The Corporation of the City of St. Catharines
CITY COUNCIL AGENDA
Special Meeting, Tuesday, December 22, 2020
Electronic Participation, 2:00 PM

As part of the City's commitment to safety during the COVID-19 pandemic, this meeting of Council will be held electronically.

This Meeting may be viewed online at www.stcatharines.ca/youtube

His Worship Mayor Walter Sendzik takes the Chair and opens the meeting

Page

1. Adoption of the Agenda

2. Declarations of Interest

3. Special Presentation

2 - 181 3.1 Kim Groombridge, Manager, Niagara District Office, Drinking Water and Environmental Compliance Division, Ministry of the Environment Conservation and Parks
Re. Air and Water Monitoring Results, 282 and 285 Ontario Street
[Addenda]

4. By-laws

4.1 Reading of By-Law
A By-law to confirm the proceedings of council at its special meeting held on the 22nd day of December, 2020 (One reading - with respect to confirming the proceedings of the meeting held on December 22, 2020).

5. Adjournment

Ministry of the Environment, Conservation and Parks
Drinking Water and Environmental Compliance Division
West Central Region

119 King Street West, 12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
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Ministère de l'Environnement de la Protection de la nature et des Parcs
Division de la conformité en matière d'eau potable et d'environnement
Direction régionale du Centre-Ouest

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Ontario

December 9, 2020

M E M O R A N D U M

TO: Phillip Hull
Senior Environmental Officer
Niagara District Office

FROM: Rui Zeng
Air Quality Analyst
Technical Support Section, West Central Region

RE: **Former GM Property Air Monitoring Survey, St. Catharines, Ontario**

At the request of the Niagara District Office of the Ontario Ministry of the Environment, Conservation and Parks (MECP), the Technical Support Section of West Central Region conducted an air monitoring survey in the vicinity of the former General Motors (GM) property in St. Catharines, Ontario. The property (282 Ontario Street, 285 Ontario Street, and 10 Pleasant Avenue) is surrounded on the North and East sides by residential properties and the South side by commercial interests and further additional residential properties. Residents and neighbouring property owners have expressed concern that the piles of debris left after demolition activities may have released and may continue to release contaminants into the air. The purpose of the air monitoring survey is to measure potential fugitive emissions from the property and determine if the results indicate any potential off-site concerns to the general public. The air monitoring survey has collected Hi-vol air samples, both upwind and downwind, on ten (10) sampling dates, and three (3) monthly dustfall samples from July 30, 2020 to October 31, 2020. The results collected during this time are presented in this memo.

Monitoring Activities

During the survey, the Technical Support Section installed a total of three sampling stations close to the property line of the former GM property for the measurements of total suspended particulate matter (TSP), metals, and dustfall. One Hi-vol sampler and

one portable meteorological sensor were deployed on municipal property at the Haig Bowl Arena, located at 17 Beech St. (Station 27097). Another Hi-vol sampler was deployed at the Region of Niagara Carlton Street Reservoir Pumping Station, located at 15 Carlton St (Station 27094). In addition, a dustfall sampler was deployed on Haig St, near the intersection of Haig St and Carlton St (Station 27096). A map of the sampling locations can be found in Appendix A.

Hi-vol samples were collected when the sampling locations were forecast to be predominantly downwind of the former GM property, a potential source of fugitive emissions. Hi-vol samples were collected on July 30, Aug 4, Aug 8, Aug 13-14, Aug 18, Aug 25, Aug 29, Oct 7, Oct 16, and Oct 24 at both Stations 27097 and 27094. The dustfall samples are monthly samples and were collected in August, September, and October 2020.

The Hi-vol samplers draw a known volume of air (40 cubic feet per minute) through a pre-weighed filter for a 24-hour period to collect suspended particulate matter, including any suspended metals (Copper, Nickel, Cadmium, Chromium, Lead, Iron, Manganese, Vanadium, and Zinc). These samples were analyzed for mass loading expressed in micrograms per meter cubed.

The dustfall sampler collects any particles in air that settle down over a given area and time under the influence of gravity. Dustfall sample results are expressed in g/m2/30days. A semi-quantitative measurement was provided for the identification of different types of materials contained in the dustfall sample.

Both types of samples, Hi-vol and dustfall, were analyzed by a stereoscopic and polarized microscope, and a scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA) for the identification of the particles contained in the samples. Following the analysis, any samples that were found to contain synthetic fibres were subsequently sent to EMSL Canada Inc., a third-party laboratory accredited for asbestos analysis. Qualitative asbestos analysis by transmission electron microscopy (TEM) and filtration technique were used to confirm any presence or absence of asbestos in the samples.

Results/Conclusions

Table 1 and Table 2 list the concentrations of suspended particulate matter and metals measured at Stations 27094 and 27097. The monitoring results were compared to Ontario Regulation 419/05 Air Pollution – Local Air Quality (O.Reg. 419/05) and Ambient Air Quality Criteria (AAQC). O.Reg. 419/05 is a regulation that sets legal limits for contaminants in air. It *"works within the province's air management framework by regulating air contaminants released into communities by various sources, including local industrial and commercial facilities."* An Ambient Air Quality Criteria (AAQC) is *"a concentration of a contaminant in air that is protective against adverse effects on health and/or the environment. AAQCs are most commonly used in environmental assessments, special studies using ambient air monitoring data, assessment of general air quality in a community and annual reporting on air quality across the province."*

Table 1: Summary of Monitoring Results at Station 27094 (Pumping Station)

Sample Date	Predominant Wind Direction	Concentration (µg/m³)									
		Suspended Particulate Matter	Copper	Nickel	Cadmium	Chromium	Lead	Iron	Manganese	Vanadium	Zinc
O. Reg. 419/05 24-hr Standard and Ambient Air Quality Criteria		**120**	**50**	**0.2**	**0.025**	**0.5**	**0.5**	**4.0**	**0.4**	**2**	**120**
30-Jul-20	NW	19	0.081	0.001	0.005	0.002	0.005	0.36	0.013	0.002	0.001
04-Aug-20	NW	6	0.054	0.001	0.005	0.002	0.005	0.1	0.005	0.002	0.001
08-Aug-20	S, NW	14	0.055	0.001	0.005	0.002	0.005	0.24	0.01	0.002	0.001
13-Aug-20	NE	60	0.34	0.001	0.005	0.0054	0.0053	0.95	0.032	0.003	0.001
18-Aug-20	NW	13	0.069	0.001	0.005	0.002	0.005	0.22	0.009	0.002	0.001
25-Aug-20	NW, SW	29	0.075	0.001	0.005	0.002	0.005	0.39	0.013	0.019	0.37
29-Aug-20	W, SW	4	0.041	0.001	0.005	0.002	0.005	0.13	0.007	0.022	0.36
07-Oct-20	NW	12	0.052	0.001	0.005	0.002	0.005	0.19	0.007	0.002	0.001
16-Oct-20	NW, SW, SE	21	0.06	0.001	0.005	0.002	0.005	0.27	0.01	0.002	0.001
24-Oct-20	NW	4	0.051	0.001	0.005	0.002	0.005	0.11	0.005	0.019	0.39

Table 2: Summary of Monitoring Results at Station 27097 (Arena)

Sample Date	Predominant Wind Direction	Concentration (µg/m³)									
		Suspended Particulate Matter	Copper	Nickel	Cadmium	Chromium	Lead	Iron	Manganese	Vanadium	Zinc
O. Reg. 419/05 24-hr Standard and Ambient Air Quality Criteria		**120**	**50**	**0.2**	**0.025**	**0.5**	**0.5**	**4.0**	**0.4**	**2**	**120**
30-Jul-20	NW	19	0.045	0.001	0.005	0.0029	0.005	0.37	0.014	0.002	0.001
04-Aug-20	NW	8	0.052	0.001	0.005	0.002	0.005	0.11	0.009	0.002	0.001
08-Aug-20	S, NW	21	0.052	0.001	0.005	0.002	0.005	0.31	0.01	0.002	0.001
13-Aug-20	NE	40	0.051	0.001	0.005	0.0031	0.0065	0.69	0.027	0.002	0.001
18-Aug-20	NW	16	0.038	0.001	0.005	0.002	0.005	0.3	0.015	0.002	0.001
25-Aug-20	NW, SW	27	0.042	0.001	0.005	0.002	0.005	0.41	0.013	0.002	0.001
29-Aug-20	W, SW	12	0.037	0.001	0.005	0.002	0.005	0.14	0.003	0.018	0.35
07-Oct-20	NW	12	0.03	0.001	0.005	0.0022	0.005	0.21	0.008	0.002	0.001
16-Oct-20	NW, SW, SE	17	0.048	0.001	0.005	0.002	0.005	0.26	0.013	0.002	0.001
24-Oct-20	NW	5	0.029	0.001	0.005	0.002	0.005	0.098	0.003	0.02	0.37

As shown in Table 1 and Table 2, the maximum measured 24-hour concentration of suspended particulate matter was 60 µg/m^3 and 40 µg/m^3 at Station 27094 and Station 27097 respectively. There were no exceedances observed in suspended particulate matter, Copper, Nickel, Cadmium, Chromium, Lead, Iron, Manganese, Vanadium, or Zinc. The measurements were all significantly below their respective O. Reg. 419/05 24-hour standards and AAQCs, even in the samples collected downwind of the potential source. All of the measurements of Cadmium and Nickel, and most of the measurements of Chromium, Lead, Vanadium, and Zinc were below their respective method detection limits.

Wind roses are used to depict the observed wind speeds and wind directions. Using a polar coordinate system of gridding, the frequency of winds over a time period is plotted by wind direction, with color bands showing wind speed ranges. The direction of the longest spoke shows the wind direction with the greatest frequency. Meteorological data from Station 27097 was used to determine corresponding local 1-minute measurements for wind speed and wind direction during the sampling events. The 24-hour wind roses in Appendix B display the predominant wind directions for each sampling period.

On October 7, 70% of the winds were from the Northwest direction, resulting in Station 27094 (Pumping Station) being directly upwind and Station 27097 (Arena) being directly downwind of the GM property. However, both stations measured the same concentrations of suspended particulate matter (12 µg/m^3) on that day. Similarly, 67% and 77% of the winds were from the Northwest direction on July 30 and Oct 24, and both upwind and downwind stations observed almost same and comparably low suspended particulate matter concentrations. Therefore, the off-site suspended particulate emissions from the former GM property to the downwind area were not observed.

The results of the microscope and SEM-EDXRA analyses are summarized in Appendix C. SEM-EDXRA results show the presence of different particles in the samples by analyzing the spectra of randomly selected particles. Hi-vol and dustfall samples mainly contained normal road dust particles (calcite, dolomite, silica, silicates, etc.).

Under the microscope, coloured and colourless minerals, biological materials, trace synthetic fibers, tire wear particles, and metal fragments were observed in the Hi-vol samples. Seven Hi-vol samples collected at Station 27094 and Station 27097 were found to contain trace synthetic fibers in the original microscopic analysis. These seven Hi-vol samples were sent for further analysis for asbestos, provided by the accredited third-party asbestos laboratory. There was no asbestos detected in any of these samples as shown in the lab report in Appendix D.

Under the microscope, the dustfall samples were mainly comprised of biological material and minerals, with biological material being the majority. No synthetic fibres were found in the dustfall samples. Therefore, they were not sent out for further asbestos analysis. Total insoluble content refers to the soluble portion and the insoluble portion of a dustfall sample. In general, dustfall samples include particles less than

1.0mm in size. As shown in Table 3, the total insoluble contents of the dustfall samples are all below the AAQC of 7 g/m^2 per 30 days.

Table 3: Dustfall Sample Results at Station 27096

Sample Period	Predominant Wind Direction	Total Insoluble Content (g/m2/30D)	Biological Material (vol%)	Minerals (vol%)
August 2020	S	2	65%	35%
September 2020	S	2.4	80%	20%
October 2020	S	3	70%	30%

Note: the 30-Day Dustfall AAQC guideline is 7 g/m^2

The monthly wind roses for August, September, and October 2020 are shown as Figures 11- 13 in Appendix B. It can be seen that the predominant winds during these three months consistently came from the South direction, which places the dustfall sampler downwind of the former GM property. The maximum winds for these three months were all above 20km/hr, which has the potential to carry particles from the facility to the neighboring residents.

Overall, Hi-vol and dustfall samples mainly contained normal road dusts. No asbestos was found in the Hi-vol samples which detected trace synthetic fibers. The measurements of suspended particulate matter and metals were significantly lower than the O. Reg. 419/05 24-hour Standards and AAQC at both stations. The amount of dust collected in the dustfall jars were also well below the AAQC guideline. Also, no elevated concentrations of suspended particulate matter were observed in the downwind samples, therefore off-site fugitive emissions from the former GM property to the general public were not observed.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Rui Zeng
Air Quality Analyst, WCR

c.
Natalie Stacey, Air, Pesticides and Environmental Planning Supervisor, WCR (A)
Kim Groombridge, Manager, Niagara District Office
Katy Potter, Supervisor, Niagara District Office

Encl.

Appendix A: Former GM Property Air Monitoring Survey, St. Catharines -- Air Monitoring Station Locations

Appendix B: Wind Roses

Appendix C: Microscope and SEM-EDXRA Results

Appendix D: Asbestos Analysis Report

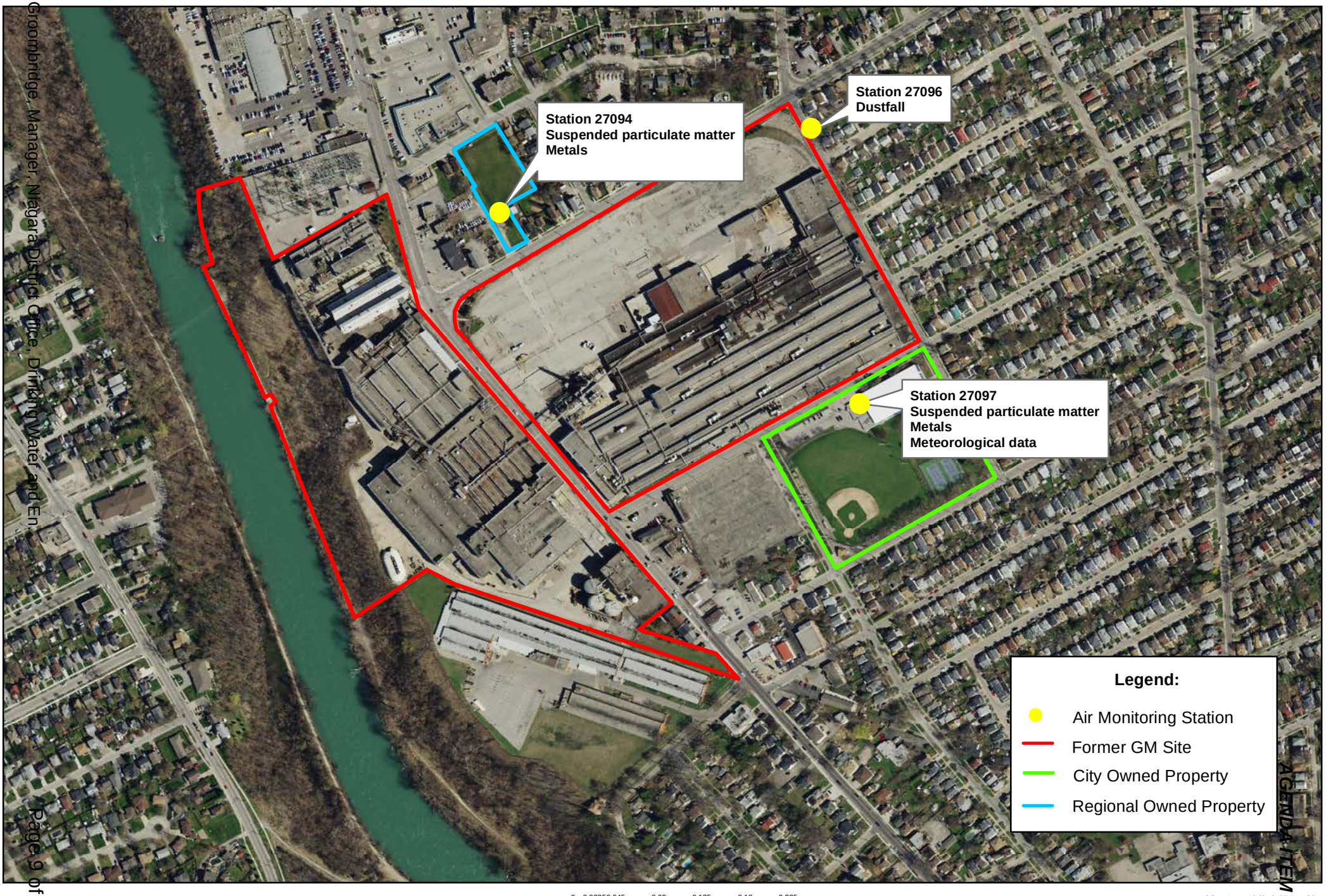
Appendix E: MECP Lab Report

Appendix A: Former GM Property Air Monitoring Survey, St. Catharines -- Air Monitoring Station Locations

Figure 1: Former GM Property Air Monitoring Survey, St. Catharines
Air Monitoring Station Locations

Ontario

Ministry of the Environment Conservation and Parks



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Kilometres

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Appendix B: Wind Roses

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Figure 1: Wind Rose – July 30, 2020 – 24 hr EST (00:00 to 24:00)

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Figure 2: Wind Rose – August 4, 2020 – 24 hr EST (00:00 to 24:00)

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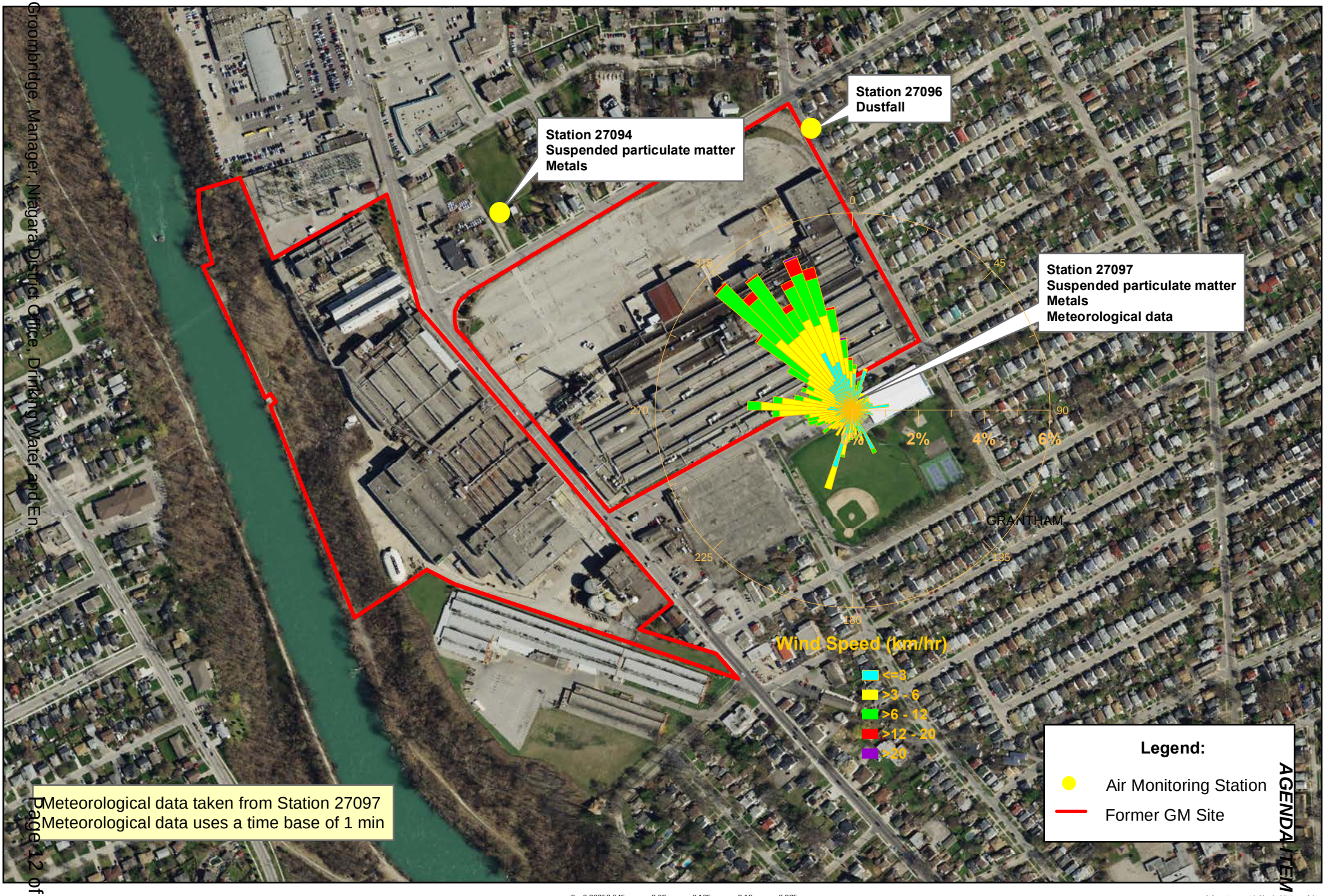

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Figure 3: Wind Rose – August 8, 2020 – 24 hr EST (00:00 to 24:00)

