
11	-79.87039	43.24652	10	2023-03-02 18:02:00	2023-03-15 15:03:00
12	-79.86280	43.25830	9	2022-02-08 09:44:00	2022-02-21 17:10:00
12	-79.86280	43.25830	11	2022-03-02 09:25:00	2022-03-16 09:57:00
12	-79.86280	43.25830	10	2022-03-28 13:59:00	2022-04-11 11:46:00
12	-79.86280	43.25830	6	2022-07-22 12:56:17	2022-08-05 13:23:00
12	-79.86280	43.25830	7	2022-08-12 13:12:00	2022-08-26 10:59:00
12	-79.86280	43.25830	7	2022-09-02 10:11:00	2022-09-16 15:29:00
12	-79.86280	43.25830	11	2022-10-13 11:01:00	2022-10-27 13:36:00
12	-79.86280	43.25830	11	2022-11-15 11:39:00	2022-11-29 12:54:00
12	-79.86280	43.25830	12	2022-12-06 12:04:00	2022-12-19 11:37:00
12	-79.86280	43.25830	9	2023-01-21 15:54:00	2023-02-10 13:24:00
12	-79.86280	43.25830	9	2023-03-02 17:31:00	2023-03-15 14:40:00
12	-79.86280	43.25830	7	2023-04-06 14:12:00	2023-04-20 12:22:00
12	-79.86280	43.25830	10	2023-05-17 14:08:00	2023-05-31 13:53:00
13	-79.88769	43.26304	11	2022-03-28 13:24:00	2022-04-11 11:32:00
13	-79.88769	43.26304	6	2022-09-01 10:12:00	2022-09-15 10:10:00
13	-79.88769	43.26304	10	2022-12-06 11:22:00	2022-12-19 11:50:00
13	-79.88769	43.26304	7	2023-04-06 13:21:00	2023-04-20 12:02:00
14	-79.87515	43.25988	10	2022-02-08 08:47:00	2022-02-21 17:21:00
14	-79.87515	43.25988	6	2022-07-22 12:27:00	2022-08-05 13:03:00
14	-79.87515	43.25988	13	2022-10-13 11:52:02	2022-10-27 14:20:00
14	-79.87515	43.25988	10	2023-01-20 14:01:00	2023-02-10 12:57:00
14	-79.87515	43.25988	14	2023-05-17 15:17:00	2023-05-31 15:06:00
15	-79.85348	43.24520	8	2022-03-28 14:19:00	2022-04-11 12:26:00
15	-79.85348	43.24520	5	2022-09-02 10:18:04	2022-09-16 15:12:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
15	-79.85348	43.24520	8	2023-04-06 15:55:00	2023-04-20 13:12:00
16	-79.76332	43.23767	9	2022-02-07 16:03:00	2022-02-21 14:35:00
16	-79.76332	43.23767	4	2022-07-21 14:32:00	2022-08-04 15:49:00
16	-79.76332	43.23767	9	2022-10-12 14:22:00	2022-10-27 11:28:00
16	-79.76332	43.23767	9	2023-01-21 09:56:00	2023-02-11 10:13:00
16	-79.76332	43.23767	6	2023-05-16 16:08:00	2023-05-30 20:32:00
17	-79.77257	43.26563	10	2022-03-28 16:52:00	2022-04-11 14:10:00
17	-79.77257	43.26563	7	2022-09-01 16:17:00	2022-09-15 15:06:00
17	-79.77257	43.26563	8	2022-12-06 13:23:00	2022-12-19 09:32:00
17	-79.77257	43.26563	9	2023-04-07 09:56:00	2023-04-20 14:17:00
18	-79.90889	43.25761	5	2022-02-07 12:35:57	2022-02-21 11:08:00
18	-79.90889	43.25761	8	2022-03-01 10:23:00	2022-03-15 10:07:00
18	-79.90889	43.25761	7	2022-03-28 10:42:00	2022-04-11 10:00:00
18	-79.90889	43.25761	4	2022-07-21 12:14:00	2022-08-04 13:49:00
18	-79.90889	43.25761	6	2022-08-11 11:32:00	2022-08-25 10:31:00
18	-79.90889	43.25761	5	2022-09-01 10:43:00	2022-09-15 10:30:00
18	-79.90889	43.25761	9	2022-10-13 13:15:00	2022-10-27 09:02:00
18	-79.90889	43.25761	9	2022-11-15 09:27:00	2022-11-29 10:59:00
18	-79.90889	43.25761	10	2022-12-06 10:30:00	2022-12-20 10:26:00
18	-79.90889	43.25761	8	2023-01-20 13:26:00	2023-02-10 11:55:00
18	-79.90889	43.25761	7	2023-03-02 16:01:00	2023-03-15 13:00:00
18	-79.90889	43.25761	5	2023-04-06 12:08:00	2023-04-20 11:04:00
18	-79.90889	43.25761	7	2023-05-17 16:11:00	2023-05-31 15:45:00
19	-79.78008	43.27556	9	2022-03-01 16:21:00	2022-03-15 14:09:00
19	-79.78008	43.27556	9	2022-03-28 16:37:00	2022-04-11 14:19:00
19	-79.78008	43.27556	10	2022-07-21 15:58:00	2022-08-04 16:46:00
19	-79.78008	43.27556	6	2022-08-11 16:12:00	2022-08-25 14:44:00
19	-79.78008	43.27556	6	2022-09-01 16:25:00	2022-09-15 15:12:00
19	-79.78008	43.27556	12	2022-10-13 10:07:00	2022-10-27 11:43:00
19	-79.78008	43.27556	14	2022-11-14 15:53:00	2022-11-28 15:13:00
19	-79.78008	43.27556	12	2022-12-05 09:35:00	2022-12-19 09:23:00
19	-79.78008	43.27556	9	2023-01-21 09:35:00	2023-02-10 14:13:00
19	-79.78008	43.27556	8	2023-03-03 09:21:00	2023-03-16 09:54:00
19	-79.78008	43.27556	7	2023-04-07 09:34:00	2023-04-20 14:07:00
19	-79.78008	43.27556	4	2023-05-17 09:44:00	2023-05-31 10:08:00
20	-79.80758	43.25468	8	2022-02-08 12:03:00	2022-02-21 15:14:00
20	-79.80758	43.25468	10	2022-03-02 11:37:00	2022-03-16 11:43:00
20	-79.80758	43.25468	10	2022-03-28 14:50:00	2022-04-11 13:20:00
21	-79.83783	43.26147	11	2022-03-02 10:55:00	2022-03-16 11:23:00
21	-79.83783	43.26147	7	2022-08-12 13:38:59	2022-08-26 10:32:00
21	-79.83783	43.26147	10	2022-11-15 11:24:00	2022-11-29 12:24:00
21	-79.83783	43.26147	9	2023-03-03 12:27:00	2023-03-16 12:00:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
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22	-79.82556	43.25508	5	2022-07-22 13:58:00	2022-08-05 14:15:00
22	-79.82556	43.25508	10	2022-10-12 15:24:00	2022-10-27 12:59:00
22	-79.82556	43.25508	11	2022-10-12 15:24:00	2022-10-27 12:56:00
22	-79.82556	43.25508	8	2023-01-21 12:50:23	2023-02-11 13:38:00
22	-79.82556	43.25508	12	2023-05-17 12:12:00	2023-05-31 12:53:00
23	-79.83996	43.27012	10	2022-02-08 10:06:45	2022-02-21 16:31:00
23	-79.83996	43.27012	11	2022-03-02 10:43:00	2022-03-16 11:15:00
23	-79.83996	43.27012	11	2022-03-28 14:35:00	2022-04-11 12:10:00
23	-79.83996	43.27012	8	2022-07-22 13:27:00	2022-08-05 13:49:00
23	-79.83996	43.27012	9	2022-08-12 13:27:00	2022-08-26 10:42:00
23	-79.83996	43.27012	7	2022-09-02 11:45:59	2022-09-16 14:24:00
23	-79.83996	43.27012	11	2022-10-13 10:26:00	2022-10-27 13:24:00
23	-79.83996	43.27012	14	2022-11-15 11:04:00	2022-11-29 12:36:00
23	-79.83996	43.27012	11	2022-12-05 11:56:00	2022-12-19 12:55:00
23	-79.83996	43.27012	9	2023-01-21 13:49:00	2023-02-10 13:51:00
23	-79.83996	43.27012	8	2023-03-03 12:46:00	2023-03-16 12:18:00
23	-79.83996	43.27012	9	2023-04-06 15:22:00	2023-04-20 12:53:00
23	-79.83996	43.27012	10	2023-05-17 13:41:00	2023-05-31 13:28:00
24	-79.80987	43.23355	6	2022-02-08 11:04:00	2022-02-21 15:37:00
24	-79.80987	43.23355	6	2022-02-08 11:06:00	2022-02-21 15:38:00
24	-79.80987	43.23355	5	2022-07-21 16:33:00	2022-08-04 17:06:00
24	-79.80987	43.23355	4	2022-07-21 16:29:00	2022-08-04 17:05:00
24	-79.80987	43.23355	8	2022-10-12 14:41:00	2022-10-27 12:31:00
24	-79.80987	43.23355	6	2023-01-21 11:56:04	2023-02-11 11:57:00
24	-79.80987	43.23355	7	2023-01-21 11:50:00	2023-02-11 11:52:00
24	-79.80987	43.23355	6	2023-05-17 11:32:00	2023-05-31 11:24:00
24	-79.80987	43.23355	7	2023-05-17 11:28:00	2023-05-31 11:22:00
25	-79.79859	43.24293	10	2022-03-02 15:11:00	2022-03-16 12:09:00
25	-79.79859	43.24293	7	2022-08-12 11:09:00	2022-08-26 10:05:00
25	-79.79859	43.24293	9	2022-11-14 15:16:00	2022-11-28 14:35:00
25	-79.79859	43.24293	9	2022-11-14 15:17:00	2022-11-28 14:36:00
25	-79.79859	43.24293	9	2023-03-03 10:53:00	2023-03-16 11:17:00
26	-79.79966	43.24815	9	2022-02-08 11:32:00	2022-02-21 15:26:00
26	-79.79966	43.24815	10	2022-03-02 11:50:00	2022-03-16 12:02:00
26	-79.79966	43.24815	7	2022-03-28 15:02:00	2022-04-11 13:29:00
27	-79.80232	43.25612	14	2022-03-02 14:50:00	2022-03-16 11:51:00
27	-79.80232	43.25612	8	2022-08-12 11:27:00	2022-08-26 09:55:00
27	-79.80232	43.25612	16	2022-11-14 15:38:00	2022-11-28 14:51:00
27	-79.80232	43.25612	12	2023-03-03 12:03:00	2023-03-16 11:36:00
28	-79.91160	43.24346	10	2022-03-29 10:00:00	2022-04-12 10:21:00
28	-79.91160	43.24346	5	2022-09-01 13:43:00	2022-09-15 12:18:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
28	-79.91160	43.24346	9	2023-04-07 15:08:00	2023-04-21 10:27:00
29	-79.85793	43.23566	8	2022-03-01 12:00:00	2022-03-15 12:00:00
29	-79.85793	43.23566	5	2022-08-11 12:47:00	2022-08-25 11:38:00
29	-79.85793	43.23566	8	2022-11-14 12:07:00	2022-11-28 12:07:00
29	-79.85793	43.23566	8	2023-03-03 13:19:00	2023-03-16 13:35:00
30	-79.86243	43.23386	7	2022-03-01 11:43:03	2022-03-15 11:06:00
30	-79.86243	43.23386	5	2022-08-11 12:37:00	2022-08-25 11:31:00
30	-79.86243	43.23386	8	2022-11-14 11:53:00	2022-11-28 23:57:00
30	-79.86243	43.23386	8	2023-03-05 13:15:00	2023-03-16 13:51:00
31	-79.78822	43.24164	8	2022-03-01 16:00:00	2022-03-15 13:57:00
31	-79.78822	43.24164	5	2022-08-11 15:48:00	2022-08-25 14:26:00
31	-79.78822	43.24164	6	2022-08-11 15:50:00	2022-08-25 14:27:00
31	-79.78822	43.24164	10	2022-11-14 15:00:00	2022-11-28 14:25:00
31	-79.78822	43.24164	8	2023-03-03 10:26:00	2023-03-16 10:49:00
31	-79.78822	43.24164	9	2023-03-03 10:29:00	2023-03-16 10:58:00
32	-79.79567	43.23573	8	2022-03-28 15:32:00	2022-04-11 13:40:00
32	-79.79567	43.23573	8	2022-03-28 15:21:00	2022-04-11 13:43:00
32	-79.79567	43.23573	5	2022-09-02 11:09:17	2022-09-16 14:43:00
32	-79.79567	43.23573	4	2022-09-02 11:13:00	2022-09-16 14:44:00
32	-79.79567	43.23573	10	2022-12-05 11:25:00	2022-12-19 10:04:00
32	-79.79567	43.23573	3	2023-04-06 17:22:00	2023-04-20 13:37:00
32	-79.79567	43.23573	5	2023-04-06 17:19:00	2023-04-20 13:35:00
33	-79.87714	43.25998	9	2022-02-08 09:01:00	2022-02-21 17:35:00
33	-79.87714	43.25998	6	2022-07-22 12:13:00	2022-08-05 12:51:00
33	-79.87714	43.25998	14	2022-10-13 12:50:01	2022-10-27 14:12:00
33	-79.87714	43.25998	11	2023-01-20 13:46:00	2023-02-10 12:12:00
33	-79.87714	43.25998	12	2023-05-17 15:34:00	2023-05-31 15:21:00
34	-79.77688	43.24551	8	2022-03-28 16:21:00	2022-04-11 13:58:00
34	-79.77688	43.24551	6	2022-09-02 11:26:37	2022-09-16 15:55:00
34	-79.77688	43.24551	10	2022-12-05 12:23:00	2022-12-19 09:50:00
34	-79.77688	43.24551	9	2022-12-05 12:26:00	2022-12-19 09:51:00
34	-79.77688	43.24551	4	2023-04-06 17:52:00	2023-04-20 13:53:00
35	-79.85331	43.19501	6	2022-03-01 14:14:00	2022-03-15 12:48:00
35	-79.85331	43.19501	6	2022-08-11 14:23:00	2022-08-25 13:09:00
35	-79.85331	43.19501	8	2022-11-14 13:39:00	2022-11-28 12:39:00
35	-79.85331	43.19501	7	2023-03-05 14:08:00	2023-03-16 15:52:00
36	-79.85331	43.21803	6	2022-03-01 12:39:46	2022-03-15 12:25:00
36	-79.85331	43.21803	5	2022-08-11 13:58:00	2022-08-25 12:52:00
36	-79.85331	43.21803	8	2023-03-03 14:00:00	2023-03-16 14:14:00
37	-79.83018	43.22586	6	2022-03-29 11:26:00	2022-04-12 11:15:00
37	-79.83018	43.22586	9	2022-12-06 14:10:00	2022-12-20 14:15:00
37	-79.83018	43.22586	5	2023-04-07 13:32:00	2023-04-20 16:41:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
38	-79.85261	43.20847	7	2022-03-29 11:46:00	2022-04-12 11:33:00