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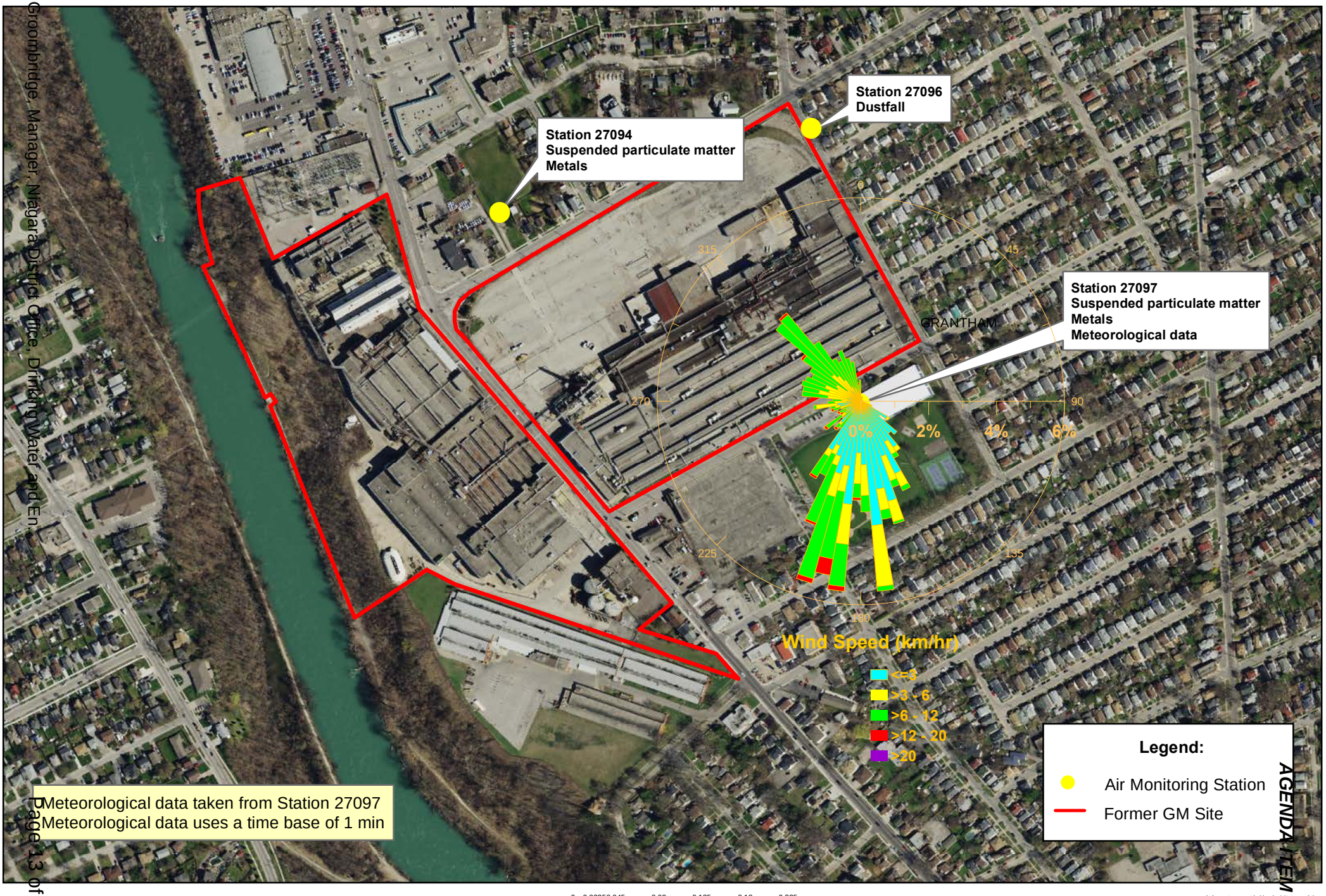

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Figure 4: Wind Rose – August 13 to August 14, 2020 – 24 hr EST (11:00 to 11:00)

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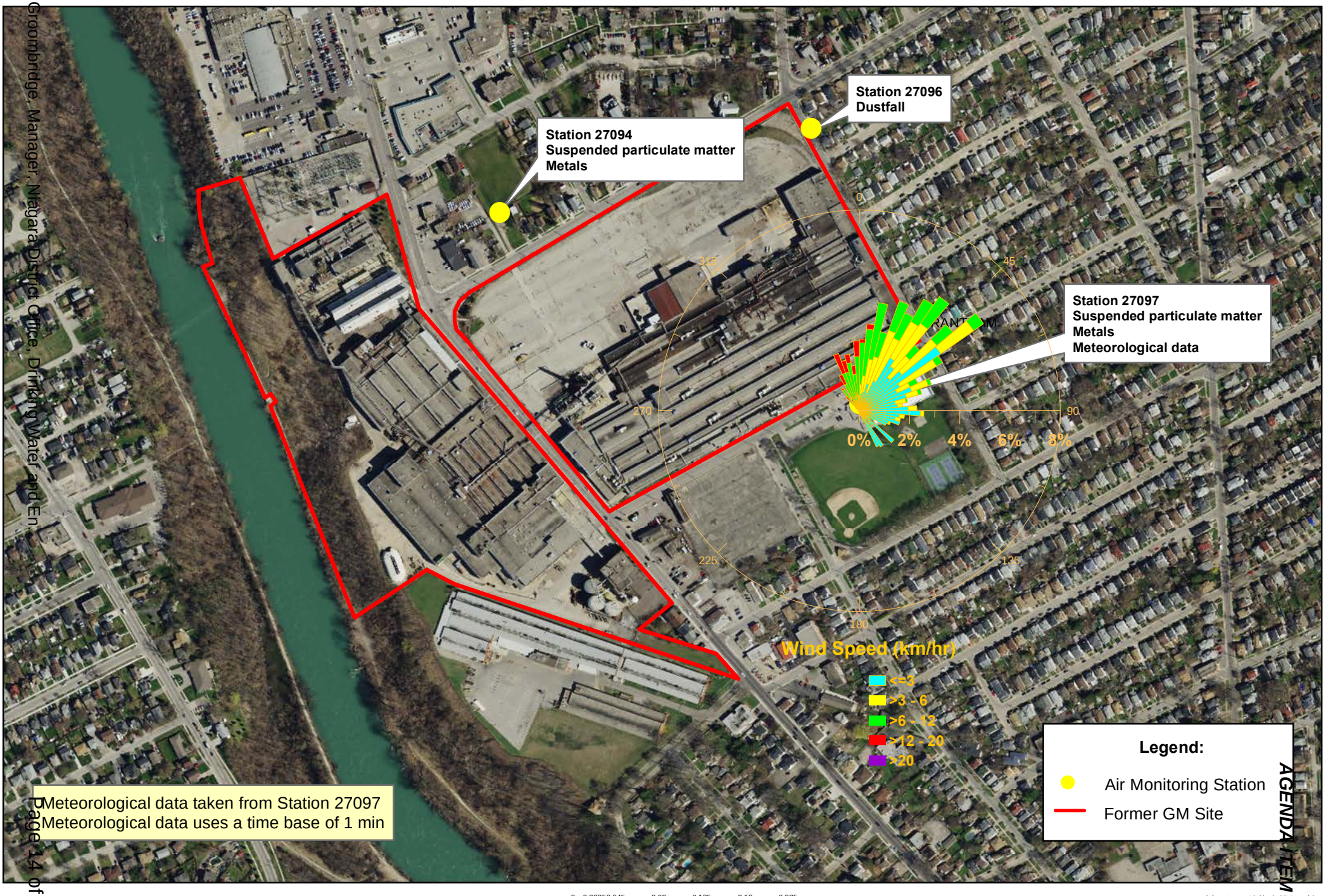

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Figure 5: Wind Rose – August 18, 2020 – 24 hr EST (00:00 to 24:00)

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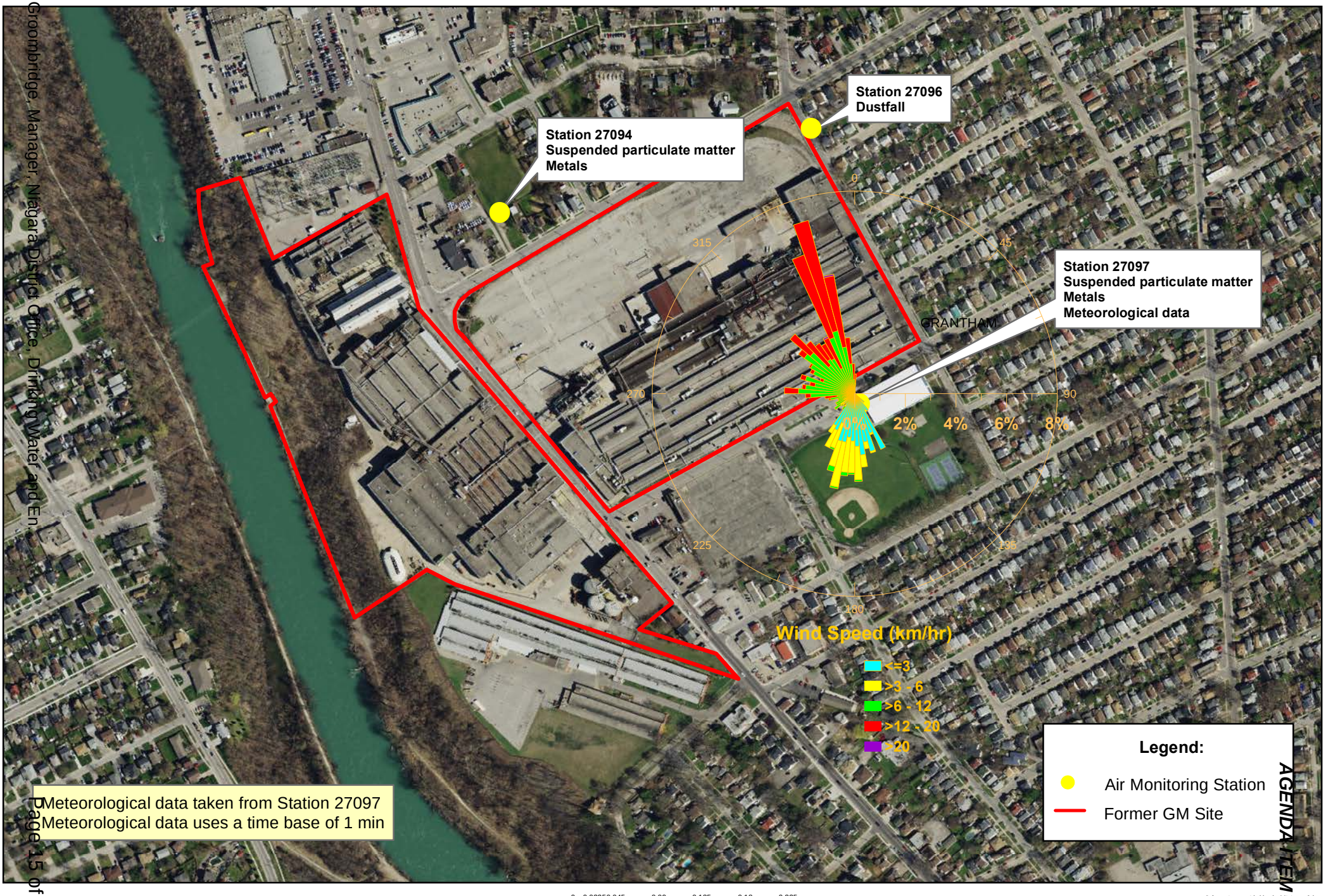

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Figure 6: Wind Rose – August 25, 2020 – 24 hr EST (00:00 to 24:00)

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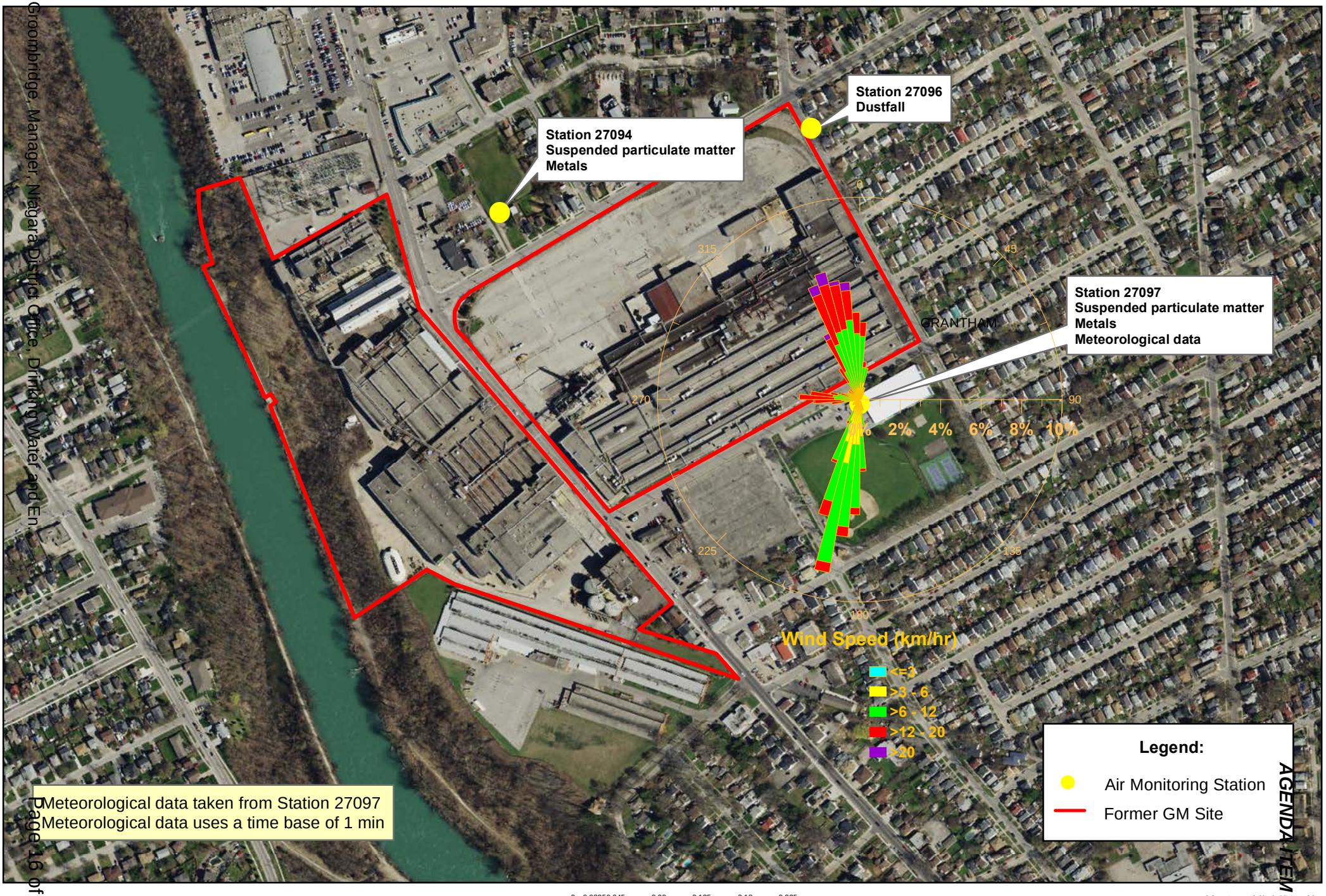

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Figure 7: Wind Rose – August 29, 2020 – 24 hr EST (00:00 to 24:00)

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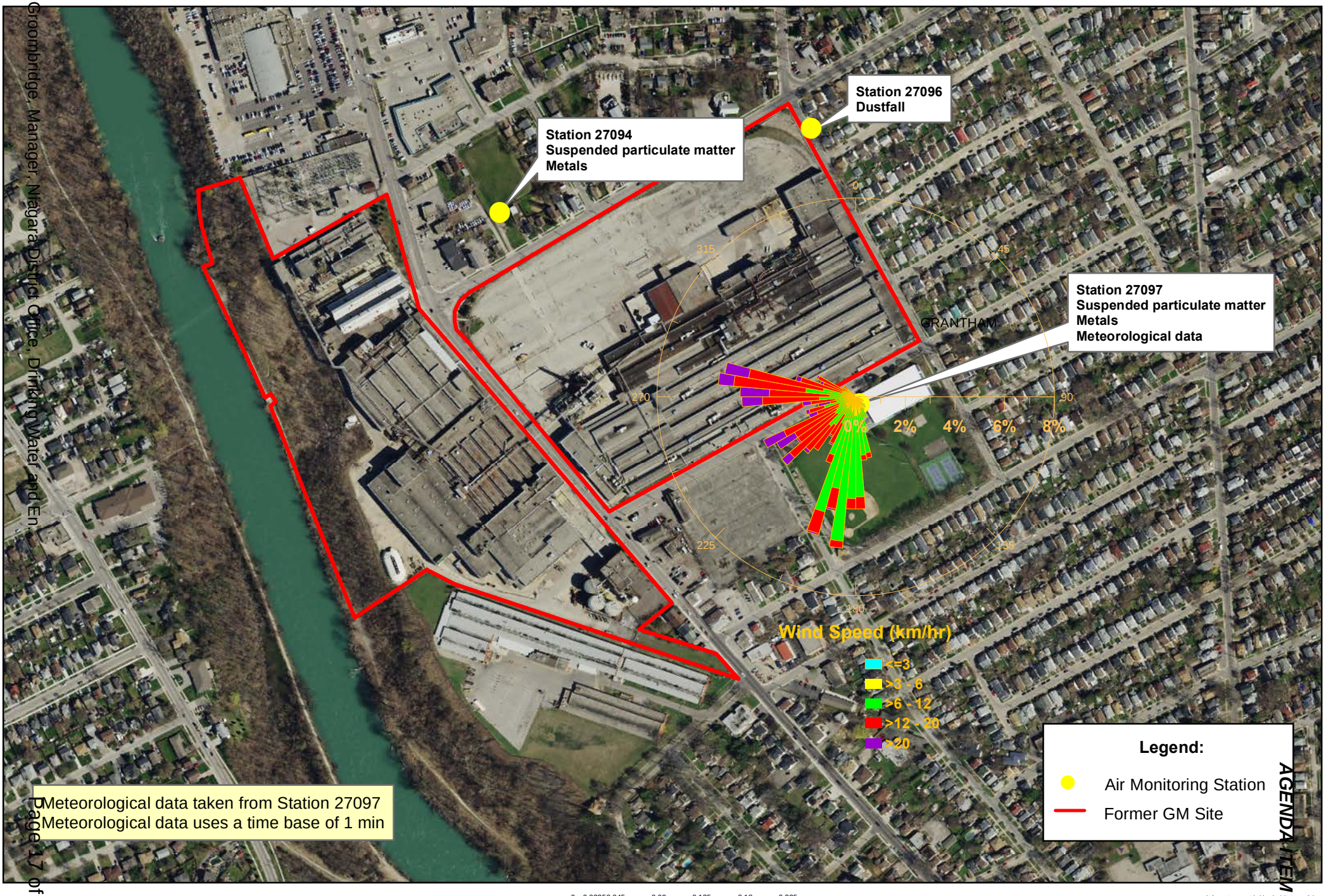

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Figure 8: Wind Rose – October 7 to October 8, 2020 – 24 hr EST (15:00 to 15:00)

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Figure 9: Wind Rose – October 16, 2020 – 24 hr EST (00:00 to 24:00)

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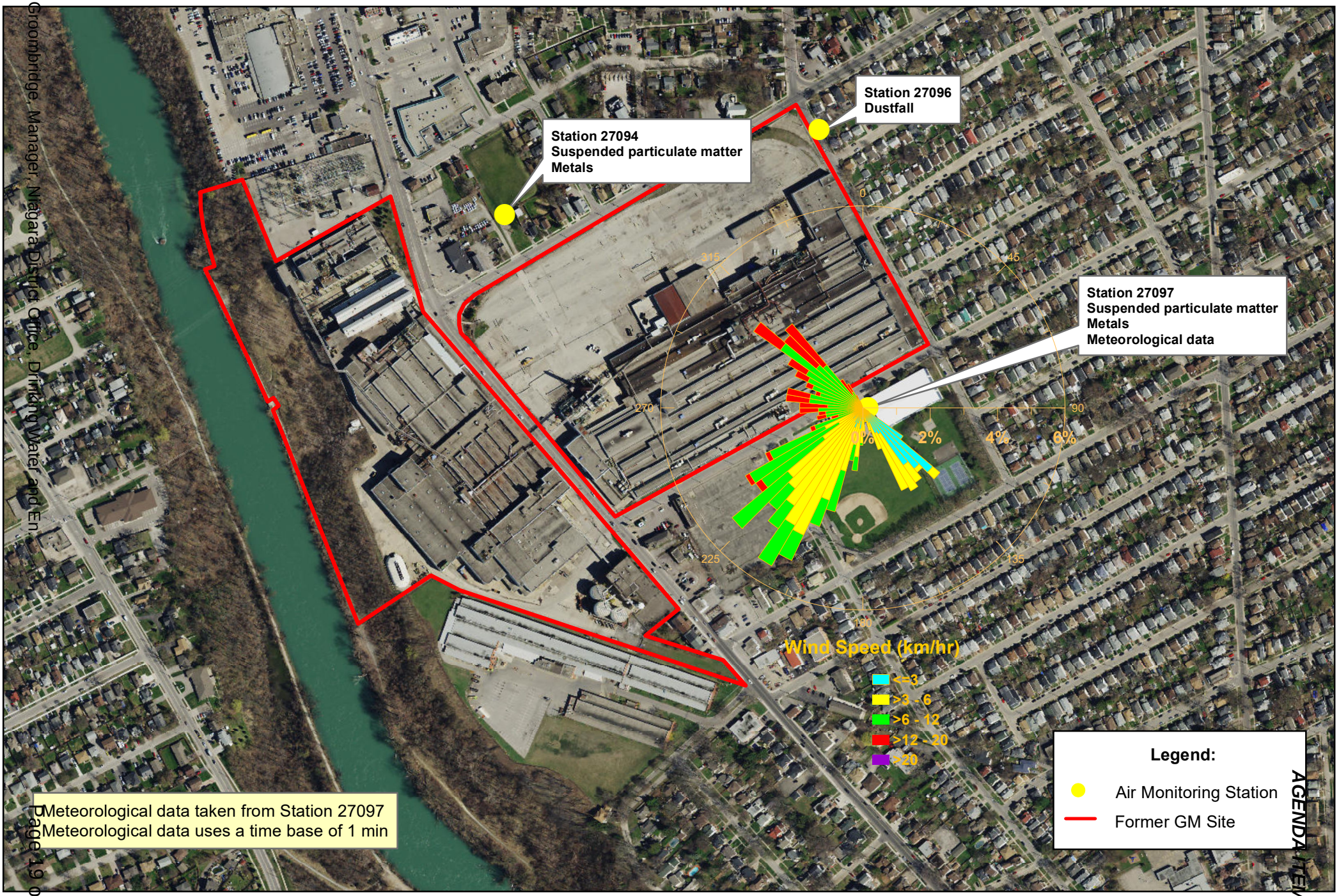

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False Northing: 0m
Central Meridian: -81
Scale Factor: 0.9996
Latitude of Origin: 0
1983 North American Datum

N W E S

0 0.02250.045 0.09 0.135 0.18 0.225
Kilometres

The maps shown here are for illustration purposes only and are not suitable for site-specific use or applications. Ministry of the Environment provides this information with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort has been made to use data believed to be accurate; a degree of error is inherent in all maps. Map products are intended for reference purposes only, and the Ministry of the Environment will accept no liability for consequential and indirect damages arising from the use of these maps. These maps are distributed 'as-is' without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose or use.

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Imagery Version - 2010

Published Month Year
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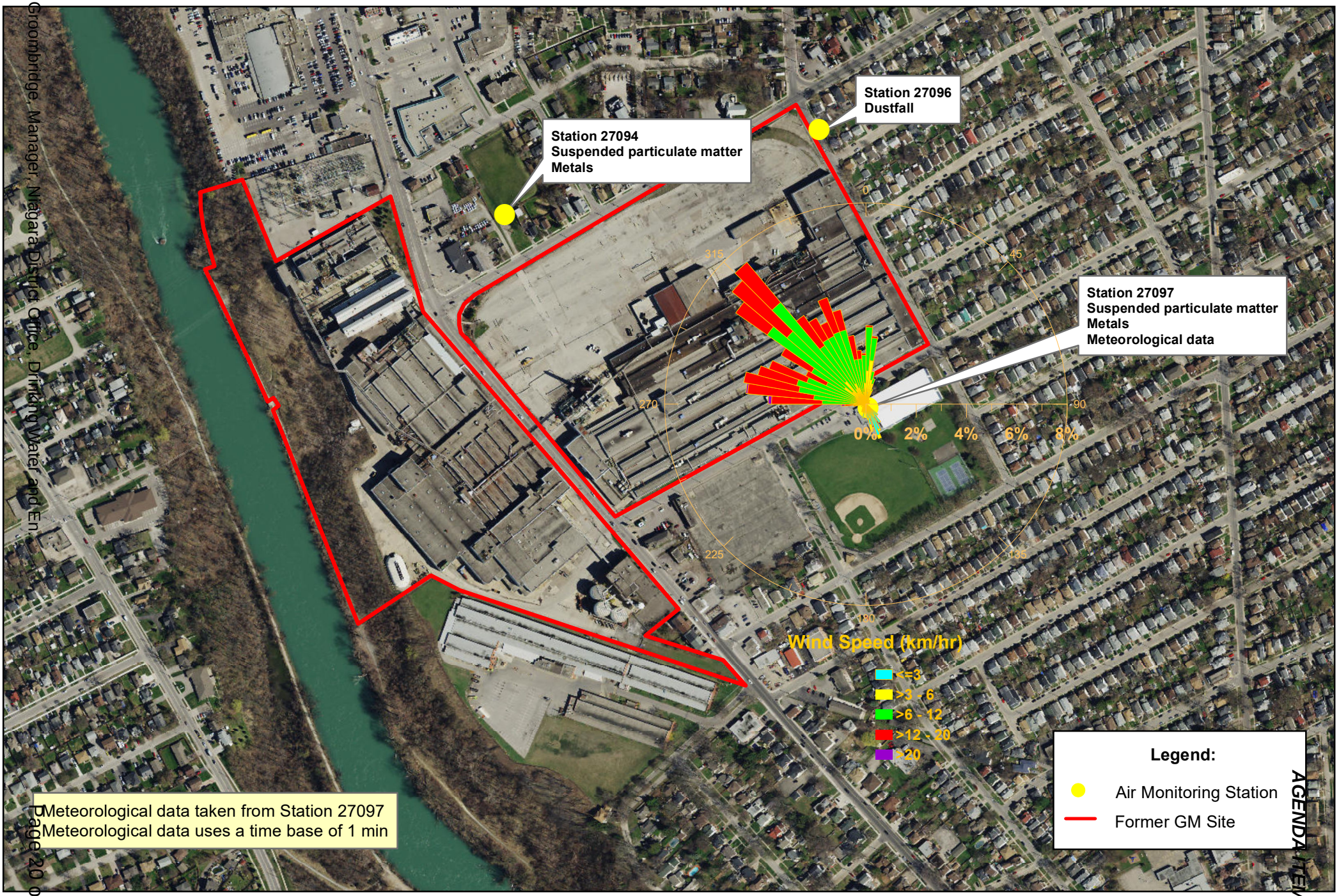
Ontario

Figure 10: Wind Rose – October 24, 2020 – 24 hr EST (00:00 to 24:00)

Ministry of the Environment Conservation and Parks



Projection:
Universal Transverse Mercator
Zone 17
False Easting: 500000m
False Northing: 0m
Central Meridian: -81
Scale Factor: 0.9996
Latitude of Origin: 0
1983 North American Datum

N W E S

0 0.02250.045 0.09 0.135 0.18 0.225
Kilometres

The maps shown here are for illustration purposes only and are not suitable for site-specific use or applications. Ministry of the Environment provides this information with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort has been made to use data believed to be accurate; a degree of error is inherent in all maps. Map products are intended for reference purposes only, and the Ministry of the Environment will accept no liability for consequential and indirect damages arising from the use of these maps. These maps are distributed 'as-is' without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose or use.

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Imagery Date: Summer - 2010

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Ontario

Figure 11: Wind Rose – Month of August, 2020

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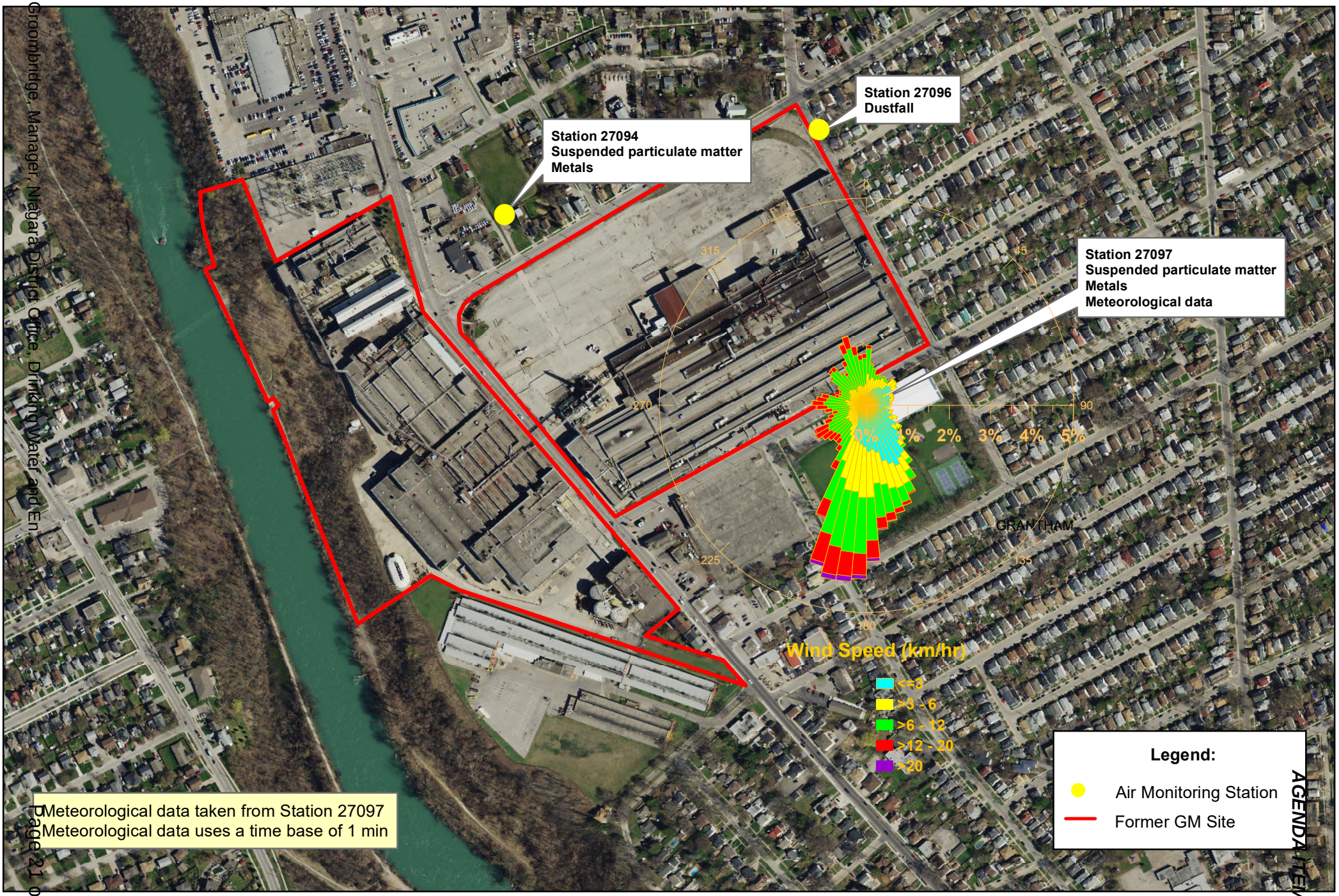

Projection:
Universal Transverse Mercator
Zone 17
False Easting: 500000m
False Northing: 0m
Central Meridian: -81
Scale Factor: 0.9996
Latitude of Origin: 0
1983 North American Datum

N W E S

0 0.02250.045 0.09 0.135 0.18 0.225
Kilometres

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Imagery Collection - 2010

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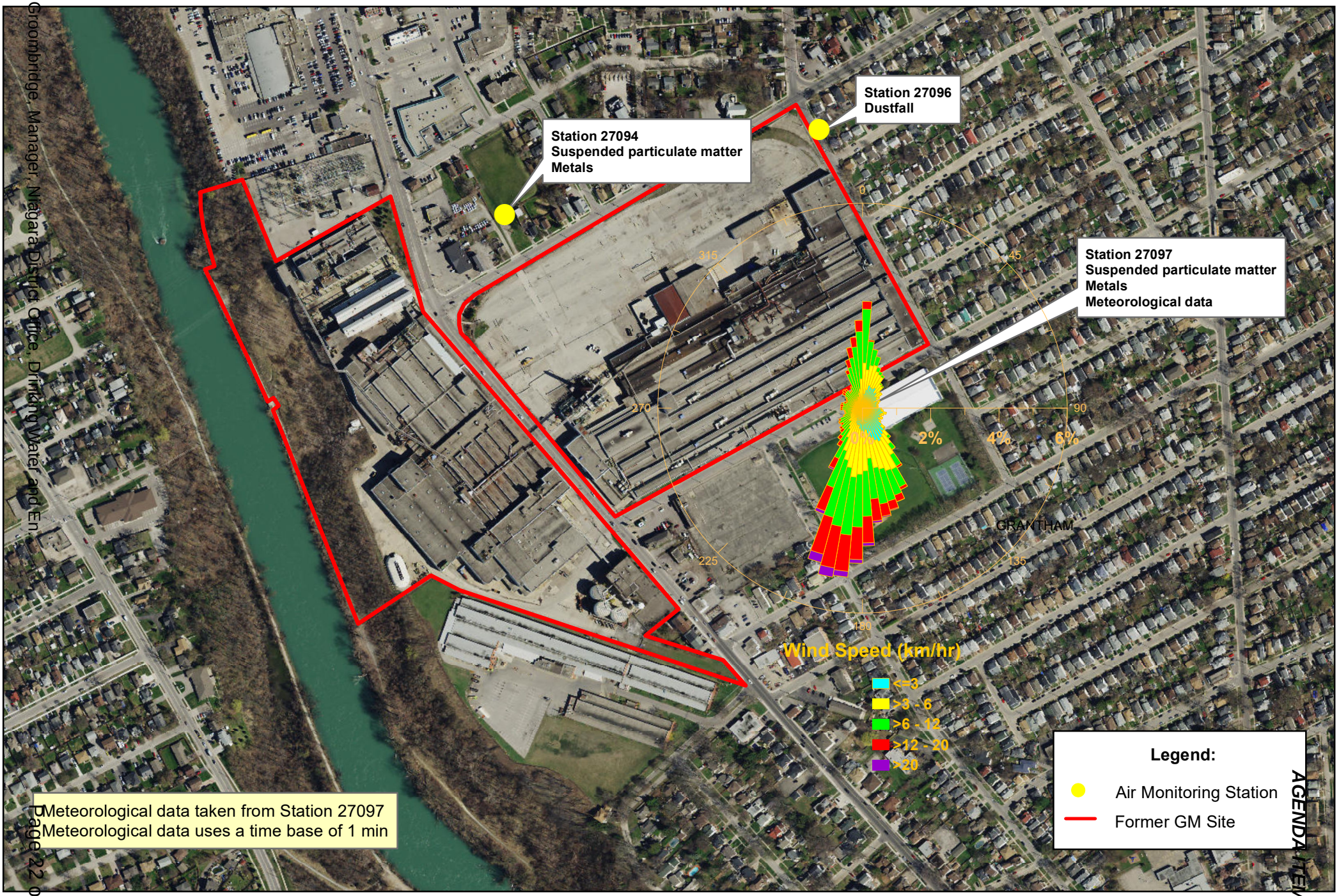
Figure 12: Wind Rose – Month of September, 2020

Ministry of the Environment Conservation and Parks



Projection:
Universal Transverse Mercator
Zone 17
False Easting: 500000m
False Northing: 0m
Central Meridian: -81
Scale Factor: 0.9996
Latitude of Origin: 0
1983 North American Datum

N W E S

0 0.02250.045 0.09 0.135 0.18 0.225
Kilometres

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Imagery Date: Version - 2010

Published Month Year
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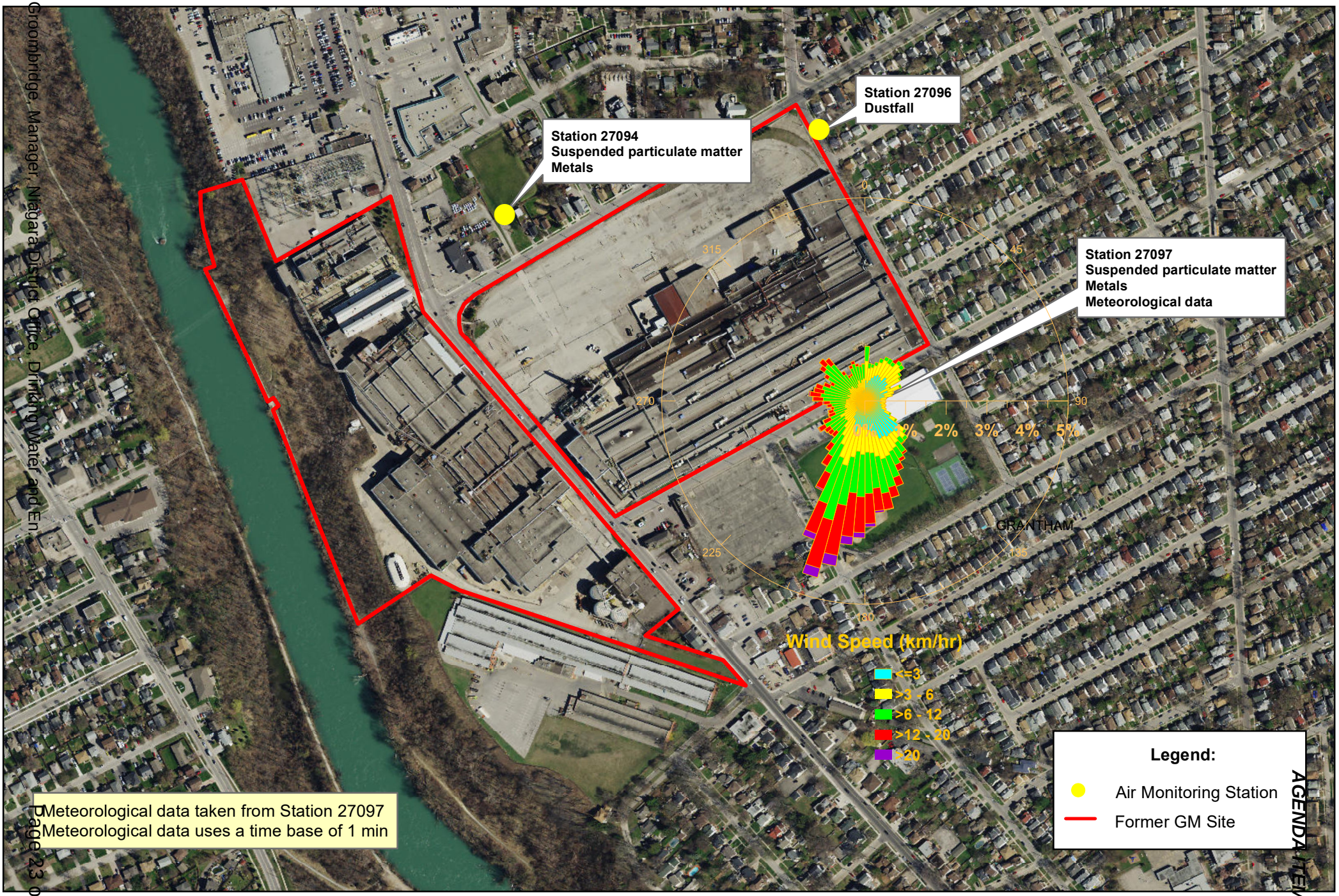
Ontario

Figure 13: Wind Rose – Month of October, 2020

Ministry of the Environment Conservation and Parks



Projection:
Universal Transverse Mercator
Zone 17
False Easting: 500000m
False Northing: 0m
Central Meridian: -81
Scale Factor: 0.9996
Latitude of Origin: 0
1983 North American Datum

N W E S

0 0.02250.045 0.09 0.135 0.18 0.225
Kilometres

The maps shown here are for illustration purposes only and are not suitable for site-specific use or applications. Ministry of the Environment provides this information with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort has been made to use data believed to be accurate; a degree of error is inherent in all maps. Map products are intended for reference purposes only, and the Ministry of the Environment will accept no liability for consequential and indirect damages arising from the use of these maps. These maps are distributed 'as-is' without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose or use.

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Imagery Date: Spring 2010

Published Month Year
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Appendix C: Microscope and SEM-EDXRA Results

Table 1 Microscope and SEM-EDXRA Results at Station 27097 and Station 27094 (part1)

	View Under Microscope		SEM-EDXRA	
	Station 27097	**Station 27094**	**Station 27097**	**Station 27094**
30-Jul-20	Colored and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found	Colored and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found Trace synthetic fibers were present	Out of 40 randomly selected particles scanned: 3 were calcite, 5 were dolomite, 2 were silica, 4 were biological materials and the rest particles were silicates	Out of 45 randomly selected particles scanned: 3 were calcite, 7 were dolomite, 3 were silica, 7 were biological materials and the rest particles were silicates
04-Aug-20	Colored and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter. A few biological materials were found Trace synthetic fibers were present	Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found Trace synthetic fibers were present Trace particles with reflective surface were found, likely metal fragments	Out of 40 randomly selected particles scanned: 3 were calcite, 5 were dolomite, 2 were silica, 3 were biological materials, 1 particle contained high titanium content and the rest particles were silicates	Out of 40 randomly selected particles scanned: 3 were calcite, 8 were dolomite, 4 were silica, 4 were biological materials, 1 was gypsum and the rest particles were silicates
08-Aug-20	Colored and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter. A few biological materials were found Trace synthetic fibers were present	Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found Trace particles with reflective surface were found, likely metal fragments	Out of 45 randomly selected particles scanned: 3 were calcite, 3 were dolomite, 2 were silica, 3 were biological materials, 1 was gypsum, 1 particle contained high titanium content and the rest particles were silicates	Out of 40 randomly selected particles scanned: 3 were calcite, 4 were dolomite, 3 were silica, 4 were biological materials, 1 particle contained high iron content, likely iron sulfate, and the rest particles were silicates
13-Aug-20	Colored and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter. A few biological materials were found	Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found Trace tire wires and fly ash were also found Trace particles with reflective surface were present, likely metal fragments	Out of 40 randomly selected particles scanned: 2 were calcite, 8 were dolomite, 3 were silica, 3 were biological materials, 1 particle contained relatively high titanium content and the rest particles were silicates	Out of 45 randomly selected particles scanned: 1 was calcite, 1 was dolomite, 3 were silica, 4 were biological materials, 1 was iron oxide and the rest particles were silicates

Table 1 Microscope and SEM-EDXRA Results at Station 27097 and Station 27094 (part2)

	View Under Microscope		SEM-EDXRA	
	Station 27097	**Station 27094**	**Station 27097**	**Station 27094**
18-Aug-20	Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found Trace synthetic fibers were present Trace particles with reflective surface were found, likely metal fragments.	Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter A few biological materials were found.	Out of 40 randomly selected particles scanned: 1 was calcite, 4 were dolomite, 2 were silica, 4 were biological materials, 1 was gypsum, 2 particles contained high copper content, likely copper debris, and the rest particles were silicates	Out of 40 randomly selected particles scanned: 8 was dolomite, 5 were silica, 8 were biological materials, 1 particle was likely clinker dust and the rest particles were silicates.
25-Aug-20	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found Trace synthetic fibers were also found	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found Trace tire wear particles were also found	Out of 45 randomly selected particles scanned: 2 were calcite, 3 were dolomite, 5 were silica, 3 were biological materials and the rest particles were silicates	Out of 45 randomly selected particles scanned: 4 were calcite, 6 were dolomite, 5 were silica, 8 were biological materials and the rest particles were silicates
29-Aug-20	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found Trace synthetic fibers were also found	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found Trace tire wear particles were also found Trace white paint sphere were also present	Out of 45 randomly selected particles scanned: 5 were calcite, 5 were dolomite, 6 were silica, 15 were biological materials and the rest particles were silicates	Out of 45 randomly selected particles scanned: 4 were calcite, 3 were dolomite, 2 were silica, 15 were biological materials and the rest particles were silicates
07-Oct-20	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Trace biological materials were found	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Trace biological materials were found	Out of 45 randomly selected particles scanned: 2 were calcite, 5 were dolomite, 3 contained iron oxide and the rest particles were likely silicates	Out of 45 randomly selected particles scanned: 2 were calcite, 5 were dolomite, 2 were silica, the rest particles were likely silicates
16-Oct-20	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Trace biological materials were found	Out of 45 randomly selected particles scanned: 5 were calcite, 14 were dolomite, 3 were silica, 2 biological materials, the rest particles were silicates	Out of 45 randomly selected particles scanned: 3 were calcite, 5 were dolomite, 1 was silica, 6 were biological materials, 1 was like iron oxide, the rest particles were silicates