38	-79.85261	43.20847	4	2022-09-01 14:55:00	2022-09-15 13:57:00
38	-79.85261	43.20847	8	2022-12-06 13:53:00	2022-12-20 14:28:00
38	-79.85261	43.20847	4	2023-04-07 13:02:00	2023-04-20 15:31:00
39	-79.84907	43.22251	5	2022-02-07 14:15:00	2022-02-21 12:17:00
39	-79.84907	43.22251	4	2022-07-21 14:06:00	2022-08-04 14:30:00
39	-79.84907	43.22251	7	2022-10-12 12:07:00	2022-10-27 09:50:00
39	-79.84907	43.22251	6	2022-10-12 12:09:00	2022-10-27 09:53:00
39	-79.84907	43.22251	5	2023-01-21 14:15:00	2023-02-11 14:19:00
39	-79.84907	43.22251	9	2023-05-16 15:34:00	2023-05-30 20:08:00
40	-79.84268	43.23868	9	2022-03-29 11:02:00	2022-04-12 11:02:00
40	-79.84268	43.23868	5	2022-09-01 14:26:00	2022-09-15 13:34:00
40	-79.84268	43.23868	5	2023-04-07 13:48:00	2023-04-20 16:59:00
41	-79.88866	43.24066	4	2022-02-07 13:51:00	2022-02-21 12:02:00
41	-79.88866	43.24066	7	2022-03-01 11:15:47	2022-03-15 10:57:00
41	-79.88866	43.24066	8	2022-03-29 10:13:00	2022-04-12 10:32:00
41	-79.88866	43.24066	3	2022-07-21 13:48:00	2022-08-04 14:18:00
41	-79.88866	43.24066	5	2022-08-11 12:23:00	2022-08-25 11:23:00
41	-79.88866	43.24066	5	2022-09-01 13:53:00	2022-09-15 12:29:00
41	-79.88866	43.24066	8	2022-10-12 11:48:00	2022-10-27 09:39:00
41	-79.88866	43.24066	7	2022-11-14 11:39:00	2022-11-28 11:45:00
41	-79.88866	43.24066	5	2023-01-21 14:34:00	2023-02-11 14:45:00
41	-79.88866	43.24066	6	2023-03-05 10:56:00	2023-03-16 14:37:00
41	-79.88866	43.24066	4	2023-04-07 15:24:00	2023-04-21 10:14:00
41	-79.88866	43.24066	7	2023-05-16 15:08:00	2023-05-30 19:49:00
42	-79.87756	43.22143	7	2022-03-01 12:19:00	2022-03-15 12:13:00
42	-79.87756	43.22143	3	2022-08-11 13:01:00	2022-08-25 11:50:00
42	-79.87756	43.22143	8	2022-11-15 10:22:00	2022-11-29 11:43:00
42	-79.87756	43.22143	7	2023-03-05 12:07:00	2023-03-16 15:14:00
43	-79.86076	43.20169	5	2022-03-01 13:06:00	2022-03-15 12:38:00
43	-79.86076	43.20169	5	2022-08-11 14:11:00	2022-08-25 13:01:00
43	-79.86076	43.20169	7	2022-11-14 13:24:00	2022-11-28 12:28:00
43	-79.86076	43.20169	7	2023-03-05 13:42:00	2023-03-16 15:36:00
44	-80.15050	43.24760	3	2022-03-01 09:19:00	2022-03-15 09:17:00
44	-80.15050	43.24760	2	2022-08-11 10:14:00	2022-08-25 09:50:00
44	-80.15050	43.24760	6	2022-11-14 10:46:00	2022-11-28 10:24:00
44	-80.15050	43.24760	3	2023-03-02 13:26:00	2023-03-15 11:55:00
45	-79.99404	43.28260	3	2022-02-07 11:24:00	2022-02-21 08:50:00
45	-79.99404	43.28260	3	2022-07-21 11:49:00	2022-08-04 12:08:00
45	-79.99404	43.28260	5	2022-10-12 10:58:00	2022-10-26 10:41:00
45	-79.99404	43.28260	3	2023-01-20 12:09:00	2023-02-10 11:15:00
45	-79.99404	43.28260	5	2023-05-16 13:52:00	2023-05-30 17:48:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
46	-80.02639	43.39417	2	2022-02-07 10:36:00	2022-02-21 10:26:00
46	-80.02639	43.39417	3	2022-07-21 11:24:00	2022-08-04 11:47:00
46	-80.02639	43.39417	3	2022-10-12 10:31:00	2022-10-26 10:17:00
46	-80.02639	43.39417	4	2023-01-20 11:40:00	2023-02-10 10:38:00
46	-80.02639	43.39417	3	2023-05-16 12:40:00	2023-05-30 17:19:00
47	-79.89756	43.22818	6	2022-03-01 11:12:00	2022-03-15 10:43:00
47	-79.89756	43.22818	5	2022-08-11 12:12:00	2022-08-25 11:04:00
47	-79.89756	43.22818	7	2022-11-14 11:24:00	2022-11-28 11:22:00
47	-79.89756	43.22818	7	2023-03-05 11:40:00	2023-03-16 14:53:00
48	-79.90779	43.17532	6	2022-03-29 12:11:00	2022-04-12 12:00:00
48	-79.90779	43.17532	4	2022-09-01 12:04:00	2022-09-15 11:47:00
48	-79.90779	43.17532	4	2023-04-07 12:01:00	2023-04-20 16:13:00
49	-79.98018	43.39443	3	2022-02-07 10:10:00	2022-02-21 10:06:00
49	-79.98018	43.39443	3	2022-07-21 11:04:00	2022-08-04 11:34:00
49	-79.98018	43.39443	5	2022-10-12 10:15:00	2022-10-26 10:01:00
49	-79.98018	43.39443	4	2023-01-20 11:18:00	2023-02-10 10:17:00
49	-79.98018	43.39443	3	2023-05-16 12:13:00	2023-05-30 16:56:00
50	-80.02733	43.39694	2	2022-03-28 10:05:00	2022-04-11 08:55:00
50	-80.02733	43.39694	2	2022-09-01 09:44:00	2022-09-15 09:44:00
50	-80.02733	43.39694	5	2022-12-06 09:31:00	2022-12-20 09:38:00
50	-80.02733	43.39694	2	2023-04-06 10:59:00	2023-04-20 10:11:00
51	-80.01173	43.19608	4	2022-03-28 12:33:00	2022-04-11 10:55:00
51	-80.01173	43.19608	5	2022-09-01 11:42:00	2022-09-15 11:22:00
51	-80.01173	43.19608	3	2023-04-07 16:54:00	2023-04-21 11:32:00
52	-79.88608	43.23003	10	2022-03-29 10:34:00	2022-04-12 10:43:00
52	-79.88608	43.23003	5	2022-09-01 14:04:00	2022-09-15 12:37:00
52	-79.88608	43.23003	6	2023-04-07 14:34:00	2023-04-21 10:00:00
53	-79.74238	43.22062	5	2022-03-29 13:13:00	2022-04-12 12:51:00
53	-79.74238	43.22062	2	2022-09-01 15:53:00	2022-09-15 14:50:00
53	-79.74238	43.22062	8	2022-12-05 10:21:00	2022-12-19 10:20:00
53	-79.74238	43.22062	5	2023-04-07 10:35:00	2023-04-20 14:36:00
54	-79.76893	43.19156	9	2022-03-29 12:44:00	2022-04-12 12:28:00
54	-79.76893	43.19156	5	2022-03-29 12:46:00	2022-04-12 12:30:00
54	-79.76893	43.19156	4	2022-09-01 15:25:00	2022-09-15 14:19:00
54	-79.76893	43.19156	4	2022-09-01 15:27:00	2022-09-15 14:21:00
54	-79.76893	43.19156	7	2022-12-05 11:07:00	2022-12-19 10:37:00
54	-79.76893	43.19156	14	2022-12-05 11:01:10	2022-12-19 10:38:00
54	-79.76893	43.19156	2	2023-04-07 11:01:00	2023-04-20 15:04:00
54	-79.76893	43.19156	4	2023-04-07 11:04:00	2023-04-20 15:02:00
55	-79.86829	43.25531	9	2022-02-08 08:23:00	2022-02-21 17:56:00
55	-79.86829	43.25531	7	2022-07-22 12:46:00	2022-08-05 13:13:00
55	-79.86829	43.25531	12	2022-10-13 11:32:00	2022-10-27 14:02:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
55	-79.86829	43.25531	10	2023-01-20 14:20:00	2023-02-10 13:12:00
55	-79.86829	43.25531	13	2023-05-17 14:30:00	2023-05-31 14:19:00
56	-79.96290	43.22282	2	2022-07-21 13:26:00	2022-08-04 14:01:00
56	-79.96290	43.22282	7	2022-10-12 11:26:00	2022-10-27 09:19:00
56	-79.96290	43.22282	4	2023-01-21 15:16:10	2023-02-11 15:12:00
56	-79.96290	43.22282	4	2023-01-21 15:13:00	2023-02-11 15:10:00
56	-79.96290	43.22282	7	2023-05-16 14:40:00	2023-05-30 18:32:00
56	-79.96290	43.22282	7	2023-05-16 14:33:00	2023-05-30 18:28:00
57	-79.80905	43.12410	4	2022-03-01 14:49:00	2022-03-15 13:11:00
57	-79.80905	43.12410	4	2022-08-11 14:49:00	2022-08-25 13:35:00
57	-79.80905	43.12410	5	2022-11-14 14:06:00	2022-11-28 13:35:00
57	-79.80905	43.12410	4	2023-03-05 15:37:00	2023-03-16 16:20:00
58	-79.96591	43.22730	5	2022-03-01 10:40:00	2022-03-15 10:22:00
58	-79.96591	43.22730	6	2022-03-01 10:46:00	2022-03-15 10:46:00
58	-79.96591	43.22730	5	2022-08-11 11:53:00	2022-08-25 10:45:00
58	-79.96591	43.22730	4	2022-08-11 11:56:00	2022-08-25 10:47:00
58	-79.96591	43.22730	6	2022-11-14 10:10:00	2022-11-28 10:57:00
58	-79.96591	43.22730	6	2022-11-14 10:05:00	2022-11-28 10:58:00
58	-79.96591	43.22730	6	2023-03-02 15:08:00	2023-03-15 12:34:00
58	-79.96591	43.22730	6	2023-03-02 15:02:00	2023-03-15 12:31:00
59	-79.63123	43.22078	5	2022-02-07 15:13:00	2022-02-21 13:50:00
59	-79.63123	43.22078	5	2022-07-21 15:36:00	2022-08-04 16:10:00
59	-79.63123	43.22078	7	2022-10-12 13:57:00	2022-10-27 10:49:00
59	-79.63123	43.22078	5	2023-01-21 10:41:00	2023-02-11 10:54:00
59	-79.63123	43.22078	4	2023-05-17 10:35:00	2023-05-31 10:56:00
60	-79.94183	43.21791	6	2022-03-28 12:58:00	2022-04-11 11:14:00
60	-79.94183	43.21791	3	2022-09-01 12:23:00	2022-09-15 12:04:00
60	-79.94183	43.21791	4	2023-04-07 15:47:00	2023-04-21 10:46:00
61	-79.72187	43.22515	6	2022-03-01 15:26:00	2022-03-15 13:36:00
61	-79.72187	43.22515	4	2022-08-11 15:20:00	2022-08-25 14:07:00
61	-79.72187	43.22515	7	2022-11-14 14:36:00	2022-11-28 14:05:00
61	-79.72187	43.22515	7	2023-03-03 09:54:00	2023-03-16 10:21:00
62	-79.68842	43.22587	7	2022-02-07 15:35:00	2022-02-21 14:08:00
62	-79.68842	43.22587	5	2022-07-21 15:10:00	2022-08-04 16:22:00
62	-79.68842	43.22587	4	2022-07-21 15:14:26	2022-08-04 16:24:00
62	-79.68842	43.22587	7	2022-10-12 13:40:00	2022-10-27 11:07:00
62	-79.68842	43.22587	6	2023-01-21 10:22:00	2023-02-11 10:31:00
62	-79.68842	43.22587	6	2023-05-17 10:12:00	2023-05-31 10:32:00
63	-79.73423	43.21724	4	2022-02-07 14:48:00	2022-02-21 12:46:00
63	-79.73423	43.21724	3	2022-07-21 14:51:00	2022-08-04 14:54:00
63	-79.73423	43.21724	5	2022-10-12 13:24:00	2022-10-27 10:28:00
63	-79.73423	43.21724	5	2023-01-21 11:11:00	2023-02-11 11:23:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
63	-79.73423	43.21724	4	2023-05-16 16:30:00	2023-05-30 20:56:00
64	-79.86795	43.25734	12	2022-03-02 09:57:00	2022-03-16 10:10:00
64	-79.86795	43.25734	9	2022-08-12 12:55:00	2022-08-26 11:15:00
64	-79.86795	43.25734	13	2022-11-15 11:51:00	2022-11-29 13:10:00
64	-79.86795	43.25734	11	2023-03-02 17:10:00	2023-03-15 14:24:00
65	-79.86636	43.26305	10	2022-02-08 09:23:00	2022-02-21 16:46:00
65	-79.86636	43.26305	11	2022-02-08 09:25:00	2022-02-21 16:46:00
65	-79.86636	43.26305	8	2022-07-22 14:28:00	2022-08-05 13:34:00
65	-79.86636	43.26305	8	2022-07-22 14:35:00	2022-08-05 13:35:00
65	-79.86636	43.26305	14	2022-10-13 11:14:00	2022-10-27 13:44:00
65	-79.86636	43.26305	13	2022-10-13 11:16:00	2022-10-27 13:46:00
65	-79.86636	43.26305	11	2023-01-21 16:14:00	2023-02-11 15:46:00
65	-79.86636	43.26305	1	2023-01-21 16:10:00	2023-02-11 15:51:00
65	-79.86636	43.26305	14	2023-05-17 14:56:00	2023-05-31 14:45:00
65	-79.86636	43.26305	15	2023-05-17 14:50:00	2023-05-31 14:49:00
66	-79.88054	43.34545	5	2022-03-01 08:25:00	2022-03-15 08:39:00
66	-79.88054	43.34545	3	2022-08-11 09:34:00	2022-08-25 09:15:00
66	-79.88054	43.34545	7	2022-11-14 09:16:00	2022-11-28 09:27:00
66	-79.88054	43.34545	4	2023-03-02 11:02:00	2023-03-15 10:49:00
69	-79.83052	43.24328	5	2022-07-21 17:14:00	2022-08-05 14:08:00
69	-79.83052	43.24328	9	2022-08-12 11:45:27	2022-08-26 10:20:00
69	-79.83052	43.24328	5	2022-09-02 10:52:32	2022-09-16 15:01:00
69	-79.83052	43.24328	9	2022-10-12 14:55:00	2022-10-27 12:41:00
69	-79.83052	43.24328	9	2022-11-15 10:48:00	2022-11-29 12:09:00
69	-79.83052	43.24328	10	2022-12-05 11:43:00	2022-12-19 11:07:00
69	-79.83052	43.24328	6	2023-01-21 12:11:00	2023-02-11 13:04:00

Appendix F: Nitrogen Oxides Passive Sampling Concentration Data

NA values in the concentration field represent values below the detection limit.