Table 1 Microscope and SEM-EDXRA Results at Station 27097 and Station 27094 (part3)

	View Under Microscope		SEM-EDXRA	
	Station 27097	**Station 27094**	**Station 27097**	**Station 27094**
24-Oct-20	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found	Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter Some biological materials were found	Out of 45 randomly selected particles scanned: 2 were calcite, 3 were dolomite, 3 were silica, 3 were biological materials, 1 contained high content of titanium and iron, the rest particles were silicates	Out of 45 randomly selected particles scanned: 12 were calcite, 8 were dolomite, 5 were silica, 3 were biological materials, 1 was like iron oxide, the rest particles were silicates

Table 2 Microscope and SEM-EDXRA Results at Station 27096

	Station 27096	
	View Under Microscope	**SEM-EDXRA**
August	35% of colored and colorless minerals were present, mainly at the size of 50 to 100 microns in diameter 65% of biological materials were found Trace tire wear particles were also present No magnetic particles were found	The examples of EDX spectra showed the presence of the following elements : silica, dolomite, and silicates
September	Around 20% of colored and colorless minerals were present, mainly at the size of 20 to 100 microns in diameter Around 80% of biological materials were found Trace tire wear particles were also present No magnetic particles were found	The examples of EDX spectra showed the presence of the following elements: silica,calcium carbonate, dolomite, and silicates (feldspar)
October	Around 30% of colored and colorless minerals were present, mainly at the size of 20 to 100 microns in diameter Around 70% of biological materials were found No magnetic particles were found	The examples of EDX spectra showed the presence of the following elements: silica, dolomite, aluminosilicates, and biological materials

Appendix D: Asbestos Analysis Report

EMSL Canada Inc.
2756 Slough Street, Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com torontolab@emsl.com

EMSL Canada Inc. 552013952
CustomerID: 55MNSE42
CustomerPO:
ProjectID:

Attn: **Kim Groombridge**
Ministry of the Environment
301 St.Paul Street
9th Floor, Suite 15
St.Catherines, ON L2R 7R4

Phone: (289) 668-0119
Fax:
Received: 10/29/2020 09:01 AM
Analysis Date: 11/5/2020
Collected: 8/25/2020

Test Report:Qualitative Asbestos Analysis by Transmission Electron Microscopy (TEM) and Filtration Technique

Sample	Description	TEM Result	Notes
C266225-0002 *552013952-0001*	Hi-vol filter, sampling date 04 Aug 2020, Station 27097	**None Detected**	
C266225-0003 *552013952-0002*	Hi-vol filter, sampling date 08 Aug 2020, Station 27097	**None Detected**	
C266225-0005 *552013952-0003*	Hi-vol filter, sampling date 18 Aug 2020, Station 27097	**None Detected**	
C266480-0001 *552013952-0004*	Hi-vol filter, sampling date 25 Aug 2020, Station 27097	**None Detected**	
C266480-0002 *552013952-0005*	Hi-vol filter, sampling date 29 Aug 2020, Station 27097	**None Detected**	
C266226-0001 *552013952-0006*	Hi-vol filter, sampling date 30 July 2020, Station 27094	**None Detected**	
C266226-0002 *552013952-0007*	Hi-vol filter, sampling date 04 Aug 2020, Station 27094	**None Detected**	

Analyst(s)
Anne Balayboa (7)

Matthew Davis or other approved signatory
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. This is a presence/absence screen only

Samples analyzed by EMSL Canada Inc. Mississauga, ON

Report Amended: 12/02/2020 12:14:09 Replaces the Inital Report 11/05/2020 17:57:45. Reason Code: Client-Change to Project

Appendix E: MECP Lab Report

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT (manager.rdf)

Log#: **C266225** Print Date: Dec. 02, 2020 09:44 AM By REPORTADMIN **** FINAL **** **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

Mail this copy to :
ORSINI, MARK
MOE - HAMILTON REGIONAL OFFICE
119 KING STREET WEST, 12TH FLOOR
HAMILTON,ONT
L8P 4Y7

Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Sep. 17, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: 27097 GM SURVEY - HAIG BOWL ARENA - M. ORSINI 289-442-7659

The results relate only to items tested.
To provide customer service feedback on this report and/or other services provided by LaSB, please contact the LaSB HelpDesk at 416-235-6030 or the Customer Service Manager at 416-235-5831

This report contains confidential information intended only for the person(s) to whom it is addressed. Any unauthorized disclosure, copying, other distribution of this report, or taking any action on its content is strictly prohibited. If you have received this report in error, please contact the LaSB HelpDesk at 416-235-6030 or the Customer Service Manager at 416-235-5831

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT (manager.rdf)

Log#: **C266225** Print Date: Dec. 02, 2020 09:44 AM By REPORTADMIN **** FINAL **** **** REPRINTED ****

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27097	C266225-0001	27097 30/JUL/2020 4956 1631	30 JUL 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

UTM:

Zone	Easting	Northing	Collection Method	Map Datum	Accuracy (metres)
230	641239	4780939	GPS	NAD83	2-5M

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
2	27097	C266225-0002	27097 04/AUG/2020 4961 1631	04 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
3	27097	C266225-0003	27097 08/AUG/2020 4973 1631	08 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
4	27097	C266225-0004	27097 13/AUG/2020 4975 1631	13 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
5	27097	C266225-0005	27097 18/AUG/2020 4988 1631	18 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field ID:	1	2
Sample ID:	C266225-0001	C266225-0002
MOE*LIMS ID:	2020AG35-00006	2020AG35-00007
Station ID:	27097	27097
Collect Date:	30 JUL 2020	04 AUG 2020
Sample Location Description:	27097 30/JUL/2020 4956 1631	27097 04/AUG/2020 4961 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076	1 Copper	0.045	ug/m3			.002	17-SEP-2020	0.052	ug/m3			.002	17-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	17-SEP-2020	.005	ug/m3	<MDL		.005	17-SEP-2020
	Chromium	0.0029	ug/m3			.002	17-SEP-2020	.002	ug/m3	<MDL		.002	17-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	17-SEP-2020	.005	ug/m3	<MDL		.005	17-SEP-2020
	Iron	0.37	ug/m3			.005	17-SEP-2020	0.11	ug/m3			.005	17-SEP-2020
	Manganese	0.014	ug/m3			.003	17-SEP-2020	0.009	ug/m3			.003	17-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	17-SEP-2020	.002	ug/m3	<MDL		.002	17-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
3091	1 NT: Identification	See Non-Target Textual result				0	17-SEP-2020	See Non-Target Textual result				0	17-SEP-2020
3285	1 Particulate; total suspended	19.0	ug/m3			1.3	14-SEP-2020	8.00	ug/m3			1.3	14-SEP-2020

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Field ID:	3	4
Sample ID:	C266225-0003	C266225-0004
MOE*LIMS ID:	2020AG35-00008	2020AG35-00009
Station ID:	27097	27097
Collect Date:	08 AUG 2020	13 AUG 2020
Sample Location Description:	27097 08/AUG/2020 4973 1631	27097 13/AUG/2020 4975 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076	1 Copper	0.052	ug/m3			.002	17-SEP-2020	0.051	ug/m3			.002	17-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	17-SEP-2020	.005	ug/m3	<MDL		.005	17-SEP-2020
	Chromium	.002	ug/m3	<MDL		.002	17-SEP-2020	0.0031	ug/m3			.002	17-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	17-SEP-2020	0.0065	ug/m3			.005	17-SEP-2020
	Iron	0.31	ug/m3			.005	17-SEP-2020	0.69	ug/m3			.005	17-SEP-2020
	Manganese	0.010	ug/m3			.003	17-SEP-2020	0.027	ug/m3			.003	17-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	17-SEP-2020	.002	ug/m3	<MDL		.002	17-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
3091	1 NT: Identification	See Non-Target Textual result				0	17-SEP-2020	See Non-Target Textual result				0	17-SEP-2020
3285	1 Particulate; total suspended	21.0	ug/m3			1.3	14-SEP-2020	40.0	ug/m3			1.3	14-SEP-2020

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Field ID:	5
Sample ID:	C266225-0005
MOE*LIMS ID:	2020AG35-00010
Station ID:	27097
Collect Date:	18 AUG 2020
Sample Location Description:	27097 18/AUG/2020 4988 1631
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076211	Copper	0.038	ug/m3			.002	17-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	17-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	17-SEP-2020
	Chromium	.002	ug/m3	<MDL		.002	17-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	17-SEP-2020
	Iron	0.30	ug/m3			.005	17-SEP-2020
	Manganese	0.015	ug/m3			.003	17-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	17-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	17-SEP-2020
3092211	NT: Identification	See Non-Target Textual result				0	17-SEP-2020
3285211	Particulate; total suspended	16.0	ug/m3			1.3	14-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C266225-0001	3092L1	NT: Identification	0	none		
C266225-0002	3092L1	NT: Identification	0	none		
C266225-0003	3092L1	NT: Identification	0	none		
C266225-0004	3092L1	NT: Identification	0	none		
C266225-0005	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266225-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C266225
Station ID: 27095
AUTHORED BY: Grace Bu
Date: September 17, 2020

These samples were received from the West Central Region. Samples were collected from the Haig Bowl Arena, 17 beach str. St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA).
Micro-physical tests were also performed.

Lab Sample No: C266225-0001
Filter number: 4956
Sample Date: July 30, 2020

The sample was comprised of a light grey color glass filter in an envelope.

Kim Groombridge, Manager, Niagara District Office Drinking Water and En...

NON TARGET TEXTUAL RESULT

Sample ID: C266225-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter
- A few biological materials were found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 3 were calcite, 5 were dolomite, 2 were silica, 4 were biological materials and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (36%), O (45%), Si (18%)
Minor (Atomic %): Na, Al (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (16%), C (31%), O (48%)
Minor (Weight %): Na, Mg, Al, Si, Fe (<2%)
Mainly contained calcite.

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (22%), O (59%), Ca (9%), Mg (10%)
Minor (Atomic %): Si (<1%)
Mainly contained dolomite
Another spectrum showed the presence of the following elements:
Major (Weight%): C (50%), O (29%), Al (4%), Si (10%) and K (5%)
Minor (Weight %): Na, Fe (<1%)
Mainly contained silicates.

Sample ID: C266225-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266225-0002
Filter number: 4961
Sample Date: August 04, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace synthetic fibers were present.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 3 were calcite, 5 were dolomite, 2 were silica, 3 were biological materials, 1 particle contained high titanium content and the rest particles were silicates.

The examples of EDX spectra were as below:

Kim Coombridge Manager, Niagara District Office Drinking Water Program...

NON TARGET TEXTUAL RESULT

Sample ID: C266225-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

One spectrum showed the presence of the following elements:
Major (Atomic%): C (27%), O (61%), Ca (11%)
Minor (Atomic %): Na, Si (<1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (38%), Si (13%), O (47%)
Minor (Atomic %): Na, Mg, Al, K, Ca (<2%)
Mainly contained silica.

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (23%), O (58%), Ca (9%), and Mg (10%)
Contained dolomite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (33%), O (52%), and Ti (8%)
Minor (Atomic %): Si (3%), Na, Al (<2%) and Mg, K, Fe (<1%)
High titanium content particle

Sample ID: C266225-0003	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266225-0003
Filter number: 4973
Sample Date: August 08, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace synthetic fibers were present.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 3 were calcite, 3 were dolomite, 2 were silica, 3 were biological materials, 1 was gypsum, 1 particle contained high titanium content and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (27%), O (55%), Ca (17%)
Minor (Atomic %): Na (<1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (12%), Si (31%), O (57%)
Contained silica.

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266225-0003	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight%): C (33%), O (35%), Al (5%), Si(16%) and Fe(6%)
Minor (Weight %): Na, Mg, Ca (<1%) and K (3%)
Mainly contained silicates.

Another spectrum showed the presence of the following elements:
Major (Weight%): C (25%), O (46%), S (10%), Na (5%) and Ca (13%)
Minor (Weight %): Si (2%)
Mainly contained gypsum

Another spectrum showed the presence of the following elements:
Major (Weight %): C (53%), O (15%), Ti (18%), and Fe (12%)
Minor (Weight %): Na, Al, Si (<1%)
High titanium content particle.

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (20%), O (59%), Ca (11%), and Mg(10%)
Contained dolomite

Sample ID: C266225-0004	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266225-0004
Filter number: 4975
Sample Date: August 13, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 2 were calcite, 8 were dolomite, 3 were silica, 3 were biological materials, 1 particle contained relatively high titanium content and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight %): C (21%), O (53%), Ca (21%)
Minor (Weight %): Mg (2%) and Na, Al, Si (<2%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (22%), Si (28%), O (51%)
Mainly contained silica.

Kim Groombridge, Manager, Niagara District Office, Drinking Water and Ep...
Page 40 of 181
AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266225-0004	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight%): C (26%), O (42%), Al (8%), and Si (16%)
Minor (Weight %): Na (4%), Ca (3%) and K, Fe (<1%)
Mainly contained silicates

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (24%), O (60%), Ca (7%), and Mg (8%)
Minor (Atomic %): Na and Si (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight %): C (36%), O (41%), Ti (5%), Ca (5%) and Si (6%)
Minor (Weight %): Na, Mg, S, K, Fe (<3%)
Relatively high titanium content particle

Sample ID: C266225-0005	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266225-0005
Filter number:4988
Sample Date: August 18, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace synthetic fibers were present.
- Trace particles with reflective surface were found, likely metal fragments.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 1 was calcite, 4 were dolomite, 2 were silica, 4 were biological materials, 1 was gypsum, 2 particles contained high copper content, likely copper debris, and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic %): C (49%), O (41%), Si (10%)
Minor (Atomic %): Br (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (22%), Mg (8%), O (56%) and Ca (10%)
Minor (Atomic %): Na (2%) and Si (<1%)
Mainly contained dolomite.

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (45%), O (35%), Al (4%), K (4%) and Si (11%)

Kim Coombridge, Manager, Niagara District Office, Drinking Water and Em...
Page 41 of 181
AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266225-0005	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Mainly contained silicates

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (22%), O (56%), S (9%), and Ca (10%)
Minor (Atomic %): Na (2%)
Mainly contained gypsum

Another spectrum showed the presence of the following elements:
Major (Weight %): C (21%), O (10%) and Cu (63%)
Minor (Weight %): Na (4%), S (1%) and Si (<1%)
High copper content particle.

Summary/Conclusion:

C266225-0001, 0002, 0003, 0004 and 0005 mainly contained normal road dusts. Trace amounts of particles with high metal contents were found in sample C266225-0002, 0003, 0004 and 0005.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C266225-0001	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266225-0001	AG	E3092A	ID3092	2224	17-SEP-20
C266225-0001	AG	E3288A	TSP3288	2213	15-SEP-20
C266225-0002	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266225-0002	AG	E3092A	ID3092	2224	17-SEP-20
C266225-0002	AG	E3288A	TSP3288	2213	15-SEP-20
C266225-0003	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266225-0003	AG	E3092A	ID3092	2224	17-SEP-20
C266225-0003	AG	E3288A	TSP3288	2213	15-SEP-20
C266225-0004	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266225-0004	AG	E3092A	ID3092	2224	17-SEP-20
C266225-0004	AG	E3288A	TSP3288	2213	15-SEP-20
C266225-0005	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266225-0005	AG	E3092A	ID3092	2224	17-SEP-20
C266225-0005	AG	E3288A	TSP3288	2213	15-SEP-20

Kim Coombridge - Manager, Niagara District Office, Drinking Water and En...
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AGENDA ITEM #3.1

LaSB Method Summary

Method	Method Description	Status	Status Description
E3079A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3082A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3289A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT (manager.rdf)

Log#: **C266480** Print Date: Dec. 02, 2020 09:45 AM By REPORTADMIN **** FINAL **** **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

Mail this copy to :
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HAMILTON,ONT
L8P 4Y7

Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Sep. 28, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: 27097 GM SURVEY - HAIG BOWL AREANA

The results relate only to items tested.
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Log#: **C266480** Print Date: Dec. 02, 2020 09:45 AM By REPORTADMIN **** FINAL **** **** REPRINTED ****

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27097	C266480-0001	27097 25/AUG/2020 5000 1631	25 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

UTM:

Zone	Easting	Northing	Collection Method	Map Datum	Accuracy (metres)
230	641239	4780939	GPS	NAD83	2-5M

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
2	27097	C266480-0002	27097 29/AUG/2020 5010 1631	29 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Field ID:	1	2
Sample ID:	C266480-0001	C266480-0002
MOE*LIMS ID:	2020AG38-00001	2020AG38-00002
Station ID:	27097	27097
Collect Date:	25 AUG 2020	29 AUG 2020
Sample Location Description:	27097 25/AUG/2020 5000 1631	27097 29/AUG/2020 5010 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076	1 Copper	0.042	ug/m3			.002	24-SEP-2020	0.037	ug/m3			.002	24-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	24-SEP-2020	.001	ug/m3	<MDL		.001	24-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	24-SEP-2020	.005	ug/m3	<MDL		.005	24-SEP-2020
	Chromium	.002	ug/m3	<MDL		.002	24-SEP-2020	.002	ug/m3	<MDL		.002	24-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	24-SEP-2020	.005	ug/m3	<MDL		.005	24-SEP-2020
	Iron	0.41	ug/m3			.005	24-SEP-2020	0.14	ug/m3			.005	24-SEP-2020
	Manganese	0.013	ug/m3			.003	24-SEP-2020	.003	ug/m3	<MDL		.003	24-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	24-SEP-2020	0.018	ug/m3			.002	24-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	24-SEP-2020	0.35	ug/m3			.001	24-SEP-2020
3091	1 NT: Identification	See Non-Target Textual result				0	23-SEP-2020	See Non-Target Textual result				0	23-SEP-2020
3285	1 Particulate; total suspended	27.0	ug/m3			1.3	22-SEP-2020	12.0	ug/m3			1.3	22-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

AGENDA ITEM #3.1

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON-TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C266480-0001	3092L1	NT: Identification	0	none		
C266480-0002	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266480-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C266480
Station ID: 27095
AUTHORED BY: Grace Bu
Date: September 23, 2020

These samples were received from the West Central Region. Samples were collected from the Haig Bowl Arena, 17 beech str. St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Microphysical tests were also performed.

Lab Sample No: C266480-0001
Filter number: 5000
Sample Date: August 25, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Some biological materials were found.
- Trace synthetic fibers were also found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 2 were calcite, 3 were dolomite, 5 were silica, 3 were biological materials and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (22%), O (52%), Si (25%)
Minor (Atomic %): Na, Al (<1%)
Mainly contained silica

Kim Groombridge, Manager, Niagara District Office, Drinking Water and Sourc...
Page 47 of 181
AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266480-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (22%), C (26%), O (51%)
Minor (Weight %): Si (<1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Weight %): C (27%), O (48%), Ca (13%), Mg (8%)
Minor (Weight %): Na, Si, Al (<2%)
Mainly contained dolomite
Another spectrum showed the presence of the following elements:
Major (Weight%): C (29%), O (44%), Al (5%), Si (15%) and K (6%)
Minor (Weight %): Na (<2%)
Mainly contained silicates

Sample ID: C266480-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266480-0002
Filter Number: 5010
Sample Date: August 29, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size from 10 to 50 microns in diameter.
- Some biological materials were found.
- Trace synthetic fibers were also found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 5 were calcite, 5 were dolomite, 6 were silica, 15 were biological materials and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight %): C (31%), O (47%), Si (18%)
Minor (Weight %): Na (3%) and Al, Ca (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (25%), C (20%), O (50%)
Minor (Weight %): Na (4%) and Cu (<1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (23%), O (57%), Ca (9%), Mg (10%)
Mainly contained dolomite

Kim Groombridge, Manager, Niagara District Office, Drinking Water and Environmental Compliance
Page 48 of 181
AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266480-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight%): C (34%), O (38%), Na (5%), Al (6%), Si (17%)
Minor (Weight %): Ca (<1%)
Mainly contained silicates

Summary/Conclusion:

C266480-0001 and 0002 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C266480-0001	AG	E3070A	HIVOL3070	2225	24-SEP-20
C266480-0001	AG	E3092A	ID3092	2224	23-SEP-20
C266480-0001	AG	E3288A	TSP3288	2213	22-SEP-20
C266480-0002	AG	E3070A	HIVOL3070	2225	24-SEP-20
C266480-0002	AG	E3092A	ID3092	2224	23-SEP-20
C266480-0002	AG	E3288A	TSP3288	2213	22-SEP-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3288A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C267059** Print Date: Oct. 28, 2020 09:05 AM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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119 KING STREET WEST, 12TH FLOOR
HAMILTON,ONT
L8P 4Y7

Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Oct. 28, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: GM SURVEY HAIG BOWL ARENA 17 BEECH ST ST. CATHARINES 27097

The results relate only to items tested.
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Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6

FINAL REPORT(manager4)

Log#: **C267059** Print Date: Oct. 28, 2020 09:05 AM By REPORTADMIN **** REPRINTED ****

Field ID	Station ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27097	27097 07/OCT/2020 4984 1631	07 OCT 2020		5	

Sample ID
C267059-0001

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C267059** Print Date: Oct. 28, 2020 09:05 AM By REPORTADMIN **** REPRINTED ****

Field ID:	1
Sample ID:	C267059-0001
MOE*LIMS ID:	2020AG42-00025
Station ID:	27097
Collect Date:	07 OCT 2020
Sample Location Description:	27097 07/OCT/2020 4984 1631
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3076	1 Copper	0.03	ug/m3				.002	21-OCT-2020
	Nickel	.001	ug/m3	<MDL			.001	21-OCT-2020
	Cadmium	.005	ug/m3	<MDL			.005	21-OCT-2020
	Chromium	0.0022	ug/m3				.002	21-OCT-2020
	Lead	.005	ug/m3	<MDL			.005	21-OCT-2020
	Iron	0.21	ug/m3				.005	21-OCT-2020
	Manganese	0.008	ug/m3				.003	21-OCT-2020
	Vanadium	.002	ug/m3	<MDL			.002	21-OCT-2020
	Zinc	.001	ug/m3	<MDL			.001	21-OCT-2020
3091	1 NT: Identification	See Non-Target Textual result					0	22-OCT-2020
3285	1 Particulate; total suspended	12.0	ug/m3				1.3	20-OCT-2020

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON-TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C267059-0001	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C267059-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C267059
Station ID: 27097
AUTHORED BY: Grace Bu
Date: October 19, 2020

These samples were received from the West Central Region. Samples were collected from the Haig Bowl Arena, 17 beech str. St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Microphysical tests were also performed.

Lab Sample No: C267059-0001
Filter number: 4984
Sample Date: October 07, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Trace biological materials were found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 2 were calcite, 5 were dolomite, 3 contained iron oxide and the rest particles were likely silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (42%), O (32%), Fe (19%)
Minor (Atomic %): Na, Mg, Al, Si, S, Ca, Mn, Cu, Zn, Sn (<1%)
Likely contained Iron oxide

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (18%), C (43%), O (36%)
Minor (Weight %): Na, Mg, Al, Si, S, Fe (<1%)
Contained calcite

Kim Groombridge, Manager, Niagara District Office/Drinking Water Inten...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C267059-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (27%), O (56%), Ca (8%), Mg (8%)
Minor (Atomic %): Na, Si (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): C (39%), O (46%), Al (5%), Si (7%)
Minor (Weight %): Mg, K, Ca, Fe (<1%), Na (<2%)
Contained silicates

Summary/Conclusion:

C267059-0001 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C267059-0001	AG	E3070A	HIVOL3070	2225	22-OCT-20
C267059-0001	AG	E3092A	ID3092	2224	22-OCT-20
C267059-0001	AG	E3288A	TSP3288	2213	21-OCT-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3288A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Coombridge, Manager, Niagara District Office, Drinking Water and Environmental Compliance
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AGENDA ITEM #3.1

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C267293** Print Date: Nov. 04, 2020 07:51 AM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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MOE - HAMILTON REGIONAL OFFICE
119 KING STREET WEST, 12TH FLOOR
HAMILTON,ONT
L8P 4Y7

Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Nov. 04, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: GM SURVEY HAIG BOWL ARENA 17 BEECH ST. ST. CATHARINES

The results relate only to items tested.
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Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6

FINAL REPORT(manager4)

Log#: **C267293** Print Date: Nov. 04, 2020 07:51 AM By REPORTADMIN **** REPRINTED ****

Field Id	Station ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27097	27097 16/OCT/2020 4987 1631	16 OCT 2020		5	

Sample ID: C267293-0001

Sample Comment Description:

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
2	27097	27097 24/OCT/2020 5072 1631	24 OCT 2020		5	

Sample ID: C267293-0002

Sample Comment Description:

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field ID:	1	2
Sample ID:	C267293-0001	C267293-0002
MOE*LIMS ID:	2020AG44-00003	2020AG44-00004
Station ID:	27097	27097
Collect Date:	16 OCT 2020	24 OCT 2020
Sample Location Description:	27097 16/OCT/2020 4987 1631	27097 24/OCT/2020 5072 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3076	1 Copper	0.048	ug/m3				.002	02-NOV-2020	0.029	ug/m3				.002	02-NOV-2020
	Nickel	.001	ug/m3	<MDL			.001	02-NOV-2020	.001	ug/m3	<MDL			.001	02-NOV-2020
	Cadmium	.005	ug/m3	<MDL			.005	02-NOV-2020	.005	ug/m3	<MDL			.005	02-NOV-2020
	Chromium	.002	ug/m3	<MDL			.002	02-NOV-2020	.002	ug/m3	<MDL			.002	02-NOV-2020
	Lead	.005	ug/m3	<MDL			.005	02-NOV-2020	.005	ug/m3	<MDL			.005	02-NOV-2020
	Iron	0.26	ug/m3				.005	02-NOV-2020	0.098	ug/m3				.005	02-NOV-2020
	Manganese	0.013	ug/m3				.003	02-NOV-2020	.003	ug/m3	<MDL			.003	02-NOV-2020
	Vanadium	.002	ug/m3	<MDL			.002	02-NOV-2020	0.02	ug/m3				.002	02-NOV-2020
	Zinc	.001	ug/m3	<MDL			.001	02-NOV-2020	0.37	ug/m3				.001	02-NOV-2020
3091	1 NT: Identification	See Non-Target Textual result					0	02-NOV-2020	See Non-Target Textual result					0	02-NOV-2020
3285	1 Particulate; total suspended	17.0	ug/m3				1.3	30-OCT-2020	5.00	ug/m3				1.3	30-OCT-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C267293-0001	3092L1	NT: Identification	0	none		
C267293-0002	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C267293-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C267293
Station ID: 27097
AUTHORED BY: Grace Bu
Date: October 30, 2020

These samples were received from the West Central Region. Samples were collected from 17 Beech St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Microphysical tests were also performed.

Lab Sample No: C267293-0001
Filter number: 4987
Sample Date: October 16, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Some biological materials were found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 5 were calcite, 14 were dolomite, 3 were silica, 2 biological materials, the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight%): C (30%), O (48%), Si (18%)
Minor (Weight%): Na (3%), Al (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:

Kim Coombridge, Manager, Niagara District Office Drinking Water and Sh...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C267293-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Major (Weight%): Ca (25%), C (19%), O (56%)
Minor (Weight %): Si (<1%)
Likely contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (24%), O (56%), Ca (11%), Mg (9%)
Minor (Atomic%): Si (<1%)
Contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): C (27%), O (46%), Al (5%), Si (15%) and K (5%)
Minor (Weight %): Na, Ca (<1%)
Likely contained feldspar silicates

Another spectrum showed the presence of the following elements:
Major (Weight%): C (70%), O (28%)
Minor (Weight %): Na (<1%)
Likely contained biological materials

Sample ID: C267293-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab sample No: C267293-0002
Filter number: 5072
Sample Date: October 24, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Some biological materials were found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 2 were calcite, 3 were dolomite, 3 were silica, 3 were biological materials, 1 contained high content of titanium and iron, the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (21%), O (45%), Si (33%)
Minor (Atomic %): Na (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (17%), C (27%), O (50%)
Minor (Weight %): Na, Mg, Al, S, Fe (<2%), Si (2%)
Likely contained calcite

Kim Coombridge Manager, Niagara District Office, Drinking Water and En...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C267293-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight %): C (29%), O (49%), Ca (12%), Mg (7%)
Minor (Weight %): Na, Al, Si, S, K, Fe (<1%)
Contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): C (24%), O (44%), Al (7%), Si (17%), Na (5%)
Minor (Weight %): Ca (<2%)
Likely contained silicates
Another spectrum showed the presence of the following elements:
Major (Weight%): C (27%), O (36%), Ti (12%), Si (7%), Fe (12%)
Minor (Weight %): Mg, Al, Ca, Mn (<2%)
Likely contained silicates

Summary/Conclusion:

C267293-0001 and C267293-0002 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C267293-0001	AG	E3070A	HIVOL3070	2225	02-NOV-20
C267293-0001	AG	E3092A	ID3092	2224	02-NOV-20
C267293-0001	AG	E3288A	TSP3288	2213	30-OCT-20
C267293-0002	AG	E3070A	HIVOL3070	2225	02-NOV-20
C267293-0002	AG	E3092A	ID3092	2224	02-NOV-20
C267293-0002	AG	E3288A	TSP3288	2213	30-OCT-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3288A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

Kim Groombridge Manager, Niagara District Office Drinking Water and En...
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AGENDA ITEM #3.1

*** End of Report ***

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT (manager.rdf)

Log#: **C266226** Print Date: Sep. 18, 2020 02:20 PM By REPORTADMIN **** FINAL **** **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Sep. 17, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: 27094 GM SURVEY - REGION OF NIAGARA CARLTON ST RESERVOIR - M. ORSINI 289-442-7659

The results relate only to items tested.
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Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27094	C266226-0001	27094 30/JUL/2020 4957 1631	30 JUL 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

UTM:

Zone	Easting	Northing	Collection Method	Map Datum	Accuracy (metres)
230	641239	4780939	GPS	NAD83	2-5M

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
2	27094	C266226-0002	27094 04/AUG/2020 4960 1631	04 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
3	27094	C266226-0003	27094 08/AUG/2020 4972 1631	08 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
4	27094	C266226-0004	27094 13/AUG/2020 4974 1631	13 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
5	27094	C266226-0005	27094 18/AUG/2020 4989 1631	18 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...
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AGENDA ITEM #3.1

Field ID:		1						2					
Sample ID:		C266226-0001						C266226-0002					
MOE*LIMS ID:		2020AG35-00011						2020AG35-00012					
Station ID:		27094						27094					
Collect Date:		30 JUL 2020						04 AUG 2020					
Sample Location Description:		27094 30/JUL/2020 4957 1631						27094 04/AUG/2020 4960 1631					
Sample Comments Description:													
Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076	1 Copper	0.081	ug/m3			.002	17-SEP-2020	0.054	ug/m3			.002	17-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	17-SEP-2020	.005	ug/m3	<MDL		.005	17-SEP-2020
	Chromium	0.0020	ug/m3			.002	17-SEP-2020	.002	ug/m3	<MDL		.002	17-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	17-SEP-2020	.005	ug/m3	<MDL		.005	17-SEP-2020
	Iron	0.36	ug/m3			.005	17-SEP-2020	0.10	ug/m3			.005	17-SEP-2020
	Manganese	0.013	ug/m3			.003	17-SEP-2020	0.005	ug/m3			.003	17-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	17-SEP-2020	.002	ug/m3	<MDL		.002	17-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
3091	1 NT: Identification	See Non-Target Textual result				0	17-SEP-2020	See Non-Target Textual result				0	17-SEP-2020
3285	1 Particulate; total suspended	19.0	ug/m3			1.3	14-SEP-2020	6.00	ug/m3			1.3	14-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

AGENDA ITEM #3.1

Field ID:	3	4
Sample ID:	C266226-0003	C266226-0004
MOE*LIMS ID:	2020AG35-00013	2020AG35-00014
Station ID:	27094	27094
Collect Date:	08 AUG 2020	13 AUG 2020
Sample Location Description:	27094 08/AUG/2020 4972 1631	27094 13/AUG/2020 4974 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076	1 Copper	0.055	ug/m3			.002	17-SEP-2020	0.34	ug/m3			.002	17-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	17-SEP-2020	.005	ug/m3	<MDL		.005	17-SEP-2020
	Chromium	.002	ug/m3	<MDL		.002	17-SEP-2020	0.0054	ug/m3			.002	17-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	17-SEP-2020	0.0053	ug/m3			.005	17-SEP-2020
	Iron	0.24	ug/m3			.005	17-SEP-2020	0.95	ug/m3			.005	17-SEP-2020
	Manganese	0.010	ug/m3			.003	17-SEP-2020	0.032	ug/m3			.003	17-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	17-SEP-2020	0.0030	ug/m3			.002	17-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	17-SEP-2020	.001	ug/m3	<MDL		.001	17-SEP-2020
3091	1 NT: Identification	See Non-Target Textual result				0	17-SEP-2020	See Non-Target Textual result				0	17-SEP-2020
3285	1 Particulate; total suspended	14.0	ug/m3			1.3	14-SEP-2020	60.0	ug/m3			1.3	14-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Field ID:	5
Sample ID:	C266226-0005
MOE*LIMS ID:	2020AG35-00015
Station ID:	27094
Collect Date:	18 AUG 2020
Sample Location Description:	27094 18/AUG/2020 4989 1631
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	MDL	Analysis Date
3076211	Copper	0.069	ug/m3			.002	17-SEP-2020
	Nickel	.001	ug/m3	<MDL		.001	17-SEP-2020
	Cadmium	.005	ug/m3	<MDL		.005	17-SEP-2020
	Chromium	.002	ug/m3	<MDL		.002	17-SEP-2020
	Lead	.005	ug/m3	<MDL		.005	17-SEP-2020
	Iron	0.22	ug/m3			.005	17-SEP-2020
	Manganese	0.009	ug/m3			.003	17-SEP-2020
	Vanadium	.002	ug/m3	<MDL		.002	17-SEP-2020
	Zinc	.001	ug/m3	<MDL		.001	17-SEP-2020
3092211	NT: Identification	See Non-Target Textual result				0	17-SEP-2020
3285211	Particulate; total suspended	13.0	ug/m3			1.3	14-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C266226-0001	3092L1	NT: Identification	0	none		
C266226-0002	3092L1	NT: Identification	0	none		
C266226-0003	3092L1	NT: Identification	0	none		
C266226-0004	3092L1	NT: Identification	0	none		
C266226-0005	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266226-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C266226
Station ID: 27094
AUTHORED BY: Grace Bu
Date: September 17, 2020

These samples were received from the West Central Region. The samples were collected from the Region of Niagara Carlton Str. Reservoir, 15 Carlton Str. St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA).
Micro-physical tests were also performed.

Lab Sample No: C266226-0001
Filter number: 4957
Sample Date: July 30, 2020

The sample was comprised of a light grey color glass filter in an envelope.

Kim Groombridge, Manager, Niagara District Office Drinking Water and En...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266226-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace synthetic fibers were present.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 3 were calcite, 7 were dolomite, 3 were silica, 7 were biological materials and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (21%), O (60%), Mg (10%) and Ca (9%)
Minor (Atomic %): Si (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (21%), C (24%) and O (53%)
Minor (Weight %): Na, Cu, Si (<2%)
Mainly contained calcite.

Another spectrum showed the presence of the following elements:
Major (Weight %): C (13%), O (54%), and Si (28%)
Minor (Weight %): Ca (3%) and Na, Mg, Al (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Weight%): C (23%), O (46%), Al (7%) and Si (14%)
Minor (Weight %): Na (3%), Fe (3%) and Mg, K, Ca (<2%)
Mainly contained silicates.

Sample ID: C266226-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266226-0002
Filter number: 4960
Sample Date: August 04, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace synthetic fibers were present.
- Trace particles with reflective surface were found, likely metal fragments.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 3 were calcite, 8 were dolomite, 4 were silica, 4 were biological materials, 1 was gypsum and the rest particles were silicates.

Kim Groombridge, Manager, Niagara District Office, Drinking Water Unit
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266226-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (35%), O (53%), Mg (6%) and Ca (5%)
Minor (Atomic %): Na, Si, Cu (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (28%), O (57%), and Si (14%)
Contained silica

Another spectrum showed the presence of the following elements:
Major (Weight %): C (14%), O (46%), Na (7%), Al (10%) and Si (21%)
Minor (Weight %): Ca (3%)
Mainly contained silicates

Another spectrum showed the presence of the following elements:
Major (Weight %): C (26%), O (49%) and Ca (23%)
Minor (Weight %): Na, Si (<2%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (35%), O (52%), S (5%) and Ca (6%)
Minor (Atomic %): Na, Si (<2%)
Mainly contained gypsum

Sample ID: C266226-0003	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266226-0003
Filter number: 4972
Sample Date: August 08, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace particles with reflective surface were found, likely metal fragments.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 3 were calcite, 4 were dolomite, 3 were silica, 4 were biological materials, 1 particle contained high iron content, likely iron sulfate, and the rest particles were silicates.

The examples of EDX spectra were as below:

Kim Coombridge Manager, Niagara District Office Drinking Water and Environ...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266226-0003	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

One spectrum showed the presence of the following elements:
Major (Weight %): C (33%), O (41%), K (5%) and Si (14%)
Minor (Weight %): Na, Mg, S, Ca, Fe (<2%) and Al (4%)
Mainly contained silicates

Another spectrum showed the presence of the following elements:
Major (Weight %): C (24%), O (57%), Ca (17%)
Minor (Weight %): Na, Si (<2%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (22%), O (58%), Mg (9%) and Ca (11%)
Minor (Atomic %): Fe (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (28%), O (56%) and Si (16%)
Contained silica

Another spectrum showed the presence of the following elements:
Major (Weight %): C (21%), O (21%), S (19%) and Fe (28%)
Minor (Weight %): Na (3%), Si (3%) and Mg, Al, K, Ca (<2%)
A particle with high iron and sulfur content.

Sample ID: C266226-0004	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266226-0004
Filter number: 4974
Sample Date: August 13, 2020

The sample was comprised of a grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.
- Trace tire wires and fly ash were also found.
- Trace particles with reflective surface were present, likely metal fragments.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 1 was calcite, 1 was dolomite, 3 were silica, 4 were biological materials, 1 was iron oxide and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic %): C (15%), O (59%) and Si (24%)

Kim Groombridge, Manager, Niagara District Office, Burlington Water and Environmental Engineering
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266226-0004	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Minor (Atomic %): Na, Mg, Al, K (<1%)
Combined silica

Another spectrum showed the presence of the following elements:
Major (Weight %): C (18%), O (49%), Al (7%), Na (5%) and Si (16%)
Minor (Weight %): Mg (1%) and K, Fe (2%)
Mainly contained silicates

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (20%), O (58%) and Ca (21%)
Minor (Atomic %): Al, Si, K (<1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (22%), O (61%), Mg (9%) and Ca (8%)
Minor (Atomic %): Na, S (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (24%), O (44%) and Fe (18%)
Minor (Atomic %): Na (3%) and Si, Cl, Ca, Cu (<1%)
Mainly contained iron oxide

Sample ID: C266226-0005	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266226-0005
Filter number: 4989
Sample Date: August 18, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Color and colorless minerals were present, mainly at the size from 5 to 40 microns in diameter.
- A few biological materials were found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 40 randomly selected particles scanned: 8 was dolomite, 5 were silica, 8 were biological materials, 1 particle was likely clinker dust and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic %): C (27%), O (54%), Mg (9%) and Ca (9%)
Minor (Atomic %): Si, Cu (<1%)
Mainly contained dolomite

Kim Groombridge Manager, Nuisance Dust Office Darkinjung Water and Ec...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266226-0005	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight %): C (37%), O (40%) and Si (11%)
Minor (Weight %): Na (3%), Al (4%) and K (4%)
Mainly contained silicates

Another spectrum showed the presence of the following elements:
Major (Atomic %): O (61%) and Si (38%)
Minor (Atomic %): Al (<1%)
Contained silica

Another spectrum showed the presence of the following elements:
Major (Weight %): C (21%), O (48%) and Ca (27%)
Minor (Weight %): Na (3%) and Si (1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (27%), O (55%), Si (4%) and Ca (10%)
Minor (Atomic %): Na (3%) and Mg, Al (<1%)
Likely contained clinker dust

Summary/Conclusion:

C266226-0001, 0002, 0003, 0004 and 0005 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C266226-0001	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266226-0001	AG	E3092A	ID3092	2224	17-SEP-20
C266226-0001	AG	E3288A	TSP3288	2213	15-SEP-20
C266226-0002	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266226-0002	AG	E3092A	ID3092	2224	17-SEP-20
C266226-0002	AG	E3288A	TSP3288	2213	15-SEP-20
C266226-0003	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266226-0003	AG	E3092A	ID3092	2224	17-SEP-20
C266226-0003	AG	E3288A	TSP3288	2213	15-SEP-20
C266226-0004	AG	E3070A	HIVOL3070	2225	17-SEP-20

Kim Coombridge, Manager, Niagara District Office, Environmental Water and En...

C266226-0004	AG	E3092A	ID3092	2224	17-SEP-20
C266226-0004	AG	E3288A	TSP3288	2213	15-SEP-20
C266226-0005	AG	E3070A	HIVOL3070	2225	17-SEP-20
C266226-0005	AG	E3092A	ID3092	2224	17-SEP-20
C266226-0005	AG	E3288A	TSP3288	2213	15-SEP-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3288A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Groombridge, Manager, Niagara District Office Drinking Water and En...

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C266481** Print Date: Sep. 28, 2020 06:09 PM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Sep. 28, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: 27094 GM SURVEY - REGION OF NIAGARA CARLTON ST. RESERVOIR

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Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C266481** Print Date: Sep. 28, 2020 06:09 PM By REPORTADMIN **** REPRINTED ****

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27094	C266481-0001	27094 25/AUG/2020 5001 1631	25 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

UTM:

Zone	Easting	Northing	Collection Method	Map Datum	Accuracy (metres)
230	641239	4780939	GPS	NAD83	2-5M

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
2	27094	C266481-0002	27094 29/AUG/2020 5011 1631	29 AUG 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Log#: **C266481**

Field ID:	1	2
Sample ID:	C266481-0001	C266481-0002
MOE*LIMS ID:	2020AG38-00003	2020AG38-00004
Station ID:	27094	27094
Collect Date:	25 AUG 2020	29 AUG 2020
Sample Location Description:	27094 25/AUG/2020 5001 1631	27094 29/AUG/2020 5011 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3076	1 Copper	0.075	ug/m3				.002	24-SEP-2020	0.041	ug/m3				.002	24-SEP-2020
	Nickel	.001	ug/m3	<MDL			.001	24-SEP-2020	.001	ug/m3	<MDL			.001	24-SEP-2020
	Cadmium	.005	ug/m3	<MDL			.005	24-SEP-2020	.005	ug/m3	<MDL			.005	24-SEP-2020
	Chromium	.002	ug/m3	<MDL			.002	24-SEP-2020	.002	ug/m3	<MDL			.002	24-SEP-2020
	Lead	.005	ug/m3	<MDL			.005	24-SEP-2020	.005	ug/m3	<MDL			.005	24-SEP-2020
	Iron	0.39	ug/m3				.005	24-SEP-2020	0.13	ug/m3				.005	24-SEP-2020
	Manganese	0.013	ug/m3				.003	24-SEP-2020	0.007	ug/m3				.003	24-SEP-2020
	Vanadium	0.019	ug/m3				.002	24-SEP-2020	0.022	ug/m3				.002	24-SEP-2020
	Zinc	0.37	ug/m3				.001	24-SEP-2020	0.36	ug/m3				.001	24-SEP-2020
3091	1 NT: Identification	See Non-Target Textual result					0	23-SEP-2020	See Non-Target Textual result					0	23-SEP-2020
3285	1 Particulate; total suspended	29.0	ug/m3				1.3	22-SEP-2020	4.00	ug/m3				1.3	22-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

AGENDA ITEM #3.1

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON-TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C266481-0001	3092L1	NT: Identification	0	none		
C266481-0002	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266481-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C266481
Station ID: 27094
AUTHORED BY: Grace Bu
Date: September 23, 2020

These samples were received from the West Central Region. Samples were collected from the Region of Niagara Carlton St. Reservoir, 15 Carlton St, Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Microphysical tests were also performed.