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
0	-79.97277	43.22930	7	2022-03-28 12:04:00	2022-04-11 10:32:00
0	-79.97277	43.22930	8	2022-03-28 12:08:00	2022-04-11 10:34:00
0	-79.97277	43.22930	6	2022-09-01 11:18:00	2022-09-15 11:00:00
0	-79.97277	43.22930	6	2022-09-01 11:21:00	2022-09-15 11:02:00
0	-79.97277	43.22930	8	2023-04-07 16:12:00	2023-04-21 11:07:00
0	-79.97277	43.22930	7	2023-04-07 16:09:00	2023-04-21 11:05:00
1	-79.96449	43.27027	13	2022-03-01 09:56:00	2022-03-15 09:50:00
1	-79.96449	43.27027	7	2022-08-11 10:42:00	2022-08-25 10:14:00
1	-79.96449	43.27027	13	2022-11-14 09:43:00	2022-11-28 09:57:00
1	-79.96449	43.27027	14	2023-03-02 12:00:00	2023-03-15 11:21:00
2	-79.93388	43.26768	7	2022-03-28 11:15:00	2022-04-11 10:10:00
2	-79.93388	43.26768	6	2022-09-01 10:55:00	2022-09-15 10:41:00
2	-79.93388	43.26768	12	2022-12-06 10:08:00	2022-12-20 10:43:00
2	-79.93388	43.26768	7	2023-04-06 11:47:00	2023-04-20 10:47:00
3	-79.90811	43.32617	9	2022-02-07 09:22:00	2022-02-21 09:29:00
3	-79.90811	43.32617	4	2022-07-21 10:40:00	2022-08-04 11:17:00
3	-79.90811	43.32617	10	2022-10-12 09:52:00	2022-10-26 09:42:00
3	-79.90811	43.32617	9	2023-01-20 10:53:00	2023-02-10 09:49:00
3	-79.90811	43.32617	7	2023-05-16 11:41:00	2023-05-30 16:20:00
4	-79.86379	43.27244	11	2022-03-28 13:45:00	2022-04-11 11:56:00
4	-79.86379	43.27244	11	2022-09-02 11:56:16	2022-09-16 14:15:00
4	-79.86379	43.27244	14	2022-12-06 11:52:00	2022-12-19 12:44:00
4	-79.86379	43.27244	9	2023-04-06 15:04:00	2023-04-20 12:39:00
5	-79.91126	43.26163	13	2022-02-07 12:07:00	2022-02-21 10:57:00
5	-79.91126	43.26163	3	2022-07-21 12:35:00	2022-08-04 13:42:00
5	-79.91126	43.26163	16	2022-10-13 13:08:01	2022-10-27 08:48:00
5	-79.91126	43.26163	14	2023-01-20 13:10:00	2023-02-10 11:42:00
5	-79.91126	43.26163	13	2023-05-17 16:25:00	2023-05-31 16:00:00
6	-79.90107	43.33951	10	2022-02-07 09:42:00	2022-02-21 09:45:00
6	-79.90107	43.33951	3	2022-07-21 10:23:00	2022-08-04 11:06:00
6	-79.90107	43.33951	12	2022-10-12 09:39:00	2022-10-26 09:30:00
6	-79.90107	43.33951	11	2023-01-20 10:34:00	2023-02-10 09:32:00
6	-79.90107	43.33951	6	2023-05-16 11:03:00	2023-05-30 15:59:00
7	-79.88915	43.25292	20	2022-03-02 08:47:00	2022-03-16 10:49:00
7	-79.88915	43.25292	11	2022-08-12 14:06:00	2022-08-26 11:53:00
7	-79.88915	43.25292	22	2022-11-15 09:39:00	2022-11-29 11:12:00
7	-79.88915	43.25292	22	2023-03-02 16:36:00	2023-03-15 13:55:00
8	-79.89347	43.27198	8	2022-03-28 10:55:00	2022-04-11 09:32:00
8	-79.89347	43.27198	8	2022-09-01 10:30:00	2022-09-15 10:19:00
8	-79.89347	43.27198	13	2022-12-06 11:08:00	2022-12-20 10:09:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
8	-79.89347	43.27198	8	2023-04-06 12:27:00	2023-04-20 11:18:00
9	-79.84130	43.25292	20	2022-02-08 10:29:52	2022-02-21 16:17:00
9	-79.84130	43.25292	5	2022-07-22 13:12:00	2022-08-05 13:58:00
9	-79.84130	43.25292	22	2022-10-13 10:48:00	2022-10-27 13:11:00
9	-79.84130	43.25292	19	2023-01-21 13:08:00	2023-02-11 13:53:00
9	-79.84130	43.25292	20	2023-05-17 13:23:00	2023-05-31 13:10:00
10	-79.81977	43.24809	5	2022-07-21 16:57:00	2022-08-05 14:25:00
10	-79.81977	43.24809	18	2022-10-12 15:06:00	2022-10-27 12:48:00
10	-79.81977	43.24809	17	2023-01-21 12:30:29	2023-02-11 13:18:00
10	-79.81977	43.24809	16	2023-05-17 11:54:00	2023-05-31 11:50:00
11	-79.87039	43.24652	15	2022-03-02 10:18:40	2022-03-16 10:38:00
11	-79.87039	43.24652	10	2022-08-12 12:15:00	2022-08-26 11:37:00
11	-79.87039	43.24652	10	2022-08-12 12:12:00	2022-08-26 11:38:00
11	-79.87039	43.24652	16	2022-11-15 09:59:00	2022-11-29 11:25:00
11	-79.87039	43.24652	15	2022-11-15 10:01:00	2022-11-29 11:26:00
11	-79.87039	43.24652	19	2023-03-02 17:58:00	2023-03-15 14:57:00
11	-79.87039	43.24652	17	2023-03-02 18:02:00	2023-03-15 15:03:00
12	-79.86280	43.25830	NA	2022-02-08 09:44:00	2022-02-21 17:10:00
12	-79.86280	43.25830	18	2022-03-02 09:25:00	2022-03-16 09:57:00
12	-79.86280	43.25830	14	2022-03-28 13:59:00	2022-04-11 11:46:00
12	-79.86280	43.25830	6	2022-07-22 12:56:17	2022-08-05 13:23:00
12	-79.86280	43.25830	10	2022-08-12 13:12:00	2022-08-26 10:59:00
12	-79.86280	43.25830	11	2022-09-02 10:11:00	2022-09-16 15:29:00
12	-79.86280	43.25830	21	2022-10-13 11:01:00	2022-10-27 13:36:00
12	-79.86280	43.25830	23	2022-11-15 11:39:00	2022-11-29 12:54:00
12	-79.86280	43.25830	19	2022-12-06 12:04:00	2022-12-19 11:37:00
12	-79.86280	43.25830	16	2023-01-21 15:54:00	2023-02-10 13:24:00
12	-79.86280	43.25830	17	2023-03-02 17:31:00	2023-03-15 14:40:00
12	-79.86280	43.25830	15	2023-04-06 14:12:00	2023-04-20 12:22:00
12	-79.86280	43.25830	NA	2023-05-17 14:08:00	2023-05-31 13:53:00
13	-79.88769	43.26304	14	2022-03-28 13:24:00	2022-04-11 11:32:00
13	-79.88769	43.26304	14	2022-09-01 10:12:00	2022-09-15 10:10:00
13	-79.88769	43.26304	18	2022-12-06 11:22:00	2022-12-19 11:50:00
13	-79.88769	43.26304	14	2023-04-06 13:21:00	2023-04-20 12:02:00
14	-79.87515	43.25988	17	2022-02-08 08:47:00	2022-02-21 17:21:00
14	-79.87515	43.25988	6	2022-07-22 12:27:00	2022-08-05 13:03:00
14	-79.87515	43.25988	25	2022-10-13 11:52:02	2022-10-27 14:20:00
14	-79.87515	43.25988	16	2023-01-20 14:01:00	2023-02-10 12:57:00
14	-79.87515	43.25988	23	2023-05-17 15:17:00	2023-05-31 15:06:00
15	-79.85348	43.24520	14	2022-03-28 14:19:00	2022-04-11 12:26:00
15	-79.85348	43.24520	12	2022-09-02 10:18:04	2022-09-16 15:12:00
15	-79.85348	43.24520	9	2023-04-06 15:55:00	2023-04-20 13:12:00
16	-79.76332	43.23767	23	2022-02-07 16:03:00	2022-02-21 14:35:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
16	-79.76332	43.23767	5	2022-07-21 14:32:00	2022-08-04 15:49:00
16	-79.76332	43.23767	18	2022-10-12 14:22:00	2022-10-27 11:28:00
16	-79.76332	43.23767	18	2023-01-21 09:56:00	2023-02-11 10:13:00
16	-79.76332	43.23767	13	2023-05-16 16:08:00	2023-05-30 20:32:00
17	-79.77257	43.26563	19	2022-03-28 16:52:00	2022-04-11 14:10:00
17	-79.77257	43.26563	13	2022-09-01 16:17:00	2022-09-15 15:06:00
17	-79.77257	43.26563	16	2022-12-06 13:23:00	2022-12-19 09:32:00
17	-79.77257	43.26563	13	2023-04-07 09:56:00	2023-04-20 14:17:00
18	-79.90889	43.25761	14	2022-02-07 12:35:57	2022-02-21 11:08:00
18	-79.90889	43.25761	15	2022-03-01 10:23:00	2022-03-15 10:07:00
18	-79.90889	43.25761	13	2022-03-28 10:42:00	2022-04-11 10:00:00
18	-79.90889	43.25761	4	2022-07-21 12:14:00	2022-08-04 13:49:00
18	-79.90889	43.25761	9	2022-08-11 11:32:00	2022-08-25 10:31:00
18	-79.90889	43.25761	12	2022-09-01 10:43:00	2022-09-15 10:30:00
18	-79.90889	43.25761	17	2022-10-13 13:15:00	2022-10-27 09:02:00
18	-79.90889	43.25761	18	2022-11-15 09:27:00	2022-11-29 10:59:00
18	-79.90889	43.25761	16	2022-12-06 10:30:00	2022-12-20 10:26:00
18	-79.90889	43.25761	15	2023-01-20 13:26:00	2023-02-10 11:55:00
18	-79.90889	43.25761	18	2023-03-02 16:01:00	2023-03-15 13:00:00
18	-79.90889	43.25761	10	2023-04-06 12:08:00	2023-04-20 11:04:00
18	-79.90889	43.25761	15	2023-05-17 16:11:00	2023-05-31 15:45:00
19	-79.78008	43.27556	20	2022-03-01 16:21:00	2022-03-15 14:09:00
19	-79.78008	43.27556	18	2022-03-28 16:37:00	2022-04-11 14:19:00
19	-79.78008	43.27556	11	2022-07-21 15:58:00	2022-08-04 16:46:00
19	-79.78008	43.27556	11	2022-08-11 16:12:00	2022-08-25 14:44:00
19	-79.78008	43.27556	11	2022-09-01 16:25:00	2022-09-15 15:12:00
19	-79.78008	43.27556	19	2022-10-13 10:07:00	2022-10-27 11:43:00
19	-79.78008	43.27556	28	2022-11-14 15:53:00	2022-11-28 15:13:00
19	-79.78008	43.27556	16	2022-12-05 09:35:00	2022-12-19 09:23:00
19	-79.78008	43.27556	18	2023-01-21 09:35:00	2023-02-10 14:13:00
19	-79.78008	43.27556	15	2023-03-03 09:21:00	2023-03-16 09:54:00
19	-79.78008	43.27556	15	2023-04-07 09:34:00	2023-04-20 14:07:00
19	-79.78008	43.27556	11	2023-05-17 09:44:00	2023-05-31 10:08:00
20	-79.80758	43.25468	17	2022-02-08 12:03:00	2022-02-21 15:14:00
20	-79.80758	43.25468	18	2022-03-02 11:37:00	2022-03-16 11:43:00
20	-79.80758	43.25468	15	2022-03-28 14:50:00	2022-04-11 13:20:00
21	-79.83783	43.26147	16	2022-03-02 10:55:00	2022-03-16 11:23:00
21	-79.83783	43.26147	12	2022-08-12 13:38:59	2022-08-26 10:32:00
21	-79.83783	43.26147	14	2022-11-15 11:24:00	2022-11-29 12:24:00
21	-79.83783	43.26147	17	2023-03-03 12:27:00	2023-03-16 12:00:00
22	-79.82556	43.25508	21	2022-03-02 11:19:00	2022-03-16 11:34:00
22	-79.82556	43.25508	5	2022-07-22 13:58:00	2022-08-05 14:15:00
22	-79.82556	43.25508	20	2022-10-12 15:24:00	2022-10-27 12:59:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
22	-79.82556	43.25508	19	2022-10-12 15:24:00	2022-10-27 12:56:00
22	-79.82556	43.25508	16	2023-01-21 12:50:23	2023-02-11 13:38:00
22	-79.82556	43.25508	20	2023-05-17 12:12:00	2023-05-31 12:53:00
23	-79.83996	43.27012	18	2022-02-08 10:06:45	2022-02-21 16:31:00
23	-79.83996	43.27012	20	2022-03-02 10:43:00	2022-03-16 11:15:00
23	-79.83996	43.27012	18	2022-03-28 14:35:00	2022-04-11 12:10:00
23	-79.83996	43.27012	10	2022-07-22 13:27:00	2022-08-05 13:49:00
23	-79.83996	43.27012	16	2022-08-12 13:27:00	2022-08-26 10:42:00
23	-79.83996	43.27012	12	2022-09-02 11:45:59	2022-09-16 14:24:00
23	-79.83996	43.27012	22	2022-10-13 10:26:00	2022-10-27 13:24:00
23	-79.83996	43.27012	30	2022-11-15 11:04:00	2022-11-29 12:36:00
23	-79.83996	43.27012	22	2022-12-05 11:56:00	2022-12-19 12:55:00
23	-79.83996	43.27012	16	2023-03-03 12:46:00	2023-03-16 12:18:00
23	-79.83996	43.27012	14	2023-04-06 15:22:00	2023-04-20 12:53:00
23	-79.83996	43.27012	19	2023-05-17 13:41:00	2023-05-31 13:28:00
23	-79.83996	43.27012	NA	2023-01-21 13:49:00	2023-02-10 13:51:00
24	-79.80987	43.23355	16	2022-02-08 11:04:00	2022-02-21 15:37:00
24	-79.80987	43.23355	13	2022-02-08 11:06:00	2022-02-21 15:38:00
24	-79.80987	43.23355	5	2022-07-21 16:33:00	2022-08-04 17:06:00
24	-79.80987	43.23355	4	2022-07-21 16:29:00	2022-08-04 17:05:00
24	-79.80987	43.23355	12	2022-10-12 14:41:00	2022-10-27 12:31:00
24	-79.80987	43.23355	11	2023-01-21 11:56:04	2023-02-11 11:57:00
24	-79.80987	43.23355	12	2023-01-21 11:50:00	2023-02-11 11:52:00
24	-79.80987	43.23355	12	2023-05-17 11:32:00	2023-05-31 11:24:00
24	-79.80987	43.23355	12	2023-05-17 11:28:00	2023-05-31 11:22:00
25	-79.79859	43.24293	17	2022-03-02 15:11:00	2022-03-16 12:09:00
25	-79.79859	43.24293	10	2022-08-12 11:09:00	2022-08-26 10:05:00
25	-79.79859	43.24293	18	2022-11-14 15:16:00	2022-11-28 14:35:00
25	-79.79859	43.24293	19	2022-11-14 15:17:00	2022-11-28 14:36:00
25	-79.79859	43.24293	18	2023-03-03 10:53:00	2023-03-16 11:17:00
26	-79.79966	43.24815	19	2022-02-08 11:32:00	2022-02-21 15:26:00
26	-79.79966	43.24815	17	2022-03-02 11:50:00	2022-03-16 12:02:00
26	-79.79966	43.24815	16	2022-03-28 15:02:00	2022-04-11 13:29:00
27	-79.80232	43.25612	22	2022-03-02 14:50:00	2022-03-16 11:51:00
27	-79.80232	43.25612	16	2022-08-12 11:27:00	2022-08-26 09:55:00
27	-79.80232	43.25612	27	2022-11-14 15:38:00	2022-11-28 14:51:00
27	-79.80232	43.25612	25	2023-03-03 12:03:00	2023-03-16 11:36:00
28	-79.91160	43.24346	11	2022-03-29 10:00:00	2022-04-12 10:21:00
28	-79.91160	43.24346	9	2022-09-01 13:43:00	2022-09-15 12:18:00
28	-79.91160	43.24346	10	2023-04-07 15:08:00	2023-04-21 10:27:00
29	-79.85793	43.23566	13	2022-03-01 12:00:00	2022-03-15 12:00:00
29	-79.85793	43.23566	8	2022-08-11 12:47:00	2022-08-25 11:38:00
29	-79.85793	43.23566	17	2022-11-14 12:07:00	2022-11-28 12:07:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
29	-79.85793	43.23566	18	2023-03-03 13:19:00	2023-03-16 13:35:00
30	-79.86243	43.23386	13	2022-03-01 11:43:03	2022-03-15 11:06:00
30	-79.86243	43.23386	8	2022-08-11 12:37:00	2022-08-25 11:31:00
30	-79.86243	43.23386	18	2023-03-05 13:15:00	2023-03-16 13:51:00
30	-79.86243	43.23386	NA	2022-11-14 11:53:00	2022-11-28 23:57:00
31	-79.78822	43.24164	15	2022-03-01 16:00:00	2022-03-15 13:57:00
31	-79.78822	43.24164	10	2022-08-11 15:48:00	2022-08-25 14:26:00
31	-79.78822	43.24164	11	2022-08-11 15:50:00	2022-08-25 14:27:00
31	-79.78822	43.24164	17	2022-11-14 15:00:00	2022-11-28 14:25:00
31	-79.78822	43.24164	18	2023-03-03 10:26:00	2023-03-16 10:49:00
31	-79.78822	43.24164	18	2023-03-03 10:29:00	2023-03-16 10:58:00
32	-79.79567	43.23573	11	2022-03-28 15:32:00	2022-04-11 13:40:00
32	-79.79567	43.23573	11	2022-03-28 15:21:00	2022-04-11 13:43:00
32	-79.79567	43.23573	5	2022-09-02 11:09:17	2022-09-16 14:43:00
32	-79.79567	43.23573	10	2022-09-02 11:13:00	2022-09-16 14:44:00
32	-79.79567	43.23573	18	2022-12-05 11:25:00	2022-12-19 10:04:00
32	-79.79567	43.23573	7	2023-04-06 17:22:00	2023-04-20 13:37:00
32	-79.79567	43.23573	5	2023-04-06 17:19:00	2023-04-20 13:35:00
33	-79.87714	43.25998	18	2022-02-08 09:01:00	2022-02-21 17:35:00
33	-79.87714	43.25998	6	2022-07-22 12:13:00	2022-08-05 12:51:00
33	-79.87714	43.25998	23	2022-10-13 12:50:01	2022-10-27 14:12:00
33	-79.87714	43.25998	18	2023-01-20 13:46:00	2023-02-10 12:12:00
33	-79.87714	43.25998	23	2023-05-17 15:34:00	2023-05-31 15:21:00
34	-79.77688	43.24551	11	2022-03-28 16:21:00	2022-04-11 13:58:00
34	-79.77688	43.24551	10	2022-09-02 11:26:37	2022-09-16 15:55:00
34	-79.77688	43.24551	15	2022-12-05 12:23:00	2022-12-19 09:50:00
34	-79.77688	43.24551	15	2022-12-05 12:26:00	2022-12-19 09:51:00
34	-79.77688	43.24551	8	2023-04-06 17:52:00	2023-04-20 13:53:00
35	-79.85331	43.19501	10	2022-03-01 14:14:00	2022-03-15 12:48:00
35	-79.85331	43.19501	9	2022-08-11 14:23:00	2022-08-25 13:09:00
35	-79.85331	43.19501	14	2022-11-14 13:39:00	2022-11-28 12:39:00
35	-79.85331	43.19501	18	2023-03-05 14:08:00	2023-03-16 15:52:00
36	-79.85331	43.21803	13	2022-03-01 12:39:46	2022-03-15 12:25:00
36	-79.85331	43.21803	8	2022-08-11 13:58:00	2022-08-25 12:52:00
36	-79.85331	43.21803	19	2023-03-03 14:00:00	2023-03-16 14:14:00
37	-79.83018	43.22586	15	2022-03-29 11:26:00	2022-04-12 11:15:00
37	-79.83018	43.22586	20	2022-12-06 14:10:00	2022-12-20 14:15:00
37	-79.83018	43.22586	9	2023-04-07 13:32:00	2023-04-20 16:41:00
38	-79.85261	43.20847	9	2022-03-29 11:46:00	2022-04-12 11:33:00
38	-79.85261	43.20847	7	2022-09-01 14:55:00	2022-09-15 13:57:00
38	-79.85261	43.20847	14	2022-12-06 13:53:00	2022-12-20 14:28:00
38	-79.85261	43.20847	7	2023-04-07 13:02:00	2023-04-20 15:31:00
39	-79.84907	43.22251	10	2022-02-07 14:15:00	2022-02-21 12:17:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
39	-79.84907	43.22251	4	2022-07-21 14:06:00	2022-08-04 14:30:00
39	-79.84907	43.22251	7	2022-10-12 12:07:00	2022-10-27 09:50:00
39	-79.84907	43.22251	10	2022-10-12 12:09:00	2022-10-27 09:53:00
39	-79.84907	43.22251	9	2023-01-21 14:15:00	2023-02-11 14:19:00
39	-79.84907	43.22251	11	2023-05-16 15:34:00	2023-05-30 20:08:00
40	-79.84268	43.23868	13	2022-03-29 11:02:00	2022-04-12 11:02:00
40	-79.84268	43.23868	9	2022-09-01 14:26:00	2022-09-15 13:34:00
40	-79.84268	43.23868	8	2023-04-07 13:48:00	2023-04-20 16:59:00
41	-79.88866	43.24066	9	2022-02-07 13:51:00	2022-02-21 12:02:00
41	-79.88866	43.24066	10	2022-03-01 11:15:47	2022-03-15 10:57:00
41	-79.88866	43.24066	10	2022-03-29 10:13:00	2022-04-12 10:32:00
41	-79.88866	43.24066	3	2022-07-21 13:48:00	2022-08-04 14:18:00
41	-79.88866	43.24066	8	2022-08-11 12:23:00	2022-08-25 11:23:00
41	-79.88866	43.24066	10	2022-09-01 13:53:00	2022-09-15 12:29:00
41	-79.88866	43.24066	12	2022-10-12 11:48:00	2022-10-27 09:39:00
41	-79.88866	43.24066	16	2022-11-14 11:39:00	2022-11-28 11:45:00
41	-79.88866	43.24066	16	2023-03-05 10:56:00	2023-03-16 14:37:00
41	-79.88866	43.24066	9	2023-04-07 15:24:00	2023-04-21 10:14:00
41	-79.88866	43.24066	14	2023-05-16 15:08:00	2023-05-30 19:49:00
41	-79.88866	43.24066	NA	2023-01-21 14:34:00	2023-02-11 14:45:00
42	-79.87756	43.22143	12	2022-03-01 12:19:00	2022-03-15 12:13:00
42	-79.87756	43.22143	7	2022-08-11 13:01:00	2022-08-25 11:50:00
42	-79.87756	43.22143	8	2022-11-15 10:22:00	2022-11-29 11:43:00
42	-79.87756	43.22143	17	2023-03-05 12:07:00	2023-03-16 15:14:00
43	-79.86076	43.20169	12	2022-03-01 13:06:00	2022-03-15 12:38:00
43	-79.86076	43.20169	7	2022-08-11 14:11:00	2022-08-25 13:01:00
43	-79.86076	43.20169	13	2022-11-14 13:24:00	2022-11-28 12:28:00
43	-79.86076	43.20169	17	2023-03-05 13:42:00	2023-03-16 15:36:00
44	-80.15050	43.24760	6	2022-03-01 09:19:00	2022-03-15 09:17:00