Lab Sample No: C266481-0001
Filter number: 5001
Sample Date: August 25, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter
- Some biological materials were found.
- Trace tire wear particles were also found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 4 were calcite, 6 were dolomite, 5 were silica, 8 were biological materials and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight %): C (12%), O (38%), Si (50%)
Mainly contained silica

Another spectrum showed the presence of the following elements:

Kim Groombridge, Manager, Niagara District Office, Drinking Water and Dr...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266481-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Major (Weight%): Ca (28%), C (18%), O (51%)
Minor (Weight %): Na, Mg, Si (<2%)
Mainly contained calcite.

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (28%), O (56%), Ca (7%), Mg (8%)
Minor (Atomic %): Na (<1%)
Mainly contained dolomite
Another spectrum showed the presence of the following elements:
Major (Weight%): C (20%), O (50%), Si (22%)
Minor (Weight %): Al (4%), K (4%) and Na (<2%)
Mainly contained silicates.

Sample ID: C266481-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C266481-0002
Filter number: 5011
Sample Date: August 29, 2020

The sample was comprised of a light grey color glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size from 10 to 50 microns in diameter
- Some biological materials were found.
- Trace tire wear particles were also found.
- Trace white paint sphere were also present.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 4 were calcite, 3 were dolomite, 2 were silica, 15 were biological materials and the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic %): C (58%), O (27%), Si (15%)
Minor (Atomic %): Na (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Atomic %): Ca (13%), C (26%), O (61%)
Minor (Atomic %): Mg, Si (<1%)
Mainly contained calcite

Another spectrum showed the presence of the following elements:

Kim Coombridge, Manager, Nuisance Assessment Office, Drinking Water and Ec...
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AGENDA ITEM #3.1

Kim Coombridge Manager, Nogata District Office, Drinking Water and PER...

NON TARGET TEXTUAL RESULT

Sample ID: C266481-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Major (Atomic %): C (24%), O (60%), Ca (8%), Mg (9%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight %): C (8%), O (47%), Na (8%), Al (9%), Si (27%)
Minor (Weight %): Ca, Fe (<1%)
Mainly contained silicates

Summary/Conclusion:

C266481-0001 and 0002 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C266481-0001	AG	E3070A	HIVOL3070	2225	24-SEP-20
C266481-0001	AG	E3092A	ID3092	2224	23-SEP-20
C266481-0001	AG	E3288A	TSP3288	2213	22-SEP-20
C266481-0002	AG	E3070A	HIVOL3070	2225	24-SEP-20
C266481-0002	AG	E3092A	ID3092	2224	23-SEP-20
C266481-0002	AG	E3288A	TSP3288	2213	22-SEP-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3288A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
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FINAL REPORT(manager4)

Log#: **C267060** Print Date: Oct. 28, 2020 09:06 AM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Oct. 28, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: GM SURVEY REGION OF NIAGARA CARLTON ST RESERVOIR 15 CARLTON ST ST. CATHARINES

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Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6

FINAL REPORT(manager4)

Log#: **C267060** Print Date: Oct. 28, 2020 09:06 AM By REPORTADMIN **** REPRINTED ****

Field ID	Station ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27094	27094 07/OCT/2020 4985 1631	07 OCT 2020		5	

Sample ID
C267060-0001

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Log#: **C267060**

Field ID:	1
Sample ID:	C267060-0001
MOE*LIMS ID:	2020AG42-00026
Station ID:	27094
Collect Date:	07 OCT 2020
Sample Location Description:	27094 07/OCT/2020 4985 1631
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3076	1 Copper	0.052	ug/m3				.002	21-OCT-2020
	Nickel	.001	ug/m3	<MDL			.001	21-OCT-2020
	Cadmium	.005	ug/m3	<MDL			.005	21-OCT-2020
	Chromium	.002	ug/m3	<MDL			.002	21-OCT-2020
	Lead	.005	ug/m3	<MDL			.005	21-OCT-2020
	Iron	0.19	ug/m3				.005	21-OCT-2020
	Manganese	0.007	ug/m3				.003	21-OCT-2020
	Vanadium	.002	ug/m3	<MDL			.002	21-OCT-2020
	Zinc	.001	ug/m3	<MDL			.001	21-OCT-2020
3091	1 NT: Identification	See Non-Target Textual result					0	22-OCT-2020
3285	1 Particulate; total suspended	12.0	ug/m3				1.3	20-OCT-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON-TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C267060-0001	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C267060-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C267060
Station ID: 27094
AUTHORED BY: Grace Bu
Date: October 19, 2020

These samples were received from the West Central Region. Samples were collected from 15 Carlton. St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Microphysical tests were also performed.

Lab Sample No: C267060-0001
Filter number: 4985
Sample Date: October 07, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Trace biological materials were found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 2 were calcite, 5 were dolomite, 2 were silica, the rest particles were likely silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (53%), O (36%), Si (11%)
Minor (Atomic %): Na, Ca (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (24%), C (19%), O (45%)
Minor (Weight %): Na, Al, Si, S (<2%), Fe (3%), Mg (3%)
Likely contained calcite

Kim Groombridge, Manager, Niagara District Office/Drinking Water Inten...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C267060-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight %): C (20%), O(52%), Ca (16%), Mg (10%)
Minor (Weight %): Na, Si, Mn, Fe (<1%)
Contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): C (41%), O (38%), Al (4%), Si (11%) and K (4%)
Minor (Weight %): Na (<2%), Ca (<1%)
Likely contained feldspar silicates

Summary/Conclusion:

C267060-0001 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C267060-0001	AG	E3070A	HIVOL3070	2225	22-OCT-20
C267060-0001	AG	E3092A	ID3092	2224	22-OCT-20
C267060-0001	AG	E3288A	TSP3288	2213	21-OCT-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3288A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Coombridge, Manager, Niagara District Office, Drinking Water and Ecr
Page 84 of 181
AGENDA ITEM #3.1

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C267292** Print Date: Nov. 04, 2020 07:50 AM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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HAMILTON,ONT
L8P 4Y7

Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Nov. 04, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: GM SURVEY REGION OF NIAGARA CARLTON ST RESERVOIR 15 CARLTON ST ST. CATHARINES

The results relate only to items tested.
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Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6

FINAL REPORT(manager4)

Log#: **C267292** Print Date: Nov. 04, 2020 07:50 AM By REPORTADMIN **** REPRINTED ****

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27094	C267292-0001	27094 16/OCT/2020 4986 1631	16 OCT 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Field Id	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
2	27094	C267292-0002	27094 24/OCT/2020 5073 1631	24 OCT 2020		5	

Sample Comment Description

LIMS Products Requested:

AG	E3070A	HIVOL3070	AG	E3092A	ID3092	AG	E3288A	TSP3288

Log#: **C267292**

Field ID:	1	2
Sample ID:	C267292-0001	C267292-0002
MOE*LIMS ID:	2020AG44-00001	2020AG44-00002
Station ID:	27094	27094
Collect Date:	16 OCT 2020	24 OCT 2020
Sample Location Description:	27094 16/OCT/2020 4986 1631	27094 24/OCT/2020 5073 1631
Sample Comments Description:		

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3076	11 Copper	0.06	ug/m3				.002	02-NOV-2020	0.051	ug/m3				.002	02-NOV-2020
	Nickel	.001	ug/m3	<MDL			.001	02-NOV-2020	.001	ug/m3	<MDL			.001	02-NOV-2020
	Cadmium	.005	ug/m3	<MDL			.005	02-NOV-2020	.005	ug/m3	<MDL			.005	02-NOV-2020
	Chromium	.002	ug/m3	<MDL			.002	02-NOV-2020	.002	ug/m3	<MDL			.002	02-NOV-2020
	Lead	.005	ug/m3	<MDL			.005	02-NOV-2020	.005	ug/m3	<MDL			.005	02-NOV-2020
	Iron	0.27	ug/m3				.005	02-NOV-2020	0.11	ug/m3				.005	02-NOV-2020
	Manganese	0.010	ug/m3				.003	02-NOV-2020	0.005	ug/m3				.003	02-NOV-2020
	Vanadium	.002	ug/m3	<MDL			.002	02-NOV-2020	0.019	ug/m3				.002	02-NOV-2020
	Zinc	.001	ug/m3	<MDL			.001	02-NOV-2020	0.39	ug/m3				.001	02-NOV-2020
3091	11 NT: Identification	See Non-Target Textual result					0	02-NOV-2020	See Non-Target Textual result					0	02-NOV-2020
3285	11 Particulate; total suspended	21.0	ug/m3				1.3	30-OCT-2020	4.00	ug/m3				1.3	30-OCT-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

CODE	DESCRIPTION
<MDL	LESS THAN METHOD DETECTION LIMIT

NON-TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C267292-0001	3092L1	NT: Identification	0	none		
C267292-0002	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C267292-0001	HiVol - Glassfibre	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C267292
Station ID: 27094
AUTHORED BY: Grace Bu
Date: October 30, 2020

These samples were received from the West Central Region. Samples were collected from 15 Carlton. St. Catherine, ON.

The samples were examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Microphysical tests were also performed.

Lab Sample No: C267292-0001
Filter number: 4986
Sample Date: October 16, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Some biological materials were found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 3 were calcite, 5 were dolomite, 1 was silica, 6 were biological materials, 1 was like iron oxide, the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight%): C (30%), O (46%), Si (19%)
Minor (Weight%): Na (2%), Mg, Al, S, K, Ca, Fe (<1%)
Mainly contained silica

Another spectrum showed the presence of the following elements:

Kim Groombridge, Manager, Niagara District Office Drinking Water and Sh...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C267292-0001	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Major (Weight%): Ca (26%), C (24%), O (47%)
Minor (Weight %): Na, Al, Si (<2%)
Likely contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (27%), O (55%), Ca (8%), Mg (8%)
Minor (Atomic %): Na, Si (<2%)
Contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): C (37%), O (38%), Al (6%), Si (11%), Fe (4%)
Minor (Weight %): Na (3%), Mg, S, Cl, K (<2%)
Likely contained silicates

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (21%), O (52%), Fe (21%)
Minor (Atomic%): Na (3%), Al, Si, S, Ca, Cr, Mn (<2%)
Likely contained iron oxide

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (70%), O (27%)
Minor (Atomic%): Na (2%), Si (<1%)
Likely contained biological materials

Sample ID: C267292-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Lab Sample No: C267292-0002
Filter number: 5073
Sample Date: October 24, 2020

The sample was comprised of a light grey colored glass filter in an envelope.

View of the filter under microscopes showed:
- Colored and colorless minerals were present, mainly at the size of 10 to 50 microns in diameter.
- Some biological materials were found.

- SEM-EDXRA Analysis (SEMI-QUANTITATIVE): Out of 45 randomly selected particles scanned: 12 were calcite, 8 were dolomite, 5 were silica, 3 were biological materials, 1 was like iron oxide, the rest particles were silicates.

The examples of EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight%): C (30%), O (48%), Si (20%)
Minor (Weight%): Na, Al, K (<1%)
Mainly contained silica

Kim Groombridge, Manager, Northeast District Office, Drinking Water and Environmental Compliance Unit
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C267292-0002	Matrix : HiVol - Glassfibre	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Weight%): Ca (28%), C (15%), O (56%)
Minor (Weight %): Si (<1%)
Likely contained calcite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (14%), O (64%), Ca (12%), Mg (8%)
Minor (Atomic %): Na, Si, Ti (<2%)
Contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight%): C (26%), O (33%), Fe (31%), Na (5%)
Minor (Weight%): Si, S, Ca (<2%)
Likely contained iron oxide

Another spectrum showed the presence of the following elements:
Major (Atomic%): C (62%), O (30%)
Minor (Atomic%): Na, Si, S, Cl, Ca (<2%)
Likely contained biological materials

Summary/Conclusion:

C267292-0001 and C267292-0002 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C267292-0001	AG	E3070A	HIVOL3070	2225	02-NOV-20
C267292-0001	AG	E3092A	ID3092	2224	02-NOV-20
C267292-0001	AG	E3288A	TSP3288	2213	30-OCT-20
C267292-0002	AG	E3070A	HIVOL3070	2225	02-NOV-20
C267292-0002	AG	E3092A	ID3092	2224	02-NOV-20
C267292-0002	AG	E3288A	TSP3288	2213	30-OCT-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3070A	THE DETERMINATION OF METALS ON GLASS FIBRE AIR FILTERS BY X-RAY FLUORESCENCE	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

Kim Coombridge, Manager, Niagara District Office, Drinking Water and Ec...
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AGENDA ITEM #3.1

E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3236A	THE DETERMINATION OF SUSPENDED PARTICULATES ON GLASS AND QUARTZ FIBRE AND ON TEFLON FILTERS BY GRAVIMETRY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Login: **C266477** Print Date: Sep. 28, 2020 06:10 PM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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HAMILTON,ONT
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Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Sep. 28, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: NIAGARA

The results relate only to items tested.
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Log#: **C266477**

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
27096	27096	C266477-0001	27096 NIAGARA - CLEAR WATER WITH LIGHT PARTICULATE AND SOME SMALL PIECES OF VEGETATION	01 SEP 2020		5	

LIMS Products Requested:

OD	E3043A	DUST3043	OD	E3046A	DUSTS3046	OD	E3092A	ID3092

Sample Comment Description

UTM:

Zone	Easting	Northing	Collection Method	Map Datum	Accuracy (metres)
230	641564	4781027	GPS	NAD83	2-5M

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Log#: **C266477**

Field ID:	27096
Sample ID:	C266477-0001
MOE*LIMS ID:	2020OD38-00001
Station ID:	27096
Collect Date:	01 SEP 2020
Sample Location Description:	27096 NIAGARA - CLEAR WATER WITH LIGHT PARTICULATE AND SOME SMALL
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3046L1	Dustfall; total insoluble	2	g/m2/30D	<MDL			2	22-SEP-2020
	Dustfall; insoluble	2	g/m2/30D	<MDL			2	22-SEP-2020
3046L2	Coal		%	NDNO				23-SEP-2020
	Coke		%	NDNO				23-SEP-2020
	Graphite		%	NDNO				23-SEP-2020
	Kish/Magnetic Particles		%	NDNO				23-SEP-2020
	Soot		%	NDNO				23-SEP-2020
	Oil Soot		%	NDNO				23-SEP-2020
	Flyash		%	NDNO				23-SEP-2020
	Wood Char		%	NDNO				23-SEP-2020
	Carbonates		%	NDNO				23-SEP-2020
	Biological Material	65	%					23-SEP-2020
	Black Rubber (from tire buffing)		%	NDNO				23-SEP-2020
	Carbon Black		%	NDNO				23-SEP-2020
	Others		%	NDNO				23-SEP-2020
	NT: Identification	See Non-Target Textual result						23-SEP-2020
	Fibres Synthetic		%	NDNO				23-SEP-2020
	Minerals	35	%					23-SEP-2020
	Paint		%	NDNO				23-SEP-2020
3092L1	NT: Identification	See Non-Target Textual result					0	23-SEP-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

AGENDA ITEM #3.1

CODE	DESCRIPTION
NDNO	NO DATA: NO PARTICLE(S) DETECTED
<MDL	LESS THAN METHOD DETECTION LIMIT

NON TARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C266477-0001	3046L2	NT: Identification				
C266477-0001	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266477-0001	Dustfall	E3046A	DUSTS3046	NT: Identification

Black Rubber (from tire buffing): Traces

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266477-0001	Dustfall	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C266477
Station ID: 27096
AUTHORED BY: Grace Bu
Date: September 23, 2020

The sample was received from the West Central Region.

The sample was examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Micro-physical tests were also performed.

Lab Sample No: C266477-0001
Sample Date: August 2020
Description of sample contents/Details: Clear water with light particulate and some small pieces of vegetation

The sample was comprised of small amounts of particulates in an envelope.

View of the particulates under microscopes showed:
- 35% of colored and colorless minerals were present, mainly at the size of 50 to 100 microns in diameter
- 65% of biological materials were found.
- Trace tire wear particles were also present.
- No magnetic particles were found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE):
The examples of EDX spectra were as below:

Kim Coombridge, Manager, Niagara District Office, Drinking Water and Em...
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AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266477-0001	Matrix : Dustfall	Method : E3092A	Product: ID3092	Parameter: NT: Identification

One spectrum showed the presence of the following elements:
Major (Atomic %): C (19%), O (64%), Si (17%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (33%), O (53%), Ca (6%), Mg (7%)
Minor (Atomic %): Si (<2%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight %): C (41%), O (26%), Al (5%), Si (17%) and K (12%)
Mainly contained silicates

Summary/Conclusion:

C266477-0001 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C266477-0001	OD	E3043A	DUST3043	2210	22-SEP-20
C266477-0001	OD	E3046A	DUSTS3046	2224	23-SEP-20
C266477-0001	OD	E3092A	ID3092	2224	23-SEP-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3043A	THE DETERMINATION OF TOTAL DUSTFALL IN AIR PARTICULATE MATTER BY GRAVIMETRY	CONTINGENCY	Method has been developed for the specific purpose of analysis of these types of samples and has not been fully validated; consult with laboratory manager for data interpretation
E3046A	THE DETERMINATION OF DUSTFALL PARTICULATES IN AIR EMISSIONS AND PRECIPITATION BY OPTICAL MICROSCOPY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Coombridge Manager, Nagagami District Office, Drinking Water and PER...

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C266907** Print Date: Oct. 14, 2020 12:25 PM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

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HAMILTON,ONT
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Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section
Approved date : Oct. 14, 2020

Inquiries to : ROBERT TOOLEY
JANET MILLS
Telephone : 416-235-6094
Telephone : 416-235-5831

LOGIN DESCRIPTION: NIAGARA

The results relate only to items tested.
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Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6

FINAL REPORT(manager4)

Log#: **C266907** Print Date: Oct. 14, 2020 12:25 PM By REPORTADMIN **** REPRINTED ****

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27096	C266907-0001	27096 SEP2020 NO. DAYS EXPOSED 30 NIAGARA	30 SEP 2020		5	

Sample Comment Description

LIMS Products Requested:

OD	E3043A	DUST3043	OD	E3046A	DUSTS3046	OD	E3092A	ID3092

Field ID:	1
Sample ID:	C266907-0001
MOE*LIMS ID:	2020OD41-00003
Station ID:	27096
Collect Date:	30 SEP 2020
Sample Location Description:	27096 SEP2020 NO. DAYS EXPOSED 30 NIAGARA
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3046L1	Dustfall; total insoluble	2.4	g/m2/30D				2	09-OCT-2020
	Dustfall; insoluble	2	g/m2/30D	<MDL			2	09-OCT-2020
3046L2	Coal		%	NDNO				09-OCT-2020
	Coke		%	NDNO				09-OCT-2020
	Graphite		%	NDNO				09-OCT-2020
	Kish/Magnetic Particles		%	NDNO				09-OCT-2020
	Soot		%	NDNO				09-OCT-2020
	Oil Soot		%	NDNO				09-OCT-2020
	Flyash		%	NDNO				09-OCT-2020
	Wood Char		%	NDNO				09-OCT-2020
	Carbonates		%	NDNO				09-OCT-2020
	Biological Material	80	%					09-OCT-2020
	Black Rubber (from tire buffing)		%	NDNO				09-OCT-2020
	Carbon Black		%	NDNO				09-OCT-2020
	Others		%	NDNO				09-OCT-2020
	NT: Identification	See Non-Target Textual result						09-OCT-2020
	Fibres Synthetic		%	NDNO				09-OCT-2020
	Minerals	20	%					09-OCT-2020
	Paint		%	NDNO				09-OCT-2020
3092L1	NT: Identification	See Non-Target Textual result					0	13-OCT-2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...
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AGENDA ITEM #3.1

CODE	DESCRIPTION
NDNO	NO DATA: NO PARTICLE(S) DETECTED
<MDL	LESS THAN METHOD DETECTION LIMIT

NONTARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C266907-0001	3046L2	NT: Identification				
C266907-0001	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266907-0001	Dustfall	E3046A	DUSTS3046	NT: Identification

Black rubber 9from tire buffing): traces

Sample ID:	Matrix :	Method :	Product:	Parameter:
C266907-0001	Dustfall	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C266907
Station ID: 27096
AUTHORED BY: Grace Bu
Date: October 09, 2020

The sample was received from the West Central Region.

The sample was examined by means of stereoscopic and polarized microscope, Scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Micro-physical tests were also performed.

Lab Sample No: C266907-0001
Sample Date: September 2020
Description of sample contents/Details: Brown/red water with light particulate and some small pieces of vegetation

The sample was comprised of small amounts of particulates in an envelope.