44	-80.15050	43.24760	5	2022-08-11 10:14:00	2022-08-25 09:50:00
44	-80.15050	43.24760	9	2022-11-14 10:46:00	2022-11-28 10:24:00
44	-80.15050	43.24760	8	2023-03-02 13:26:00	2023-03-15 11:55:00
45	-79.99404	43.28260	7	2022-02-07 11:24:00	2022-02-21 08:50:00
45	-79.99404	43.28260	3	2022-07-21 11:49:00	2022-08-04 12:08:00
45	-79.99404	43.28260	7	2022-10-12 10:58:00	2022-10-26 10:41:00
45	-79.99404	43.28260	6	2023-01-20 12:09:00	2023-02-10 11:15:00
45	-79.99404	43.28260	8	2023-05-16 13:52:00	2023-05-30 17:48:00
46	-80.02639	43.39417	7	2022-02-07 10:36:00	2022-02-21 10:26:00
46	-80.02639	43.39417	3	2022-07-21 11:24:00	2022-08-04 11:47:00
46	-80.02639	43.39417	7	2022-10-12 10:31:00	2022-10-26 10:17:00
46	-80.02639	43.39417	7	2023-01-20 11:40:00	2023-02-10 10:38:00
46	-80.02639	43.39417	6	2023-05-16 12:40:00	2023-05-30 17:19:00
47	-79.89756	43.22818	11	2022-03-01 11:12:00	2022-03-15 10:43:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
47	-79.89756	43.22818	7	2022-08-11 12:12:00	2022-08-25 11:04:00
47	-79.89756	43.22818	13	2022-11-14 11:24:00	2022-11-28 11:22:00
47	-79.89756	43.22818	15	2023-03-05 11:40:00	2023-03-16 14:53:00
48	-79.90779	43.17532	10	2022-03-29 12:11:00	2022-04-12 12:00:00
48	-79.90779	43.17532	10	2022-09-01 12:04:00	2022-09-15 11:47:00
48	-79.90779	43.17532	8	2023-04-07 12:01:00	2023-04-20 16:13:00
49	-79.98018	43.39443	10	2022-02-07 10:10:00	2022-02-21 10:06:00
49	-79.98018	43.39443	3	2022-07-21 11:04:00	2022-08-04 11:34:00
49	-79.98018	43.39443	11	2022-10-12 10:15:00	2022-10-26 10:01:00
49	-79.98018	43.39443	9	2023-01-20 11:18:00	2023-02-10 10:17:00
49	-79.98018	43.39443	9	2023-05-16 12:13:00	2023-05-30 16:56:00
50	-80.02733	43.39694	5	2022-03-28 10:05:00	2022-04-11 08:55:00
50	-80.02733	43.39694	6	2022-09-01 09:44:00	2022-09-15 09:44:00
50	-80.02733	43.39694	8	2022-12-06 09:31:00	2022-12-20 09:38:00
50	-80.02733	43.39694	4	2023-04-06 10:59:00	2023-04-20 10:11:00
51	-80.01173	43.19608	8	2022-03-28 12:33:00	2022-04-11 10:55:00
51	-80.01173	43.19608	6	2022-09-01 11:42:00	2022-09-15 11:22:00
51	-80.01173	43.19608	8	2023-04-07 16:54:00	2023-04-21 11:32:00
52	-79.88608	43.23003	14	2022-03-29 10:34:00	2022-04-12 10:43:00
52	-79.88608	43.23003	11	2022-09-01 14:04:00	2022-09-15 12:37:00
52	-79.88608	43.23003	11	2023-04-07 14:34:00	2023-04-21 10:00:00
53	-79.74238	43.22062	8	2022-03-29 13:13:00	2022-04-12 12:51:00
53	-79.74238	43.22062	7	2022-09-01 15:53:00	2022-09-15 14:50:00
53	-79.74238	43.22062	15	2022-12-05 10:21:00	2022-12-19 10:20:00
53	-79.74238	43.22062	6	2023-04-07 10:35:00	2023-04-20 14:36:00
54	-79.76893	43.19156	9	2022-03-29 12:44:00	2022-04-12 12:28:00
54	-79.76893	43.19156	10	2022-03-29 12:46:00	2022-04-12 12:30:00
54	-79.76893	43.19156	10	2022-09-01 15:25:00	2022-09-15 14:19:00
54	-79.76893	43.19156	9	2022-09-01 15:27:00	2022-09-15 14:21:00
54	-79.76893	43.19156	13	2022-12-05 11:07:00	2022-12-19 10:37:00
54	-79.76893	43.19156	15	2022-12-05 11:01:10	2022-12-19 10:38:00
54	-79.76893	43.19156	5	2023-04-07 11:01:00	2023-04-20 15:04:00
54	-79.76893	43.19156	5	2023-04-07 11:04:00	2023-04-20 15:02:00
55	-79.86829	43.25531	17	2022-02-08 08:23:00	2022-02-21 17:56:00
55	-79.86829	43.25531	7	2022-07-22 12:46:00	2022-08-05 13:13:00
55	-79.86829	43.25531	23	2022-10-13 11:32:00	2022-10-27 14:02:00
55	-79.86829	43.25531	17	2023-01-20 14:20:00	2023-02-10 13:12:00
55	-79.86829	43.25531	23	2023-05-17 14:30:00	2023-05-31 14:19:00
56	-79.96290	43.22282	NA	2023-01-21 15:16:10	2023-02-11 15:12:00
56	-79.96290	43.22282	2	2022-07-21 13:26:00	2022-08-04 14:01:00
56	-79.96290	43.22282	11	2022-10-12 11:26:00	2022-10-27 09:19:00
56	-79.96290	43.22282	9	2023-01-21 15:13:00	2023-02-11 15:10:00
56	-79.96290	43.22282	13	2023-05-16 14:40:00	2023-05-30 18:32:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
56	-79.96290	43.22282	12	2023-05-16 14:33:00	2023-05-30 18:28:00
57	-79.80905	43.12410	9	2022-03-01 14:49:00	2022-03-15 13:11:00
57	-79.80905	43.12410	5	2022-08-11 14:49:00	2022-08-25 13:35:00
57	-79.80905	43.12410	10	2022-11-14 14:06:00	2022-11-28 13:35:00
57	-79.80905	43.12410	12	2023-03-05 15:37:00	2023-03-16 16:20:00
58	-79.96591	43.22730	11	2022-03-01 10:40:00	2022-03-15 10:22:00
58	-79.96591	43.22730	11	2022-03-01 10:46:00	2022-03-15 10:46:00
58	-79.96591	43.22730	7	2022-08-11 11:53:00	2022-08-25 10:45:00
58	-79.96591	43.22730	7	2022-08-11 11:56:00	2022-08-25 10:47:00
58	-79.96591	43.22730	12	2022-11-14 10:10:00	2022-11-28 10:57:00
58	-79.96591	43.22730	12	2022-11-14 10:05:00	2022-11-28 10:58:00
58	-79.96591	43.22730	13	2023-03-02 15:08:00	2023-03-15 12:34:00
58	-79.96591	43.22730	13	2023-03-02 15:02:00	2023-03-15 12:31:00
59	-79.63123	43.22078	10	2022-02-07 15:13:00	2022-02-21 13:50:00
59	-79.63123	43.22078	6	2022-07-21 15:36:00	2022-08-04 16:10:00
59	-79.63123	43.22078	12	2022-10-12 13:57:00	2022-10-27 10:49:00
59	-79.63123	43.22078	5	2023-01-21 10:41:00	2023-02-11 10:54:00
59	-79.63123	43.22078	10	2023-05-17 10:35:00	2023-05-31 10:56:00
60	-79.94183	43.21791	9	2022-03-28 12:58:00	2022-04-11 11:14:00
60	-79.94183	43.21791	8	2022-09-01 12:23:00	2022-09-15 12:04:00
60	-79.94183	43.21791	8	2023-04-07 15:47:00	2023-04-21 10:46:00
61	-79.72187	43.22515	11	2022-03-01 15:26:00	2022-03-15 13:36:00
61	-79.72187	43.22515	8	2022-08-11 15:20:00	2022-08-25 14:07:00
61	-79.72187	43.22515	13	2022-11-14 14:36:00	2022-11-28 14:05:00
61	-79.72187	43.22515	14	2023-03-03 09:54:00	2023-03-16 10:21:00
62	-79.68842	43.22587	8	2022-02-07 15:35:00	2022-02-21 14:08:00
62	-79.68842	43.22587	5	2022-07-21 15:10:00	2022-08-04 16:22:00
62	-79.68842	43.22587	4	2022-07-21 15:14:26	2022-08-04 16:24:00
62	-79.68842	43.22587	13	2022-10-12 13:40:00	2022-10-27 11:07:00
62	-79.68842	43.22587	15	2023-01-21 10:22:00	2023-02-11 10:31:00
62	-79.68842	43.22587	12	2023-05-17 10:12:00	2023-05-31 10:32:00
63	-79.73423	43.21724	9	2022-02-07 14:48:00	2022-02-21 12:46:00
63	-79.73423	43.21724	3	2022-07-21 14:51:00	2022-08-04 14:54:00
63	-79.73423	43.21724	8	2022-10-12 13:24:00	2022-10-27 10:28:00
63	-79.73423	43.21724	9	2023-01-21 11:11:00	2023-02-11 11:23:00
63	-79.73423	43.21724	8	2023-05-16 16:30:00	2023-05-30 20:56:00
64	-79.86795	43.25734	21	2022-03-02 09:57:00	2022-03-16 10:10:00
64	-79.86795	43.25734	12	2022-08-12 12:55:00	2022-08-26 11:15:00
64	-79.86795	43.25734	27	2022-11-15 11:51:00	2022-11-29 13:10:00
64	-79.86795	43.25734	20	2023-03-02 17:10:00	2023-03-15 14:24:00
65	-79.86636	43.26305	NA	2023-01-21 16:14:00	2023-02-11 15:46:00
65	-79.86636	43.26305	25	2022-02-08 09:23:00	2022-02-21 16:46:00
65	-79.86636	43.26305	23	2022-02-08 09:25:00	2022-02-21 16:46:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
65	-79.86636	43.26305	10	2022-07-22 14:28:00	2022-08-05 13:34:00
65	-79.86636	43.26305	10	2022-07-22 14:35:00	2022-08-05 13:35:00
65	-79.86636	43.26305	28	2022-10-13 11:14:00	2022-10-27 13:44:00
65	-79.86636	43.26305	29	2022-10-13 11:16:00	2022-10-27 13:46:00
65	-79.86636	43.26305	23	2023-01-21 16:10:00	2023-02-11 15:51:00
65	-79.86636	43.26305	25	2023-05-17 14:56:00	2023-05-31 14:45:00
65	-79.86636	43.26305	25	2023-05-17 14:50:00	2023-05-31 14:49:00
66	-79.88054	43.34545	9	2022-03-01 08:25:00	2022-03-15 08:39:00
66	-79.88054	43.34545	5	2022-08-11 09:34:00	2022-08-25 09:15:00
66	-79.88054	43.34545	13	2022-11-14 09:16:00	2022-11-28 09:27:00
66	-79.88054	43.34545	10	2023-03-02 11:02:00	2023-03-15 10:49:00
69	-79.83052	43.24328	NA	2023-01-21 12:11:00	2023-02-11 13:04:00
69	-79.83052	43.24328	5	2022-07-21 17:14:00	2022-08-05 14:08:00
69	-79.83052	43.24328	12	2022-08-12 11:45:27	2022-08-26 10:20:00
69	-79.83052	43.24328	11	2022-09-02 10:52:32	2022-09-16 15:01:00
69	-79.83052	43.24328	15	2022-10-12 14:55:00	2022-10-27 12:41:00
69	-79.83052	43.24328	18	2022-11-15 10:48:00	2022-11-29 12:09:00
69	-79.83052	43.24328	18	2022-12-05 11:43:00	2022-12-19 11:07:00

Appendix G: Sulphur Dioxide Passive Sampling Concentration Data

NA values in the concentration field represent values below the detection limit.

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
0	-79.9728	43.2293	1	2022-03-28 12:05:00	2022-04-11 10:33:00
0	-79.9728	43.2293	1	2022-03-28 12:09:00	2022-04-11 10:34:00
0	-79.9728	43.2293	NA	2022-09-01 11:18:00	2022-09-15 11:01:00
0	-79.9728	43.2293	1	2022-09-01 11:21:00	2022-09-15 11:02:00
0	-79.9728	43.2293	NA	2023-04-07 16:13:00	2023-04-21 11:08:00
0	-79.9728	43.2293	NA	2023-04-07 16:11:00	2023-04-21 11:06:00
1	-79.9645	43.2703	NA	2022-03-01 09:57:00	2022-03-15 09:51:00
1	-79.9645	43.2703	1	2022-08-11 10:40:54	2022-08-25 10:15:00
1	-79.9645	43.2703	NA	2022-11-14 09:43:00	2022-11-28 09:57:00
1	-79.9645	43.2703	1	2023-03-02 12:01:00	2023-03-15 11:22:00
2	-79.9339	43.2677	1	2022-03-28 11:16:00	2022-04-11 10:10:00
2	-79.9339	43.2677	1	2022-12-06 10:08:00	2022-12-20 10:43:00
2	-79.9339	43.2677	NA	2022-09-01 10:56:00	2022-09-15 10:41:00
2	-79.9339	43.2677	NA	2023-04-06 11:48:00	2023-04-20 10:47:00
3	-79.9081	43.3262	1	2022-10-12 09:52:00	2022-10-26 09:42:00
3	-79.9081	43.3262	1	2023-01-20 10:55:00	2023-02-10 09:48:00
3	-79.9081	43.3262	NA	2022-07-21 10:41:00	2022-08-04 11:18:00
3	-79.9081	43.3262	NA	2023-05-16 11:42:00	2023-05-30 16:22:00
3	-79.9081	43.3262	NA	2022-02-07 09:26:00	2022-02-21 09:30:00
4	-79.8638	43.2724	3	2022-03-28 13:45:00	2022-04-11 11:57:00
4	-79.8638	43.2724	NA	2022-09-02 11:58:33	2022-09-16 14:16:00
4	-79.8638	43.2724	2	2022-12-06 11:52:00	2022-12-19 12:44:00
4	-79.8638	43.2724	NA	2023-04-06 15:05:00	2023-04-20 12:40:00
5	-79.9113	43.2616	2	2022-10-13 13:08:48	2022-10-27 08:48:52
5	-79.9113	43.2616	1	2023-01-20 13:14:00	2023-02-10 11:43:00
5	-79.9113	43.2616	2	2023-05-17 16:26:00	2023-05-31 16:01:00
5	-79.9113	43.2616	NA	2022-07-21 12:35:56	2022-08-04 13:43:00
5	-79.9113	43.2616	NA	2022-02-07 12:09:00	2022-02-21 10:58:00
6	-79.9011	43.3395	1	2022-10-12 09:39:00	2022-10-26 09:30:00
6	-79.9011	43.3395	1	2023-01-20 10:37:00	2023-02-10 09:34:00
6	-79.9011	43.3395	NA	2022-07-21 10:24:00	2022-08-04 11:09:00
6	-79.9011	43.3395	NA	2023-05-16 11:08:00	2023-05-30 16:02:00
6	-79.9011	43.3395	NA	2022-02-07 09:43:00	2022-02-21 09:48:00
7	-79.8891	43.2529	NA	2022-03-02 08:50:00	2022-03-16 10:50:00
7	-79.8891	43.2529	1	2022-08-12 14:07:07	2022-08-26 11:54:00
7	-79.8891	43.2529	NA	2022-11-15 09:40:00	2022-11-29 11:12:00
7	-79.8891	43.2529	1	2023-03-02 16:38:00	2023-03-15 13:56:00
8	-79.8935	43.2720	3	2022-03-28 10:56:00	2022-04-11 09:33:00
8	-79.8935	43.2720	1	2022-09-01 10:30:00	2022-09-15 10:20:00
8	-79.8935	43.2720	NA	2022-12-06 11:08:00	2022-12-20 10:10:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
8	-79.8935	43.2720	NA	2023-04-06 12:28:00	2023-04-20 11:19:00
9	-79.8413	43.2529	NA	2022-07-22 13:13:00	2022-08-05 13:58:00
9	-79.8413	43.2529	3	2022-10-13 10:49:58	2022-10-27 13:12:05
9	-79.8413	43.2529	7	2023-05-17 13:24:00	2023-05-31 13:11:00
9	-79.8413	43.2529	NA	2022-02-08 10:34:00	2022-02-21 16:18:00
10	-79.8198	43.2481	1	2022-07-21 16:58:27	2022-08-05 14:26:00
10	-79.8198	43.2481	2	2022-10-12 15:07:00	2022-10-27 12:49:57
10	-79.8198	43.2481	1	2023-01-21 12:30:00	2023-02-11 13:20:00
10	-79.8198	43.2481	5	2023-05-17 11:55:00	2023-05-31 11:51:00
10	-79.8198	43.2481	NA	2022-02-08 12:21:00	2022-02-21 15:59:00
11	-79.8704	43.2465	2	2022-08-12 12:16:53	2022-08-26 11:38:00
11	-79.8704	43.2465	2	2022-08-12 12:13:30	2022-08-26 11:39:00
11	-79.8704	43.2465	2	2022-11-15 10:00:00	2022-11-29 11:26:00
11	-79.8704	43.2465	NA	2022-11-15 10:01:00	2022-11-29 11:27:00
11	-79.8704	43.2465	3	2023-03-02 18:00:00	2023-03-15 14:58:00
11	-79.8704	43.2465	3	2023-03-02 18:04:00	2023-03-15 15:04:00
12	-79.8628	43.2583	NA	2022-03-02 09:26:56	2022-03-16 09:59:00
12	-79.8628	43.2583	3	2022-03-28 14:00:00	2022-04-11 11:47:00
12	-79.8628	43.2583	NA	2022-07-22 12:57:00	2022-08-05 13:25:00
12	-79.8628	43.2583	1	2022-08-12 13:12:00	2022-08-26 11:00:00
12	-79.8628	43.2583	2	2022-09-02 10:11:45	2022-09-16 15:29:00
12	-79.8628	43.2583	3	2022-10-13 11:02:00	2022-10-27 13:37:00
12	-79.8628	43.2583	1	2022-12-06 12:05:00	2022-12-19 11:37:00
12	-79.8628	43.2583	1	2023-01-21 15:56:00	2023-02-10 13:25:00
12	-79.8628	43.2583	4	2023-03-02 17:32:00	2023-03-15 14:41:00
12	-79.8628	43.2583	3	2023-03-02 17:32:00	2023-03-15 14:41:00
12	-79.8628	43.2583	10	2023-05-17 14:10:00	2023-05-31 13:54:00
12	-79.8628	43.2583	NA	2022-11-15 11:42:00	2022-11-29 12:55:00
12	-79.8628	43.2583	NA	2023-04-06 14:13:00	2023-04-20 12:23:00
12	-79.8628	43.2583	NA	2022-02-08 09:45:00	2022-02-21 17:10:00
13	-79.8877	43.2630	1	2022-03-28 13:25:00	2022-04-11 11:33:00
13	-79.8877	43.2630	NA	2022-09-01 10:13:00	2022-09-15 10:10:00
13	-79.8877	43.2630	1	2022-12-06 11:22:00	2022-12-19 11:50:00
13	-79.8877	43.2630	NA	2023-04-06 13:22:00	2023-04-20 12:03:00
14	-79.8752	43.2599	NA	2022-07-22 12:28:00	2022-08-05 13:04:00
14	-79.8752	43.2599	3	2022-10-13 11:53:21	2022-10-27 14:21:00
14	-79.8752	43.2599	1	2023-01-20 14:02:05	2023-02-10 12:59:00
14	-79.8752	43.2599	7	2023-05-17 15:18:00	2023-05-31 15:07:00
14	-79.8752	43.2599	NA	2022-02-08 08:48:00	2022-02-21 17:22:00
15	-79.8535	43.2452	2	2022-03-28 14:20:00	2022-04-11 12:27:00
15	-79.8535	43.2452	NA	2022-09-02 10:34:19	2022-09-16 15:13:00
15	-79.8535	43.2452	NA	2023-04-06 15:57:00	2023-04-20 13:13:00
16	-79.7633	43.2377	NA	2022-07-21 14:33:00	2022-08-04 15:50:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
16	-79.7633	43.2377	NA	2022-10-12 14:22:00	2022-10-27 11:29:20
16	-79.7633	43.2377	1	2023-01-21 09:58:00	2023-02-11 10:14:00
16	-79.7633	43.2377	NA	2023-05-16 16:10:00	2023-05-30 20:33:00
16	-79.7633	43.2377	NA	2022-02-07 16:06:13	2022-02-21 14:36:00
17	-79.7726	43.2656	7	2022-03-28 16:49:00	2022-04-11 14:11:00
17	-79.7726	43.2656	2	2022-09-01 16:17:00	2022-09-15 15:07:00
17	-79.7726	43.2656	4	2022-12-06 13:23:00	2022-12-19 09:32:00
17	-79.7726	43.2656	1	2023-04-07 09:57:00	2023-04-20 14:18:00
18	-79.9089	43.2576	NA	2022-03-01 10:23:00	2022-03-15 10:07:00
18	-79.9089	43.2576	NA	2022-07-21 12:15:00	2022-08-04 13:49:00
18	-79.9089	43.2576	NA	2022-08-11 11:32:46	2022-08-25 10:32:00
18	-79.9089	43.2576	1	2022-03-28 10:43:00	2022-04-11 10:02:00
18	-79.9089	43.2576	1	2022-09-01 10:44:00	2022-09-15 10:31:00
18	-79.9089	43.2576	2	2022-10-13 13:16:00	2022-10-27 09:03:00
18	-79.9089	43.2576	1	2022-12-06 10:30:00	2022-12-20 10:26:00
18	-79.9089	43.2576	1	2023-01-20 13:29:13	2023-02-10 11:56:00
18	-79.9089	43.2576	1	2023-03-02 16:02:00	2023-03-15 13:02:00
18	-79.9089	43.2576	3	2023-05-17 16:13:00	2023-05-31 15:46:00
18	-79.9089	43.2576	NA	2022-11-15 09:27:00	2022-11-29 11:00:00
18	-79.9089	43.2576	NA	2023-04-06 12:09:00	2023-04-20 11:06:00
18	-79.9089	43.2576	NA	2022-02-07 12:37:16	2022-02-21 11:10:00
19	-79.7801	43.2756	12	2022-02-07 16:26:00	2022-02-21 14:54:00
19	-79.7801	43.2756	8	2022-03-01 16:22:00	2022-03-15 14:10:00
19	-79.7801	43.2756	11	2022-03-28 16:39:00	2022-04-11 14:18:00
19	-79.7801	43.2756	8	2022-07-21 15:59:00	2022-08-04 16:46:00
19	-79.7801	43.2756	3	2022-08-11 16:12:38	2022-08-25 14:44:00
19	-79.7801	43.2756	4	2022-09-01 16:25:00	2022-09-15 15:14:00
19	-79.7801	43.2756	6	2022-10-13 10:08:33	2022-10-27 11:44:00
19	-79.7801	43.2756	7	2022-11-14 15:53:00	2022-11-28 15:13:00
19	-79.7801	43.2756	4	2022-12-05 09:36:00	2022-12-19 09:23:00
19	-79.7801	43.2756	8	2023-01-21 09:37:00	2023-02-10 14:14:00
19	-79.7801	43.2756	6	2023-03-03 09:25:00	2023-03-16 09:55:00
19	-79.7801	43.2756	6	2023-04-07 09:35:00	2023-04-20 14:08:00
19	-79.7801	43.2756	2	2023-05-17 09:45:00	2023-05-31 10:10:00
20	-79.8076	43.2547	NA	2022-03-02 11:38:00	2022-03-16 11:45:00
20	-79.8076	43.2547	NA	2022-02-08 12:03:00	2022-02-21 15:15:00
21	-79.8378	43.2615	1	2022-03-02 10:55:00	2022-03-16 11:24:00
21	-79.8378	43.2615	2	2022-08-12 13:38:00	2022-08-26 10:33:00