View of the particulates under microscopes showed:
- Around 20% of colored and colorless minerals were present, mainly at the size of 20 to 100 microns in diameter
- Around 80% of biological materials were found.
- Trace tire wear particles were also present.
- No magnetic particles were found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE):

Kim Coombridge, Manager, Niagara District Office, Drinking Water and Em...
Page 100 of 181
AGENDA ITEM #3.1

NON TARGET TEXTUAL RESULT

Sample ID: C266907-0001	Matrix : Dustfall	Method : E3092A	Product: ID3092	Parameter: NT: Identification

The example EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Weight%): C (15%), O (59%), Si (26%)
Mainly contained silica

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (37%), O (36%), Ca (25%)
Minor (Atomic %): Mg, Al, Si, P, K, Cu (<1%)
Mainly contained Calcium carbonate

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (38%), O (47%), Ca (7%), Mg (7%)
Minor (Atomic %): Al, Si (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (42%), O (38%), Al (4%), Si (12%) and K (3%)
Minor (Atomic %): Na, Mg, Cl, Ca (<1%)
Contained silicates (feldspar)

Summary/Conclusion:

C266907-0001 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C266907-0001	OD	E3043A	DUST3043	2210	09-OCT-20
C266907-0001	OD	E3046A	DUSTS3046	2224	13-OCT-20
C266907-0001	OD	E3092A	ID3092	2224	13-OCT-20

LaSB Method Summary

Method	Method Description	Status	Status Description
E3043A	THE DETERMINATION OF TOTAL DUSTFALL IN AIR PARTICULATE MATTER BY GRAVIMETRY	CONTINGENCY	Method has been developed for the specific purpose of analysis of these types of samples and has not been fully validated; consult with laboratory manager for data interpretation
E3046A	THE DETERMINATION OF DUSTFALL PARTICULATES IN AIR EMISSIONS AND PRECIPITATION BY OPTICAL MICROSCOPY	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request
E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

Kim Coombridge - Manager, Niagara District Office, Drinking Water and Ec...
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*** End of Report ***

Ministry of the Environment, Conservation and Parks
Laboratory Services Branch - 125 Resources Road
Etobicoke, Ontario M9P 3V6
FINAL REPORT(manager4)

Log#: **C267510** Print Date: Nov. 16, 2020 09:45 PM By REPORTADMIN **** REPRINTED ****

Program Code 130113102

Program: MOE OPERATIONS DIVISION
Study: AIR,INDUSTRY,PRIVATE NETWORKS
Project: WEST CENTRAL REG. TECH SUPPORT
Activity: POINT SOURCE MONITORING
Organization: WCR-HAMILTON DISTRICT OFFICE

Org. Id: 407606

Mail this copy to :
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MOE - HAMILTON REGIONAL OFFICE
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HAMILTON,ONT
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Final reports to : WCR-AIR-DATA
ORSINI, MARK

Approved for release by : DAVE MORSE Manager, Organic Contaminants Section Approved date : Nov. 16, 2020

Inquiries to : ROBERT TOOLEY Telephone : 416-235-6094
JANET MILLS Telephone : 416-235-5831

LOGIN DESCRIPTION: NIAGARA

The results relate only to items tested.
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Log#: **C267510**

Field ID	Station ID	Sample ID	Sample Location Description	Sampling Date	Time	Zone	Sampler Information
1	27096	C267510-0001	NIAGARA 27096 OCT. 2020 NO. DAY EXPOSED 32	31 OCT 2020		5	

Sample Comment Description

LIMS Products Requested:

OD	E3043A	DUST3043	OD	E3046A	DUSTS3046	OD	E3092A	ID3092

UTM:

Zone	Easting	Northing	Collection Method	Map Datum	Accuracy (metres)
230	641564	4781027	GPS	NAD83	2-5M

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Field ID:	1
Sample ID:	C267510-0001
MOE*LIMS ID:	2020OD45-00002
Station ID:	27096
Collect Date:	31 OCT 2020
Sample Location Description:	NIAGARA 27096 OCT. 2020 NO. DAY EXPOSED 32
Sample Comments Description:	

Listid	Parmname	Value	Units	Qual	Rmk1	Rmk2	MDL	Analysis Date
3046L1	Dustfall; total insoluble	3.0	g/m2/30D				2	10-NOV-2020
	Dustfall; insoluble	2	g/m2/30D	<MDL			2	10-NOV-2020
3046L2	Coal		%	NDNO				12-NOV-2020
	Coke		%	NDNO				12-NOV-2020
	Graphite		%	NDNO				12-NOV-2020
	Kish/Magnetic Particles		%	NDNO				12-NOV-2020
	Soot		%	NDNO				12-NOV-2020
	Oil Soot		%	NDNO				12-NOV-2020
	Flyash		%	NDNO				12-NOV-2020
	Wood Char		%	NDNO				12-NOV-2020
	Carbonates		%	NDNO				12-NOV-2020
	Biological Material	70	%					12-NOV-2020
	Black Rubber (from tire buffing)		%	NDNO				12-NOV-2020
	Carbon Black		%	NDNO				12-NOV-2020
	Others		%	NDNO				12-NOV-2020
	NT: Identification	See Non-Target Textual result						12-NOV-2020
	Fibres Synthetic		%	NDNO				12-NOV-2020
	Minerals	30	%					12-NOV-2020
	Paint		%	NDNO				12-NOV-2020
3092L1	NT: Identification	See Non-Target Textual result					0	12-NOV-2020

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AGENDA ITEM #3.1

CODE	DESCRIPTION
NDNO	NO DATA: NO PARTICLE(S) DETECTED
<MDL	LESS THAN METHOD DETECTION LIMIT

NONTARGET TEXTUAL RESULT

Sample ID:	Listid :	Parmname :	Value:	Units:	Qual:	Remarks:
C267510-0001	3046L2	NT: Identification				
C267510-0001	3092L1	NT: Identification	0	none		

TEXT COMMENTS

Sample ID:	Matrix :	Method :	Product:	Parameter:
C267510-0001	Dustfall	E3092A	ID3092	NT: Identification

Environmental Forensics Section

SUBMISSION: C267510
Station ID: 27096
AUTHORED BY: Grace Bu
Date: November 10, 2020

The sample was received from the West Central Region.

The sample was examined by means of stereoscopic and polarized microscope, scanning electron microscope with an energy dispersive x-ray analyzer (SEM-EDXRA). Micro-physical tests were also performed.

Lab Sample No: C267510-0001
Sample Date: October 2020
Description of sample contents/Details: Light yellow water with light particulate, with 2 leaves and some small pieces of vegetation

The sample was comprised of small amounts of particulates in an envelope.

View of the particulates under microscopes showed:
- Around 30% of colored and colorless minerals were present, mainly at the size of 20 to 100 microns in diameter
- Around 70% of biological materials were found.
- No magnetic particles were found.

SEM-EDXRA Analysis (SEMI-QUANTITATIVE):

The example EDX spectra were as below:
One spectrum showed the presence of the following elements:
Major (Atomic%): C (11%), O (66%), Si (23%)
Mainly contained silica

Kim Groombridge, Manager, Niagara District Office, Drinking Water and Env.
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NON TARGET TEXTUAL RESULT

Sample ID: C267510-0001	Matrix : Dustfall	Method : E3092A	Product: ID3092	Parameter: NT: Identification

Another spectrum showed the presence of the following elements:
Major (Atomic %): C (30%), O (55%), Ca (7%), Mg (7%)
Minor (Atomic %): Al, Si (<1%)
Mainly contained dolomite

Another spectrum showed the presence of the following elements:
Major (Weight %): C (15%), O (53%), Al (8%), Si (15%), K (3%), Fe (4%)
Minor (Weight %): Na, Ca (<2%)
Likely contained aluminosilicates

Another spectrum showed the presence of the following elements:
Major (Weight %): C (57%), O (42%)
Minor (Weight %): Ca (<1%)
Likely contained Biological materials

Summary/Conclusion:

C267510-0001 mainly contained normal road dusts.

Product Completion

Sample ID	Matrix	Method	Product	Analytical Department	Completion Date
C267510-0001	OD	E3043A	DUST3043	2210	12-NOV-20
C267510-0001	OD	E3046A	DUSTS3046	2224	12-NOV-20
C267510-0001	OD	E3092A	ID3092	2224	12-NOV-20

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E3092A	THE IDENTIFICATION OF PARTICULATE MATTER BY QUALITATIVE AND SEMI-QUANTITATIVE TECHNIQUES	ROUTINE	Method has been fully validated, is deemed fit for purpose and has the associated Uncertainty information available upon request

*** End of Report ***

Kim Coombridge - Manager, Niagara District Office Drinking Water and En...
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2020 Surface Water Quality Study near the Former GM Property
285 Ontario Street, City of St. Catharines

Technical Memorandum

Prepared For:
Niagara District Office, West Central Region
Ministry of the Environment, Conservation and Parks

Prepared By:
Michael Spencer
Technical Support Section, West Central Region
Ministry of the Environment Conservation and Parks

December 11, 2020

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1.0 Introduction

In a January 29, 2020 letter from Shelley Chemnitz, Chief Administrative Officer, City of St. Catharines to Kim Groombridge, Manager Niagara District Office, Ministry of Environment, Conservation and Parks, the City of St. Catharines (City) requested that the Ministry of Environment, Conservation and Parks (MECP) assess any potential offsite environmental impacts including surface water from the former General Motors (GM) property located at 285 Ontario Street in the City of St. Catharines. The former GM property was previously a production facility and is located directly east of Twelve Mile Creek.

To assist the MECP Niagara District Office with the City request, MECP Technical Support Surface Water completed surface water quality sampling of a former GM storm sewer outfall, a City storm sewer outfall, and various upstream and downstream locations on Twelve Mile Creek. Surface water quality sampling was completed during a snow melt event on February 13, 2020, a dry event on September 23, 2020 and a rain event on October 20, 2020.

This Technical Memorandum provides the surface water quality sampling results and an interpretation of the results regarding potential surface water quality impact.

2.0 Background Information

2.1 Twelve Mile Creek

Twelve Mile Creek has a total watershed drainage area of approximately 132km^2. The watershed has six main subwatersheds known as Upper Twelve Mile Creek, Lake Gibson system, Richardson Creek, Francis Creek, Dicks Creek and Lower Twelve Mile Creek. The former GM property is located within the Lower Twelve Mile Creek subwatershed.

The Lower Twelve Mile Creek subwatershed has historically been totally reconstructed. It was originally modified as part of the Welland Canal and then enlarged to accommodate flow from the Ontario Power Generation DeCew Generating Station. The dominant source of flow in the Lower Twelve Mile Creek originates from the DeCew Generating Station which diverts flow from the Old Welland Canal system. The discharge from the DeCew Generating Station represents more than 98% of the flow in Twelve Mile Creek at its outlet to Lake Ontario. The DeCew Generating Station discharge can reach up to 220 m^3/s (or 220,000 L/s). (AquaResource, 2009)

2.2 Urban Stormwater Overview

Urban stormwater comprises rainfall and snowmelt that either seeps into the ground or runs off the land into storm sewers which eventually discharge to creeks and lakes. Contaminants tend to build up on urban impervious surfaces such as roadways, parking lots, etc. from various sources. As such, urban stormwater may contain elevated levels of contaminants including suspended solids, nutrients, bacteria, metals, chlorides, oil and grease, and pesticides. These contaminants can then be picked up by stormwater and transferred to creeks and lakes.

Sources of urban stormwater contaminants include:

- vehicular traffic which accounts for much of the buildup of contaminants on road surfaces (tire wear, brake pad wear, engine oil and lubricant drippings, corrosion)
- asphalt pavement deterioration
- road and driveway maintenance (asphalt repair, road salting, driveway sealant)
- lawn maintenance **(**fertilizers, pesticides)
- industrial and commercial activities (loading/unloading areas, storage, vehicle maintenance); and
- air pollution fallout (vehicle emissions, industrial sources, wind erosion)

(MOE, 2003a) (MOE, 2003b) (Cons. Toronto, 2001)

In general terms, older municipal areas have catchbasins and sewers for stormwater quantity control to prevent flooding and property damage similar to the area of St. Catharines sampled for this assessment. Newer municipal areas may have additional stormwater quality control measures (ie. detention ponds, etc.) to remove suspended solids and associated contaminants in stormwater.

3.0 Surface Water Quality Criteria

Surface water quality criteria provide assessment benchmarks for background water quality, end-of-pipe discharge quality, and water quality within the receiver after mixing. Various surface water quality criteria were incorporated into this assessment. The assessment will primarily focus on end-of-pipe storm sewer outfall water quality. The assessment will also discuss the upstream and downstream water quality in Twelve Mile Creek. However, the water quality in Twelve Mile Creek would be dominated by its very large flow in comparison to the much smaller flows from the storm sewer outfalls.

An overview of the surface water quality criteria is provided in the following sections.

3.1 Provincial Water Quality Objectives

The MECP Water Management document (MOEE, 1994) contains the Ontario Provincial Water Quality Objectives (PWQO). PWQO are numerical and narrative ambient surface water quality criteria that represent a desirable level of water quality that the MECP strives to maintain in the surface waters of the Province. PWQO are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycle during indefinite exposure to the water. PWQO provide a baseline for assessing surface water quality and act as a simple measure of ecosystem health.

3.2 Canadian Water Quality Guidelines

The MECP Water Management document (MOEE, 1994) identifies that the Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life (CCME, 2020) can also be used to complement or augment the PWQO since they have similar purpose and application. In the

absence of a PWQO for a specific parameter or if a specific parameter PWQO has a more recently developed CWQG, the CWQG was incorporated into this assessment.

3.3 Typical Urban Stormwater Quality for Metals

In addition to the PWQO and CWQG, typical urban stormwater quality can be incorporated as criteria to identify non-typical or elevated stormwater results. The MECP Stormwater Manual (MOE, 2003a) contains a list of observed urban stormwater runoff concentrations for metals that have been included in this assessment. As well, the Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010) contains metals results for typical urban neighbourhoods in St. Catharines (Walkers Creek at Lakeshore Road and Spring Garden Creek at Lakeshore Road) and an upstream reference site (Twelve Mile Creek at 1st Street Louth) for the watershed that have been incorporated into this assessment.

3.4 Typical Urban Stormwater Quality for Polycyclic Aromatic Hydrocarbons

Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) can be contained in urban stormwater. PAHs have low solubility in water and a high potential for adsorption to particulate matter in soil and in water. As such, PAHs adsorbed to particulate matter in soil and water can be picked up by stormwater runoff and transferred to creeks and lakes. Urban sources of PAHs to the aquatic environment include deposition of atmospheric PAHs (ie. vehicular emissions), deterioration of asphalt pavement and car tires, spills of petroleum products (ie. engine oil and lubricant drippings) and creosote treated railway ties. Atmospheric deposition has been estimated to be the main source of PAHs to soils and aquatic sediments. (Gov. of Can., 1994)

The Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010) included PAH results within the Twelve Mile Creek watershed and concluded that those results were within typical ranges found in urban watersheds (Boyd, 1999). PAH results for Carter Creek Park Upstream from this study were incorporated into this assessment as a comparison for the watershed.

The U.S. Geological Survey studied PAHs in Urban Stormwater in Madison, Wisconsin (Selbig, 2009) to characterize PAH concentrations from urban source areas including residential feeder streets (1500 vehicles per day) and collector streets (10,000 to 15,000 vehicles per day). The study was also consistent with similar studies that measured PAH concentrations in urban stormwater in Michigan. The study results were incorporated into this assessment as another source of typical urban PAH concentrations.

3.5 Polychlorinated Biphenyls Threshold for Typical Urban Areas

Polychlorinated biphenyls (PCB) are man-made synthetic chlorinated hydrocarbon compounds that have been produced commercially since 1929. PCB refers to any one or any combination of 209 specific chemicals (known as congeners) that are similar in structure. PCBs were never manufactured in Canada, however, they were widely used in this country. They were used as ingredients in many industrial materials (ie. sealing and caulking compounds, cutting oils, inks and paint additives). PCBs were also used to make coolants and lubricants for electrical equipment (ie. transformers and capacitors) (Gov. of Can., 2020).

Generally, PCBs are relatively insoluble in water, adsorb to soil and sediment, are persistent in the environment, bioaccumulate in aquatic biota and biomagnify within the aquatic food chain. Concern about the environmental impact of PCBs led to a North American ban on manufacturing and importing by 1977. Trace levels of PCBs in the environment are found all over the world (WHO, 2003) (Gov. of Can., 2020).

Benoit et al. (2016) developed environmental triggers in five Ontario watersheds including Twelve Mile Creek to differentiate potential source areas from background PCB conditions in urban areas. Background concentrations do not represent natural conditions but rather reflect typical concentrations in urban areas in the absence of known PCB sources.

The study established a surface water PCB Threshold at greater than 10 ng/L (ie. 10x PWQO). It identified that results at most background areas did not show evidence of a PCB source at less than 10 ng/L. However, it noted that PCB results exceeding 20 ng/L may occur in urban background areas following rain events due to increased suspended solids. PCBs are typically more prevalent during runoff events in urban areas since they are hydrophobic and strongly sorb to suspended solids.

The study also included surface water quality data from the Twelve Mile Creek watershed. Specifically, Benoit et al. (2016) identified that Twelve Mile Creek non-source sites (ie. locations with a lack of evidence of a source) had PCB results for wet events that ranged from 1.5 to 22.4 ng/L with an average of 9.5 ng/L. PCB results for non-source dry events ranged from 0.8 to 3.9 ng/L with an average of 2.0 ng/L.

3.6 How are the Provincial Water Quality Objectives Set?

The scientific procedure to set a PWQO involves a review of global aquatic toxicological literature including effects such as aquatic toxicity, bioaccumulation and mutagenicity. Additional information such as odour in water, tainting of fish flesh and impacts on wildlife may also be taken into consideration. The PWQO is then set based on the lowest effect concentration with an added safety factor to be conservative (MOEE, 1994). As such, PWQO are not set at acutely or chronically lethal benchmarks.

For additional information, the following provides an example of the procedure to set a PWQO for a specific parameter and a comparison to the lab detection limit. As an example, studies for contaminant ABC have identified effect concentrations from 10 to 100 ug/L based on a lab analysis detection limit of 3 ug/L. The lowest effect concentration of 10 ug/L with a safety factor of 10 results in a PWQO of 1 ug/L. Since the setting of the PWQO is based on the scientific procedure and not the lab analysis detection limit, this PWQO would be lower than the lab analysis detection limit.

3.7 Lab Method Detection Limit for Metals

Metals results from the MECP lab are reported as a value with a specific uncertainty factor and a method detection limit. The reviewer then typically interprets the result with an understanding of the uncertainty factor. The first sampling event samples (snow event) were analysed with a

single analysis method and the results were presented as the reported value in a July 16, 2020 MECP memorandum (Spencer, 2020).

After the first sampling event, the MECP lab recommended that two analysis methods be used and the metal parameter result with the lowest detection limit be used in the assessment. The MECP lab also recommended that any metal results less than the lowest method detection limit be identified as non-detect in the interpretation. Therefore, the main body of this Technical Memorandum will follow this procedure and interpret any metals results less than the lowest method detection limit as non-detect.

In addition, since the first sampling event metal results were originally presented as values and the Coalition for a Better St. Catharines provided comments (Van Meer, 2020), Appendix A will also provide an interpretation using the previously presented values.

4.0 Sampling Locations

The surface water quality sampling locations for the storm sewer outfalls and Twelve Mile Creek are illustrated in Figure 1. As well, the following table provides a description of the sampling locations:

Sampling Locations	**Description**	**Sample Id**
TMC Upstream Far	Twelve Mile Creek approximately 300m upstream of GM West Outfall and upstream of former GM property.	TMCUS
TMC Upstream	Twelve Mile Creek approximately 20m upstream of GM West Outfall and adjacent to former GM property. Across from groundwater monitoring well.	TMC1
GM West Outfall	Former GM storm sewer outfall associated with West Tilt Plate Separator.	TMCOut1
City West Outfall	Municipal storm sewer outfall in line with Carlton Street.	TMCOut2
TMC Downstream	Twelve Mile Creek approximately 40m downstream of City West Outfall and adjacent to former GM property. Across from groundwater monitoring well.	TMC2
TMC Downstream Far	Twelve Mile Creek approximately 130m downstream of City West Outfall, downstream of former GM property and just upstream of railway bridge abutment.	TMCDS

The City's main storm sewer in line with Carlton Street captures stormwater from Ontario Street and combined sewer overflows at the intersection of Carlton Street and Ontario Street. The main storm sewer then splits into two sewer pipes and two sewer outfalls that are contained in the same concrete outfall structure. The City West Outfall is the downstream outfall in the concrete outfall structure. The upstream outfall in the concrete outfall structure is not in service (Green, personal communication 2020) and was not sampled since it was always dry during all sampling

events. Previous stormwater flows from the former GM property East Plant (east side of Ontario Street) to the main storm sewer are believed to be capped (Green, personal communication 2020).

The Twelve Mile Creek samples were collected approximately 2m from the shoreline using a sampling pole. While Twelve Mile Creek has a very large flow and mixing capacity in comparison to the storm sewer outfall flows, it is anticipated that the outfalls discharge would flow along the shoreline while mixing for some distance due to the difference in flow and water quality.

A duplicate set of samples was collected at TMC Downstream Far during each sampling event for quality assurance and quality control.

Twelve Mile Creek Sampling near GM Property St. Catharines

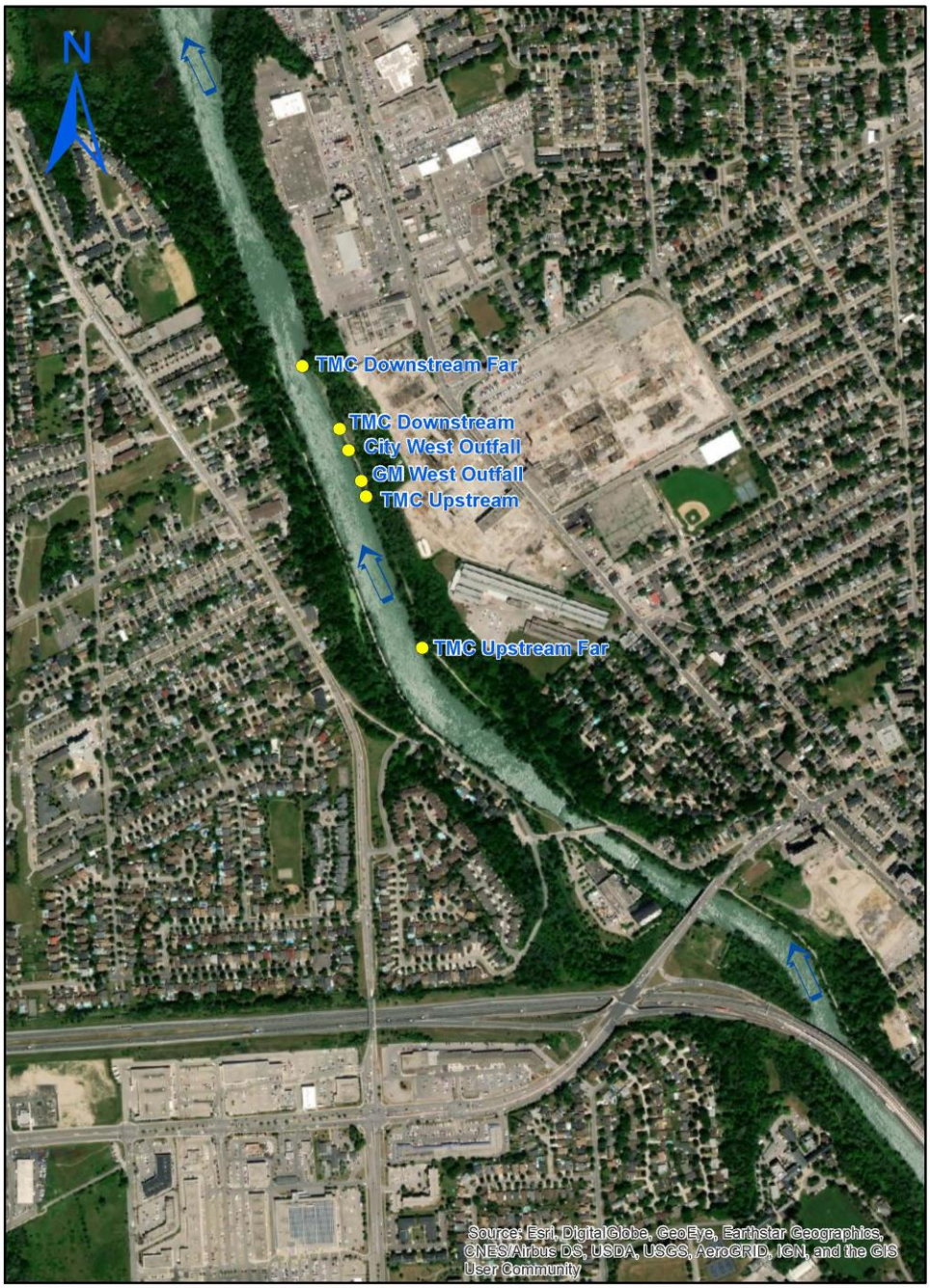

Figure 1: Twelve Mile Creek Sampling near GM Property St. Catharines

5.0 Lab Analysis

The surface water quality samples were analyzed at the MECP lab for general chemistry (including suspended solids), metals, volatile organic compounds (VOC), acid base neutrals (semi-volatiles), polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB). The wide range of analysis was chosen to be consistent with previous GM reports completed for the former GM Property.