21	-79.8378	43.2615	2	2023-03-03 12:28:00	2023-03-16 12:01:00
22	-79.8256	43.2551	NA	2022-03-02 11:20:00	2022-03-16 11:35:00
22	-79.8256	43.2551	NA	2022-07-22 13:59:00	2022-08-05 14:16:00
22	-79.8256	43.2551	2	2022-10-12 15:30:00	2022-10-27 12:59:50
22	-79.8256	43.2551	5	2022-10-12 15:25:00	2022-10-27 12:57:59

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
22	-79.8256	43.2551	1	2023-01-21 12:51:01	2023-02-11 13:39:00
22	-79.8256	43.2551	9	2023-05-17 12:13:00	2023-05-31 12:55:00
23	-79.8400	43.2701	NA	2022-07-22 13:27:00	2022-08-05 13:49:00
23	-79.8400	43.2701	2	2022-03-02 10:44:00	2022-03-16 11:16:00
23	-79.8400	43.2701	6	2022-03-28 14:37:00	2022-04-11 12:11:00
23	-79.8400	43.2701	2	2022-08-12 13:28:00	2022-08-26 10:42:00
23	-79.8400	43.2701	2	2022-09-02 11:46:54	2022-09-16 14:25:00
23	-79.8400	43.2701	1	2022-10-13 10:27:00	2022-10-27 13:24:59
23	-79.8400	43.2701	1	2022-11-15 11:04:00	2022-11-29 12:36:00
23	-79.8400	43.2701	7	2022-12-05 11:56:00	2022-12-19 12:56:00
23	-79.8400	43.2701	3	2023-01-21 13:50:30	2023-02-10 13:52:00
23	-79.8400	43.2701	3	2023-03-03 12:48:00	2023-03-16 12:19:00
23	-79.8400	43.2701	11	2023-05-17 13:43:00	2023-05-31 13:29:00
23	-79.8400	43.2701	NA	2023-04-06 15:23:00	2023-04-20 12:54:00
23	-79.8400	43.2701	NA	2022-02-08 10:13:00	2022-02-21 16:32:00
24	-79.8099	43.2335	1	2022-07-21 16:34:00	2022-08-04 17:07:00
24	-79.8099	43.2335	NA	2022-07-21 16:30:07	2022-08-04 17:05:00
24	-79.8099	43.2335	1	2022-10-12 14:41:00	2022-10-27 12:32:24
24	-79.8099	43.2335	1	2023-01-21 11:57:00	2023-02-11 11:58:00
24	-79.8099	43.2335	NA	2023-01-21 11:52:00	2023-02-11 11:53:00
24	-79.8099	43.2335	NA	2023-05-17 11:33:00	2023-05-31 11:25:00
24	-79.8099	43.2335	NA	2023-05-17 11:29:00	2023-05-31 11:23:00
24	-79.8099	43.2335	NA	2022-02-08 11:05:00	2022-02-21 15:38:00
24	-79.8099	43.2335	NA	2022-02-08 11:07:00	2022-02-21 15:39:00
25	-79.7986	43.2429	NA	2022-03-02 15:12:00	2022-03-16 12:11:00
25	-79.7986	43.2429	1	2022-08-12 11:13:37	2022-08-26 10:06:00
25	-79.7986	43.2429	3	2023-03-03 10:55:00	2023-03-16 11:18:00
25	-79.7986	43.2429	NA	2022-11-14 15:16:00	2022-11-28 14:35:00
25	-79.7986	43.2429	NA	2022-11-14 15:17:00	2022-11-28 14:35:00
26	-79.7997	43.2482	NA	2022-03-02 11:49:00	2022-03-16 12:03:00
26	-79.7997	43.2482	3	2022-03-28 15:03:00	2022-04-11 13:30:00
26	-79.7997	43.2482	NA	2022-02-08 11:33:00	2022-02-21 15:26:00
27	-79.8023	43.2561	NA	2022-03-02 14:51:00	2022-03-16 11:53:00
27	-79.8023	43.2561	2	2022-08-12 11:27:00	2022-08-26 09:56:00
27	-79.8023	43.2561	5	2023-03-03 12:05:00	2023-03-16 11:37:00
27	-79.8023	43.2561	NA	2022-11-14 15:39:00	2022-11-28 14:52:00
28	-79.9116	43.2435	3	2022-03-29 10:01:00	2022-04-12 10:22:00
28	-79.9116	43.2435	NA	2022-09-01 13:44:00	2022-09-15 12:18:00
28	-79.9116	43.2435	2	2023-04-07 15:09:00	2023-04-21 10:28:00
29	-79.8579	43.2357	1	2022-03-01 12:00:00	2022-03-15 12:01:00
29	-79.8579	43.2357	NA	2022-08-11 12:49:29	2022-08-25 11:38:00
29	-79.8579	43.2357	2	2023-03-03 13:21:00	2023-03-16 13:36:00
29	-79.8579	43.2357	NA	2022-11-14 12:07:00	2022-11-28 12:07:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
30	-79.8624	43.2339	NA	2022-03-01 11:47:30	2022-03-15 11:07:00
30	-79.8624	43.2339	2	2022-08-11 12:40:00	2022-08-25 11:32:00
30	-79.8624	43.2339	2	2023-03-05 13:16:00	2023-03-16 13:52:00
30	-79.8624	43.2339	NA	2022-11-14 11:53:00	2022-11-28 23:57:00
31	-79.7882	43.2416	1	2022-03-01 15:58:00	2022-03-15 13:55:00
31	-79.7882	43.2416	NA	2022-03-01 16:01:00	2022-03-15 13:57:00
31	-79.7882	43.2416	NA	2022-08-11 15:48:41	2022-08-25 14:26:00
31	-79.7882	43.2416	1	2022-08-11 15:51:02	2022-08-25 14:28:00
31	-79.7882	43.2416	4	2023-03-03 10:26:00	2023-03-16 10:57:00
31	-79.7882	43.2416	4	2023-03-03 10:29:00	2023-03-16 11:00:00
31	-79.7882	43.2416	NA	2022-11-14 15:00:00	2022-11-28 14:26:00
32	-79.7957	43.2357	2	2022-03-28 15:33:00	2022-04-11 13:44:00
32	-79.7957	43.2357	2	2022-03-28 15:23:00	2022-04-11 13:41:00
32	-79.7957	43.2357	NA	2022-09-02 11:11:48	2022-09-16 14:44:00
32	-79.7957	43.2357	NA	2022-09-02 11:14:16	2022-09-16 14:45:00
32	-79.7957	43.2357	1	2022-12-05 11:25:00	2022-12-19 10:04:00
32	-79.7957	43.2357	NA	2023-04-06 17:23:00	2023-04-20 13:38:00
32	-79.7957	43.2357	NA	2023-04-06 17:20:00	2023-04-20 13:36:00
33	-79.8771	43.2600	NA	2022-07-22 12:14:00	2022-08-05 12:52:00
33	-79.8771	43.2600	3	2022-10-13 12:51:06	2022-10-27 14:13:00
33	-79.8771	43.2600	1	2023-01-20 13:48:25	2023-02-10 12:13:00
33	-79.8771	43.2600	6	2023-05-17 15:36:00	2023-05-31 15:22:00
33	-79.8771	43.2600	NA	2022-02-08 09:02:00	2022-02-21 17:36:00
34	-79.7769	43.2455	NA	2022-09-02 11:28:43	2022-09-16 15:56:00
34	-79.7769	43.2455	1	2022-03-28 16:22:00	2022-04-11 13:59:00
34	-79.7769	43.2455	NA	2022-12-05 12:27:00	2022-12-19 09:52:00
34	-79.7769	43.2455	NA	2022-12-05 12:24:00	2022-12-19 09:50:00
34	-79.7769	43.2455	NA	2023-04-06 17:53:00	2023-04-20 13:54:00
35	-79.8533	43.1950	NA	2022-03-01 14:15:00	2022-03-15 12:49:00
35	-79.8533	43.1950	NA	2022-11-14 13:39:00	2022-11-28 12:39:00
35	-79.8533	43.1950	2	2022-08-11 14:24:00	2022-08-25 13:10:00
35	-79.8533	43.1950	1	2023-03-05 14:09:00	2023-03-16 15:53:00
36	-79.8533	43.2180	NA	2022-03-01 12:43:00	2022-03-15 12:27:00
36	-79.8533	43.2180	NA	2022-08-11 13:59:23	2022-08-25 12:53:00
36	-79.8533	43.2180	3	2023-03-03 14:01:00	2023-03-16 14:15:00
37	-79.8302	43.2259	3	2022-03-29 11:27:00	2022-04-12 11:16:00
37	-79.8302	43.2259	NA	2022-12-06 14:11:00	2022-12-20 14:16:00
37	-79.8302	43.2259	NA	2023-04-07 13:33:00	2023-04-20 16:42:00
38	-79.8526	43.2085	3	2022-03-29 11:47:00	2022-04-12 11:34:00
38	-79.8526	43.2085	NA	2022-09-01 14:55:00	2022-09-15 13:57:00
38	-79.8526	43.2085	NA	2022-12-06 13:54:00	2022-12-20 14:28:00
38	-79.8526	43.2085	NA	2023-04-07 13:04:00	2023-04-20 15:32:00
39	-79.8491	43.2225	NA	2022-07-21 14:09:19	2022-08-04 14:32:00

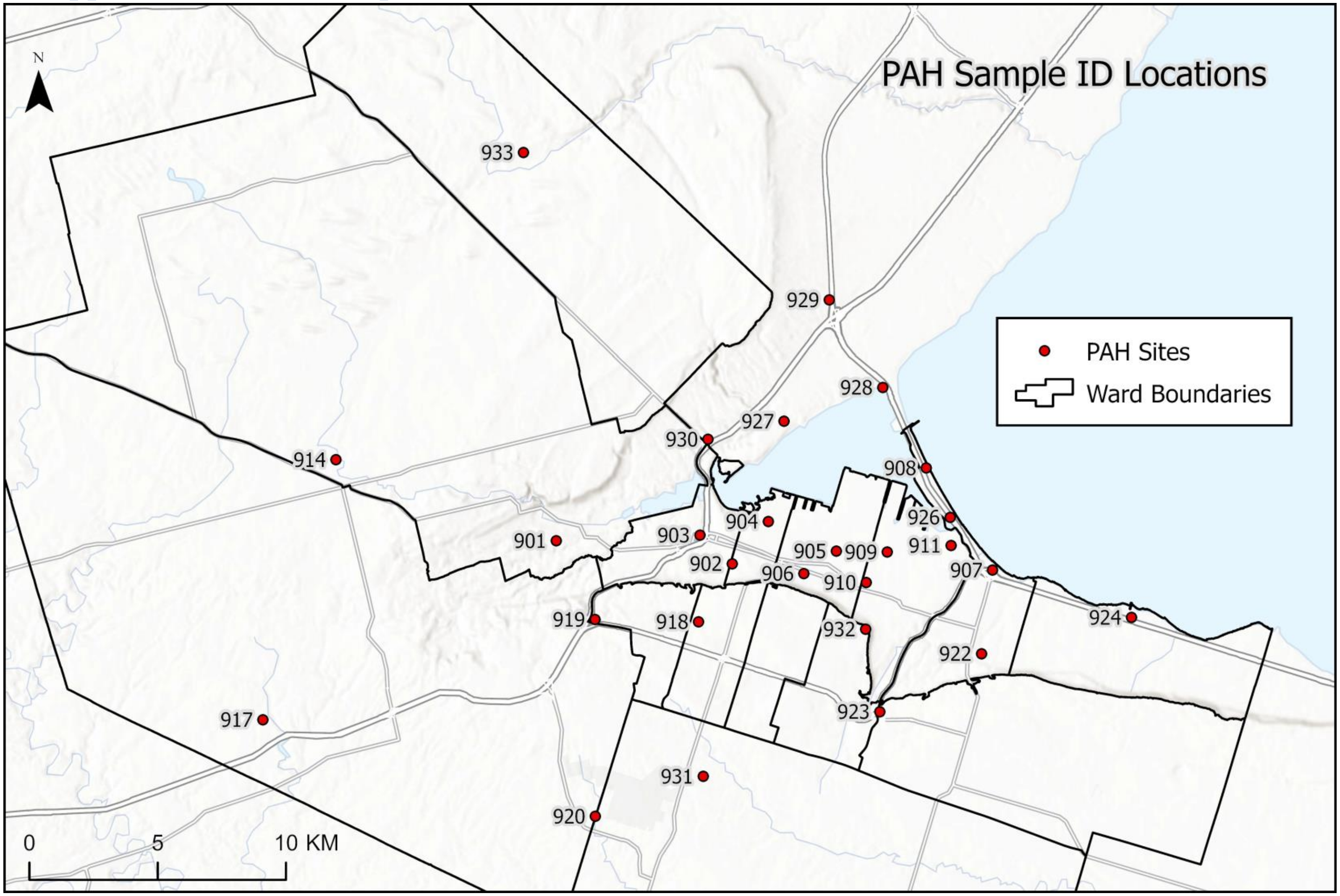
Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
39	-79.8491	43.2225	1	2022-10-12 12:08:00	2022-10-27 09:52:00
39	-79.8491	43.2225	1	2022-10-12 12:09:00	2022-10-27 09:54:00
39	-79.8491	43.2225	NA	2023-01-21 14:17:06	2023-02-11 14:20:00
39	-79.8491	43.2225	1	2023-05-16 15:35:00	2023-05-30 20:09:00
39	-79.8491	43.2225	NA	2022-02-07 14:16:00	2022-02-21 12:18:00
40	-79.8427	43.2387	4	2022-03-29 11:03:00	2022-04-12 11:03:00
40	-79.8427	43.2387	1	2022-09-01 14:27:00	2022-09-15 13:34:00
40	-79.8427	43.2387	NA	2023-04-07 13:50:00	2023-04-20 17:00:00
41	-79.8887	43.2407	NA	2022-07-21 13:49:04	2022-08-04 14:19:00
41	-79.8887	43.2407	NA	2022-08-11 12:23:32	2022-08-25 11:23:00
41	-79.8887	43.2407	NA	2022-09-01 13:53:00	2022-09-15 12:30:00
41	-79.8887	43.2407	NA	2022-11-14 11:39:00	2022-11-28 11:45:00
41	-79.8887	43.2407	NA	2022-03-01 11:32:00	2022-03-15 10:58:00
41	-79.8887	43.2407	6	2022-03-29 10:14:00	2022-04-12 10:33:00
41	-79.8887	43.2407	3	2022-10-12 11:49:00	2022-10-27 09:40:00
41	-79.8887	43.2407	1	2023-01-21 14:35:00	2023-02-11 14:46:00
41	-79.8887	43.2407	3	2023-03-05 10:58:00	2023-03-16 14:38:00
41	-79.8887	43.2407	7	2023-05-16 15:10:00	2023-05-30 19:51:00
41	-79.8887	43.2407	NA	2023-04-07 15:25:00	2023-04-21 10:15:00
42	-79.8776	43.2214	1	2022-03-01 12:20:41	2022-03-15 12:13:00
42	-79.8776	43.2214	1	2022-08-11 13:02:21	2022-08-25 11:50:00
42	-79.8776	43.2214	NA	2022-11-15 10:23:00	2022-11-29 11:44:00
42	-79.8776	43.2214	2	2023-03-05 12:09:00	2023-03-16 15:15:00
43	-79.8608	43.2017	NA	2022-03-01 13:08:00	2022-03-15 12:38:00
43	-79.8608	43.2017	NA	2022-11-14 13:24:00	2022-11-28 12:28:00
43	-79.8608	43.2017	NA	2022-08-11 14:12:23	2022-08-25 13:02:00
43	-79.8608	43.2017	2	2023-03-05 13:44:00	2023-03-16 15:37:00
44	-80.1505	43.2476	NA	2022-11-14 10:47:00	2022-11-28 10:24:00
44	-80.1505	43.2476	NA	2022-03-01 09:27:00	2022-03-15 09:18:00
44	-80.1505	43.2476	NA	2022-08-11 10:15:00	2022-08-25 10:14:00
44	-80.1505	43.2476	NA	2023-03-02 13:27:00	2023-03-15 11:54:00
45	-79.9940	43.2826	NA	2022-07-21 11:50:12	2022-08-04 12:09:00
45	-79.9940	43.2826	NA	2022-10-12 10:59:00	2022-10-26 10:43:00
45	-79.9940	43.2826	1	2023-01-20 12:11:00	2023-02-10 11:16:00
45	-79.9940	43.2826	NA	2023-05-16 13:54:00	2023-05-30 17:50:00
45	-79.9940	43.2826	NA	2022-02-07 11:26:24	2022-02-21 08:50:00
46	-80.0264	43.3942	NA	2022-07-21 11:25:14	2022-08-04 11:48:00
46	-80.0264	43.3942	NA	2022-10-12 10:34:41	2022-10-26 10:17:00
46	-80.0264	43.3942	NA	2023-01-20 11:42:00	2023-02-10 10:40:00
46	-80.0264	43.3942	NA	2023-05-16 12:41:00	2023-05-30 17:20:00
46	-80.0264	43.3942	NA	2022-02-07 10:38:24	2022-02-21 10:27:00
47	-79.8976	43.2282	NA	2022-03-01 11:13:00	2022-03-15 10:44:00
47	-79.8976	43.2282	NA	2022-08-11 12:13:24	2022-08-25 11:05:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
47	-79.8976	43.2282	NA	2022-11-14 11:24:00	2022-11-28 11:22:00
47	-79.8976	43.2282	3	2023-03-05 11:44:00	2023-03-16 14:54:00
48	-79.9078	43.1753	2	2022-03-29 12:12:00	2022-04-12 12:01:00
48	-79.9078	43.1753	2	2022-09-01 12:04:00	2022-09-15 11:48:00
48	-79.9078	43.1753	NA	2023-04-07 12:04:00	2023-04-20 16:14:00
49	-79.9802	43.3944	NA	2022-07-21 11:06:30	2022-08-04 11:35:00
49	-79.9802	43.3944	2	2022-10-12 10:15:00	2022-10-26 10:01:00
49	-79.9802	43.3944	NA	2023-01-20 11:20:00	2023-02-10 10:19:00
49	-79.9802	43.3944	NA	2023-05-16 12:15:00	2023-05-30 16:58:00
49	-79.9802	43.3944	NA	2022-02-07 10:12:00	2022-02-21 10:07:00
50	-80.0273	43.3969	NA	2022-09-01 09:44:00	2022-09-15 09:45:00
50	-80.0273	43.3969	NA	2022-12-06 09:31:00	2022-12-20 09:38:00
50	-80.0273	43.3969	1	2022-03-28 10:06:00	2022-04-11 08:57:00
50	-80.0273	43.3969	NA	2023-04-06 11:01:00	2023-04-20 10:12:00
51	-80.0117	43.1961	NA	2022-09-01 11:42:00	2022-09-15 11:23:00
51	-80.0117	43.1961	1	2022-03-28 12:34:00	2022-04-11 10:56:00
51	-80.0117	43.1961	NA	2023-04-07 16:56:00	2023-04-21 11:33:00
52	-79.8861	43.2300	5	2022-03-29 10:34:00	2022-04-12 10:44:00
52	-79.8861	43.2300	NA	2022-09-01 14:05:00	2022-09-15 12:38:00
52	-79.8861	43.2300	NA	2023-04-07 14:35:00	2023-04-21 10:01:00
53	-79.7424	43.2206	NA	2022-03-29 13:14:00	2022-04-12 12:51:00
53	-79.7424	43.2206	NA	2022-12-05 10:22:00	2022-12-19 10:21:00
53	-79.7424	43.2206	NA	2022-09-01 15:54:00	2022-09-15 14:50:00
53	-79.7424	43.2206	NA	2023-04-07 10:36:00	2023-04-20 14:37:00
54	-79.7689	43.1916	NA	2022-09-01 15:25:00	2022-09-15 14:20:00
54	-79.7689	43.1916	NA	2022-09-01 15:27:00	2022-09-15 14:23:00
54	-79.7689	43.1916	NA	2022-12-05 11:08:00	2022-12-19 10:37:00
54	-79.7689	43.1916	1	2022-03-29 12:45:00	2022-04-12 12:29:00
54	-79.7689	43.1916	1	2022-03-29 12:47:00	2022-04-12 12:31:00
54	-79.7689	43.1916	NA	2022-12-05 11:00:00	2022-12-19 10:39:00
54	-79.7689	43.1916	NA	2023-04-07 11:05:00	2023-04-20 15:03:00
55	-79.8683	43.2553	NA	2022-07-22 12:47:00	2022-08-05 13:14:00
55	-79.8683	43.2553	6	2022-10-13 11:32:45	2022-10-27 14:03:11
55	-79.8683	43.2553	1	2023-01-20 14:22:00	2023-02-10 13:13:00
55	-79.8683	43.2553	12	2023-05-17 14:31:00	2023-05-31 14:20:00
56	-79.9629	43.2228	NA	2022-07-21 13:27:00	2022-08-04 14:02:00
56	-79.9629	43.2228	1	2022-10-12 11:29:02	2022-10-27 09:20:11
56	-79.9629	43.2228	1	2023-01-21 15:18:00	2023-02-11 15:13:00
56	-79.9629	43.2228	NA	2023-01-21 15:14:00	2023-02-11 15:11:00
56	-79.9629	43.2228	2	2023-05-16 14:41:00	2023-05-30 18:34:00
56	-79.9629	43.2228	2	2023-05-16 14:34:00	2023-05-30 18:30:00
57	-79.8090	43.1241	NA	2022-03-01 14:50:00	2022-03-15 13:12:00
57	-79.8090	43.1241	NA	2022-08-11 14:49:22	2022-08-25 13:36:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
57	-79.8090	43.1241	NA	2022-11-14 14:07:00	2022-11-28 13:35:00
57	-79.8090	43.1241	1	2023-03-05 15:39:00	2023-03-16 16:21:00
58	-79.9659	43.2273	NA	2022-03-01 10:43:00	2022-03-15 10:24:00
58	-79.9659	43.2273	NA	2022-03-01 10:46:00	2022-03-15 10:27:00
58	-79.9659	43.2273	NA	2022-08-11 11:53:56	2022-08-25 10:46:00
58	-79.9659	43.2273	NA	2022-11-14 10:06:00	2022-11-28 10:57:00
58	-79.9659	43.2273	1	2022-08-11 11:57:43	2022-08-25 10:47:00
58	-79.9659	43.2273	1	2022-11-14 10:10:00	2022-11-28 10:57:00
58	-79.9659	43.2273	1	2023-03-02 15:09:00	2023-03-15 12:35:00
58	-79.9659	43.2273	1	2023-03-02 15:03:00	2023-03-15 12:32:00
59	-79.6312	43.2208	NA	2022-07-21 15:37:29	2022-08-04 16:10:00
59	-79.6312	43.2208	NA	2022-10-12 13:57:00	2022-10-27 10:52:00
59	-79.6312	43.2208	NA	2023-01-21 10:43:05	2023-02-11 10:55:00
59	-79.6312	43.2208	NA	2023-05-17 10:36:00	2023-05-31 10:57:00
59	-79.6312	43.2208	NA	2022-02-07 15:15:00	2022-02-21 13:50:00
60	-79.9418	43.2179	NA	2022-09-01 12:24:00	2022-09-15 12:05:00
60	-79.9418	43.2179	2	2022-03-28 12:59:00	2022-04-11 11:15:00
60	-79.9418	43.2179	NA	2023-04-07 15:49:00	2023-04-21 10:48:00
61	-79.7219	43.2252	NA	2022-03-01 15:27:00	2022-03-15 13:37:00
61	-79.7219	43.2252	NA	2022-08-11 15:20:27	2022-08-25 14:08:00
61	-79.7219	43.2252	NA	2022-11-14 14:36:00	2022-11-28 14:05:00
61	-79.7219	43.2252	2	2023-03-03 09:58:00	2023-03-16 10:22:00
62	-79.6884	43.2259	NA	2022-07-21 15:10:57	2022-08-04 16:23:00
62	-79.6884	43.2259	NA	2022-07-21 15:14:57	2022-08-04 16:25:00
62	-79.6884	43.2259	NA	2022-10-12 13:41:00	2022-10-27 11:08:05
62	-79.6884	43.2259	NA	2023-01-21 10:23:56	2023-02-11 10:33:00
62	-79.6884	43.2259	NA	2023-05-17 10:14:00	2023-05-31 10:34:00
62	-79.6884	43.2259	NA	2022-02-07 15:38:00	2022-02-21 14:09:00
63	-79.7342	43.2172	NA	2022-07-21 14:51:31	2022-08-04 14:55:00
63	-79.7342	43.2172	NA	2022-10-12 13:24:00	2022-10-27 10:28:50
63	-79.7342	43.2172	1	2023-01-21 11:11:00	2023-02-11 11:25:00
63	-79.7342	43.2172	NA	2023-05-16 16:31:00	2023-05-30 20:57:00
63	-79.7342	43.2172	NA	2022-02-07 14:49:00	2022-02-21 12:46:00
64	-79.8680	43.2573	1	2022-03-02 09:58:57	2022-03-16 10:13:00
64	-79.8680	43.2573	2	2022-08-12 12:55:00	2022-08-26 11:15:00
64	-79.8680	43.2573	NA	2022-11-15 11:51:00	2022-11-29 13:10:00
64	-79.8680	43.2573	2	2023-03-02 17:11:00	2023-03-15 14:25:00
65	-79.8664	43.2631	NA	2022-07-22 14:29:00	2022-08-05 13:34:00
65	-79.8664	43.2631	NA	2022-07-22 14:36:00	2022-08-05 13:36:00
65	-79.8664	43.2631	3	2022-10-13 11:15:03	2022-10-27 13:45:05
65	-79.8664	43.2631	3	2022-10-13 11:16:34	2022-10-27 13:46:59
65	-79.8664	43.2631	3	2023-01-21 16:16:00	2023-02-11 15:49:00
65	-79.8664	43.2631	1	2023-01-21 16:11:33	2023-02-11 15:52:00

Site ID	Longitude	Latitude	Concentration (ppb)	Start Time	End Time
65	-79.8664	43.2631	7	2023-05-17 14:58:00	2023-05-31 14:49:00
65	-79.8664	43.2631	7	2023-05-17 14:51:00	2023-05-31 14:50:00
65	-79.8664	43.2631	NA	2022-02-08 09:25:00	2022-02-21 16:47:00
65	-79.8664	43.2631	NA	2022-02-08 09:28:00	2022-02-21 16:50:00
66	-79.8805	43.3454	NA	2022-03-01 08:34:00	2022-03-15 08:39:00
66	-79.8805	43.3454	NA	2022-08-11 09:35:00	2022-08-25 09:17:00
66	-79.8805	43.3454	NA	2022-11-14 09:17:00	2022-11-28 09:27:00
66	-79.8805	43.3454	1	2022-11-14 09:16:00	2022-11-28 09:27:00
66	-79.8805	43.3454	NA	2023-03-02 11:03:00	2023-03-15 10:50:00
69	-79.8305	43.2433	NA	2022-09-02 10:53:15	2022-09-16 15:02:00
69	-79.8305	43.2433	NA	2022-07-21 17:15:00	2022-08-05 14:08:00
69	-79.8305	43.2433	2	2022-08-12 11:54:00	2022-08-26 10:20:00
69	-79.8305	43.2433	1	2022-10-12 14:56:00	2022-10-27 12:42:00
69	-79.8305	43.2433	2	2022-11-15 10:49:00	2022-11-29 12:10:00
69	-79.8305	43.2433	2	2022-12-05 11:43:00	2022-12-19 11:07:00
69	-79.8305	43.2433	1	2023-01-21 12:14:00	2023-02-11 13:05:00
69	-79.8305	43.2433	1	2023-01-21 12:14:00	2023-02-11 13:05:00

Appendix H: PAH Sample Site IDs



Appendix I: O_3, NO_2, NO_X, and SO_2 Sample Site IDs