6.0 Surface Water Quality Sampling Results

The following sections provide the sampling results and interpretation for the snow melt, dry and rain sampling events.

6.1 Snow Melt Event February 13, 2020 Results

The snow melt event sampling was completed on February 13, 2020 for all sampling locations. The snow melt event had created runoff since the GM West Outfall and the City West Outfall were discharging. As well, the average daily temperature was above freezing (Environment Canada's St. Catharines Airport Met Station Id. 6137304).

The Lower Twelve Mile Creek flow on February 13, 2020 was approximately 165.8 m^3/s (165,800 L/s) based on the St. Lawrence Seaway Management Corporation recorded flow diversion from the Welland Canal system to the Decew Generating Station (Frick, personal communication 2020a).

The snow melt event sampling results are contained in Table 1 and discussed below.

(i) General Chemistry Results

Higher alkalinity results were recorded at the GM West Outfall (188 mg/L) and the City West Outfall (242 mg/L) in comparison to the Twelve Mile Creek upstream (102 and 103 mg/L) and downstream (101, 103 and 103 mg/L) locations. Alkalinity is a measure of a water's capacity to neutralize an acid. The PWQO states that "Alkalinity should not be decreased by more than 25% of the natural concentration." The Twelve Mile Creek downstream locations results were similar to the upstream locations results.

Higher conductivity results were recorded at the GM West Outfall (899 uS/cm) and the City West Outfall (5370 uS/cm) in comparison to the Twelve Mile Creek upstream (341 and 344 uS/cm) and downstream (348, 351 and 352 uS/cm) locations. There is no PWQO for conductivity. Conductivity serves as a control parameter and is an indicator of water quality changes since it is relatively sensitive to variations in dissolved solids concentrations. The higher conductivity results at the GM West Outfall and the City West Outfall likely reflect the higher dissolved solids concentrations. Urban runoff is expected to have elevated levels of solids from roads and construction sites (MOE,

2003a). As well, the higher dissolved solids concentrations likely reflect the snow melt containing road salt. It is estimated that 97% of road salt used in Canada is in the form of sodium chloride (CCME, 2011). The sodium results for the GM West Outfall (59.4 mg/L) and the City West Outfall (954 mg/L) were also elevated in comparison to Twelve Mile Creek (17.5 to 19.9 mg/L).

The pH results were all within the PWQO range at all the sampling locations.

Overall, the snow melt event general chemistry results are not considered a surface water concern.

(ii) Metals Results

The GM West Outfall cadmium and iron results exceeded the PWQO. As well, the City West Outfall aluminum, chromium, cobalt, copper, iron and zinc results exceeded the PWQO.

Aluminum - The City West Outfall aluminum result (167 ug/L) exceeded the PWQO (75 ug/L). However, the result was less than observed urban stormwater aluminum concentrations (1200 to 2500 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The aluminum result was also within the range of wet event results for typical urban neighbourhoods in St. Catharines (135 to 528 ug/L at Walkers Creek at Lakeshore Road and Spring Garden Creek at Lakeshore Road) (Benoit and Dove, 2010). The result was also less than wet event results at the upstream reference site Twelve Mile Creek at 1st Street Louth (651 and 950 ug/L) (Benoit and Dove, 2010). The Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010) also identified that aluminum is likely found naturally at elevated levels in the watershed due to geological features. The Twelve Mile Creek upstream and downstream locations results were all less than the PWQO.

Cadmium – The GM West Outfall cadmium result (0.817 ug/L) exceeded the PWQO. (0.2 ug/L). However, the result was less than observed urban stormwater cadmium concentrations (1 to 24 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The cadmium result was only slightly higher than the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 0.732 ug/L at Walkers Creek and Spring Garden Creek at Lakeshore Road) (Benoit and Dove, 2010). The Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limit (<0.8 ug/L).

Chromium - The City West Outfall chromium result (2.42 ug/L) exceeded the PWQO (1 ug/L). However, the result was only slightly higher than the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 2.32 ug/L at Walkers Creek and Spring Garden Creek at Lakeshores Road) (Benoit and Dove, 2010). The Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limit (<1 ug/L).

Cobalt - The City West Outfall cobalt result (2.24 ug/L) exceeded the PWQO (0.9 ug/L). The MECP Stormwater Manual (MOE, 2003a) does not contain cobalt in the list of observed urban stormwater concentrations. The Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limit (<1 ug/L).

Copper - The City West Outfall copper result (35.2 ug/L) exceeded the PWQO (5 ug/L). However, the result was less than observed urban stormwater copper concentrations (45 to 460 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The Twelve Mile Creek upstream and downstream locations results were all less than the PWQO.

Iron - The GM West Outfall iron result (332 ug/L) slightly exceeded the PWQO (300 ug/L) and the City West Outfall iron result (391 ug/L) exceeded the PWQO. However, the results were less than observed urban stormwater iron concentrations (2700 to 7200 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The GM West Outfall result was within the range of wet event results for typical urban neighbourhoods in St. Catharines (106 to 340 ug/L at Walkers Creek and Spring Garden Creek at Lakeshore Road)(Benoit and Dove, 2010), while the City West Outfall result was only slightly higher. The results were less than wet event results at the upstream reference site Twelve Mile Creek at 1st Street Louth (582 and 1070 ug/L) (Benoit and Dove, 2010). The Twelve Mile Creek upstream and downstream locations results were all less than the PWQO.

Zinc - The City West Outfall zinc result (93.3 ug/L) exceeded the PWQO (30 ug/L). However, the result was less than observed urban stormwater zinc concentrations (140 to 260 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The Twelve Mile Creek upstream and downstream locations results were all less than the PWQO.

Overall, the snow melt event metals results were within typical ranges for urban stormwater.

(iii) Volatile Organic Compounds Results

The GM West Outfall VOC results for cis-1,2-dichloroethene (0.3 ug/L), tetrachloroethene (0.2 ug/L) and trichloroethene (0.7 ug/L) were all less than their PWQO (200, 50 and 20 ug/L respectively).

The City West Outfall VOC results for toluene (0.4 ug/L), bromodichloromethane (0.5 ug/L) and tetrachloroethene (0.4 ug/L) were all less than their PWQO (0.8, 200 and 50 ug/L respectively).

The Twelve Mile Creek upstream and downstream locations VOC results were all non-detect at the method detection limit.

Overall, the snow melt event VOC results are not considered a surface water concern.

(iv) Acid Base Neutral (Semi-Volatile) Results

The GM West Outfall acid base neutral results were all non-detect at the method detection limit. The Twelve Mile Creek upstream and downstream sampling locations acid base neutral results were all non-detect at the method detection limit.

The City West Outfall acid base neutral results for 4-nitrophenol (0.9 ug/L) and camphene (0.6 ug/L) were less than their PWQO (50 and 2 ug/L respectively).

Overall, the snow melt event acid base neutral results are not considered a surface water concern.

(v) Polycyclic Aromatic Hydrocarbons Results

The GM West Outfall PAH results were all non-detect at the method detection limit. As well, the Twelve Mile Creek upstream and downstream locations were all non-detect at the method detection limit.

The City West Outfall had five detections of PAHs (benzo(a)pyrene, chrysene, fluoranthene, phenanthrene and pyrene) that either exceeded the PWQO and/or CWQG.

Benzo(a)pyrene - The City West Outfall benzo(a)pyrene result (33 ng/L) exceeded the CWQG (15 ng/L). However, the result was less than the Carter Creek Park Upstream maximum result (110 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater concentrations from residential feeder streets (mean 290 ng/L) and collector streets (mean 620 ng/L) (Selbig, 2009).

Chrysene - The City West Outfall chrysene result (93 ng/L) exceeded the PWQO (0.1 ng/L). However, the result was less than the Carter Creek Park Upstream maximum result (140 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater concentrations from residential feeder streets (mean 230 ng/L) and collector streets (mean 660 ng/L) (Selbig, 2009).

Fluoranthene – The City West Outfall fluoranthene result (210 ng/L) exceeded the PWQO (0.8 ng/L) and the more recently developed CWQG (40 ng/L). However, the result was less than the Carter Creek Park Upstream maximum result (440 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater from residential feeder streets (mean 640 ng/L) and collector streets (mean 1720 ng/L) (Selbig, 2009).

Phenanthrene – The City West Outfall phenanthrene result (130 ng/L) exceeded the PWQO (30 ng/L), however, it was less than the more recently developed CWQG (400 ng/L). In addition, the result was less than the Carter Creek Park Upstream maximum

result (220 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). The result was also less than typical urban stormwater from residential feeder streets (mean 310 ng/L) and collector streets (mean 780 ng/L) (Selbig, 2009).

Pyrene – The City West Outfall pyrene result (180 ng/L) exceeded the CWQG (25 ng/L). However, the result was less than the Carter Creek Park Upstream maximum result (330 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater from residential feeder streets (mean 500 ng/L) and collector streets (mean 1250 ng/L) (Selbig, 2009).

Overall, the snow melt event PAH results were within typical ranges for urban stormwater.

(vi) Polychlorinated Biphenyls Results

A discussion of the PCB results is provided in Section 7.0. It should be noted that the GM West Outfall total PCB result has been corrected in Table 1 since the previous MECP memorandum (Spencer, 2020) contained an error.

6.2 Dry Event September 23, 2020 Results

The dry event sampling was completed on September 23, 2020 at all sampling locations except the GM West Outfall. The GM West Outfall was not discharging so it was not sampled. The Niagara Peninsula Conservation Authority's Port Dalhousie Wastewater Treatment Plant precipitation gauge recorded zero precipitation from September 14 to 23.

The Lower Twelve Mile Creek flow on September 23, 2020 was approximately 187.0 m^3/s (187,000 L/s) based on the St. Lawrence Seaway Management Corporation recorded flow diversion from the Welland Canal system to the Decew Generating Station (Frick, personal communication 2020b).

The dry event sampling results are contained in Table 2 and discussed below.

(i) General Chemistry Results

The City West Outfall and Twelve Mile Creek upstream and downstream locations results for alkalinity, conductivity and solids were all relatively similar.

The pH results were within the PWQO range at all the sampling locations.

Overall, the dry event general chemistry results are not considered a surface water concern.

(ii) Metals Results

The City West Outfall metals results were all either non-detect at the method detection limit or less than the PWQO, except aluminum. The Twelve Mile Creek upstream and downstream locations results were all either non-detect at the method detection limit or less than the PWQO, except aluminum.

Aluminum - The City West Outfall aluminum result (81.3 ug/L) slightly exceeded the PWQO (75 ug/L). However, the result was less than dry event results for typical urban neighbourhoods in St. Catharines (103 ug/L at Walkers Creek and 193 ug/L at Spring Garden Creek at Lakeshore Road) (Benoit and Dove, 2010). The result was also less than the dry event results at the upstream reference site Twelve Mile Creek at 1st Street Louth (173 and 273 ug/L) (Benoit and Dove, 2010). Benoit and Dove (2010) also identified that aluminum is likely found naturally at elevated levels in the watershed due to geological features. The result was less than the upstream Twelve Mile Creek results.

The Twelve Mile Creek upstream (91.1 and 131 ug/L) and downstream (102, 127 and 133 ug/L) results also exceeded the PWQO.

Overall, the dry event metals results were within typical ranges for dry event urban surface water.

(iii) Volatile Organic Compounds Results

The City West Outfall VOC results were all non-detect at the method detection limits. As well, the Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limits.

Overall, the dry event VOC results are not considered a surface water concern.

(iv) Acid Base Neutral (Semi-Volatile) Results

The City West Outfall acid base neutral results were all non-detect at the method detection limits. As well, the Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limits.

Overall, the dry event acid base neutral results are not considered a surface water concern.

(v) Polycyclic Aromatic Hydrocarbons Results

The City West Outfall PAH results were all non-detect at the method detection limit. As well, the Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limit.

Overall, the dry event PAH results are not considered a surface water concern.

(vi) Polychlorinated Biphenyls Results

A discussion of the PCB results is provided in Section 7.0.

6.3 Rain Event October 20, 2020 Results

The rain event sampling was completed on October 20, 2020 at all sampling locations. The Niagara Peninsula Conservation Authority's Port Dalhousie Wastewater Treatment Plant precipitation gauge recorded 15.25 mm of precipitation in the 24 hours prior to sampling.

The Lower Twelve Mile Creek flow on September 23, 2020 was approximately 217.3 m^3/s (217,300 L/s) based on the St. Lawrence Seaway Management Corporation recorded flow diversion from the Welland Canal system to the Decew Generating Station (Frick, personal communication 2020c).

The rain event sampling results are contained in Table 3 and discussed below.

(i) General Chemistry Results

Higher alkalinity results were recorded at the GM West Outfall (133 mg/L) and the City West Outfall (214 mg/L) in comparison to the Twelve Mile Creek upstream (97 and 98.4 mg/L) and downstream (96.7, 96.9 and 97.6 mg/L) locations. The PWQO states that "Alkalinity should not be decreased by more than 25% of the natural concentration." The Twelve Mile Creek downstream locations results were similar to the upstream locations results.

Higher conductivity results were recorded at the GM West Outfall (525 uS/cm) and the City West Outfall (1380 uS/cm) in comparison to the Twelve Mile Creek upstream (290 and 292 uS/cm) and downstream (289, 290 and 291 uS/cm) locations. Conductivity is an indicator of water quality changes since it is relatively sensitive to variations in dissolved solids concentrations. Higher dissolved solids results were recorded at the GM West Outfall (336 mg/L) and the City West Outfall (857 mg/L) in comparison to the Twelve Mile Creek upstream (168 and 172 mg/L) and downstream (164, 167 and 167 mg/L) locations. As such, the higher conductivity results at the GM West Outfall and City West Outfall reflect the higher dissolved solids concentrations in stormwater.

The pH results were all within the PWQO range at all the sampling locations.

Overall, the rain event general chemistry results are not a surface water concern.

(ii) Metals Results

The GM West Outfall and the City West outfall chromium and copper results exceeded the PWQO. The Twelve Mile Creek upstream and downstream locations aluminum results exceeded the PWQO. As previously discussed, Benoit and Dove (2010) identified

that aluminum is likely found naturally at elevated levels in the watershed due to geological features.

Chromium - The GM West Outfall chromium result (1.26 ug/L) slightly exceeded the PWQO (1 ug/L) while the City West Outfall result (2.37 ug/L) exceeded the PWQO. The City West Outfall result was only slightly higher than the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 2.32 ug/L at Walkers Creek and Spring Garden Creek at Lakeshores Road) (Benoit and Dove, 2010). The Twelve Mile Creek upstream and downstream locations results were all non-detect at the method detection limit (<1 ug/L).

Copper - The GM West Outfall copper result (7.08 ug/L) and City West Outfall result (8.46 ug/L) exceeded the PWQO (5 ug/L). However, the results were less than observed urban stormwater copper concentrations (45 to 460 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The GM West Outfall result was within the range of wet event results for typical urban neighbourhoods in St. Catharines (2.53 to 7.83 ug/L at Walkers Creek and Spring Garden Creek at Lakeshores Road) (Benoit and Dove, 2010), while the City West Outfall result was only slightly higher. The Twelve Mile Creek upstream and downstream locations results were all less than the PWQO.

Overall, the rain event metals results were within typical ranges for urban stormwater.

(iii) Volatile Organic Compounds Results

The GM West Outfall and the City West Outfall VOC results were all non-detect at the method detection limits. As well, the Twelve Mile Creek upstream and downstream sampling locations results were all non-detect at the method detection limits.

Overall, the rain event VOC results are not a surface water concern.

(iv) Acid Base Neutral (Semi-Volatile) Results

The GM West Outfall and City West Outfall acid base neutral results were all non-detect at the method detection limits. As well, the Twelve Mile Creek upstream and downstream sampling locations results were non-detect at the method detection limit.

Overall, the rain event acid base neutral results are not a surface water concern.

(v) Polycyclic Aromatic Hydrocarbons Results

The GM outfall results had three PAH detections. The benzo(a)pyrene result (4 ng/L) was less than the CWQG (15 ng/L). The fluoranthene result (13 ng/L) exceeded the PWQO (0.8 ng/L), however, it was less than the more recently developed CWQG (40 ng/L). The pyrene result (12 ng/L) was less than the CWQG (25 ng/L).

The City West Outfall PAH results were all non-detect at the method detection limits. As well, the Twelve Mile Creek upstream and downstream sampling locations results were all non-detect at the method detection limits.

Overall, the rain event PAH results are not a surface water concern.

(vi) Polychlorinated Biphenyls Results

A discussion of the PCB results is provided in Section 7.0.

7.0 Overall PCB Sampling Results

7.1 Twelve Mile Creek PCB Results

The Twelve Mile Creek dry event total PCB results for upstream locations (0.1 and 0.3 ng/L) and downstream locations (0.1, 0.2 and 0.2 ng/L) were all less than the PWQO.

The Twelve Mile Creek snow melt event total PCB results for upstream locations (0.1 and 0.1 ng/L) and downstream locations (non-detect) were all less than the PWQO.

The Twelve Mile Creek rain event total PCB results for upstream locations (0.4 and 0.6 ng/L) and downstream locations (0.3, 0.3 and 0.5 ng/L) were all less than the PWQO.

The Twelve Mile Creek total PCB results were all less than the PWQO and would not be considered a surface water concern. That being said, a noticeable increase in PCB concentration in Twelve Mile Creek from these storm sewer outfalls is not anticipated since the concentration in Twelve Mile Creek would likely be dominated by its very large flow in comparison to the much smaller flow from the storm sewer outfalls.

7.2 City West Outfall PCB Results

The City West Outfall dry event total PCB result (0.9 ng/L) was slightly less than the PWQO (1 ng/L), less than the PCB Threshold (10 ng/L) and within the range of Twelve Mile Creek non-source sites for dry events (0.8 to 3.9 ng/L, average 2.0 ng/L) (Benoit et al., 2016).

The snow melt and rain events total PCB results can be assessed together as a wet event. For the snow melt event, the City West Outfall result (11.0 ng/L) exceeded the PWQO (1 ng/L) and slightly exceeded the PCB Threshold (10 ng/L). For the rain event, the City West Outfall result (9.3 ng/L) exceeded the PWQO, however, it was slightly less than the PCB Threshold. Both results were within the range of Twelve Mile Creek non-source sites for wet events (1.5 to 22.4 ng/L, average 9.5 ng/L) (Benoit et al., 2016). Based on the snow melt and rain events results, the average wet event total PCB concentration is 10.1 ng/L which only very slightly exceeds the PCB Threshold.

Generally, based on the three sampling events total PCB results, the City West Outfall would be considered a non-source and reflect typical urban area concentrations.

7.3 GM West Outfall PCB Results

Generally, PCBs are typically more prevalent during runoff events in urban areas since they are hydrophobic and strongly sorb to suspended solids. The GM West Outfall was not discharging during the dry event sampling. As such, it is not considered a continuous PCB source and is considered runoff event driven.

The snow melt and rain events total PCB results can be assessed together as wet events. For the snow melt event, the GM West Outfall result (15.6 ng/L) exceeded the PWQO (1 ng/L) and exceeded the PCB Threshold (10 ng/L). However, the result was within the range of Twelve Mile Creek non-source sites for wet events (1.5 to 22.4 ng/L, average 9.5 ng/L) (Benoit et al., 2016). For the rain event, the GM West Outfall total PCB result (23.7 ng/L) exceeded the PWQO and exceeded the PCB Threshold. The result was also slightly higher than the range of Twelve Mile Creek non-source sites for wet events. Based on the snow melt and rain events results, the average wet event total PCB concentration is 19.7 ng/L which exceeds the PCB Threshold, however, it is within the range of Twelve Mile Creek non-source sites for wet events (1.5 to 22.4 ng/L) (Benoit et al., 2016).

Benoit et al. (2016) developed a water quality PCB Threshold to differentiate potential source areas from background PCB conditions in urban areas using a minimum of three rain events to confirm the consistency of the results. It identified that event-based water quality sampling is a useful component of PCB assessments if used with other lines of evidence that provide evidence of exposure (ie. exposed biota such as mussels or passive samplers). Event based water quality sampling is limited since it only represents conditions at the time of sampling and may not reflect long term conditions. However, sampling on various occasions would identify a range of conditions that may exist with some consistency. Generally, two wet event sample results are not statistically definitive. However, the GM West Outfall was also sampled on six occasions during the Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010) and the average results were relatively consistent with the two collected for this study. An additional sample was collected on December 1, 2020 to confirm that current conditions at the site have not changed the average PCB concentrations observed in this discharge and the results will be provided in an addendum to this report.

From an overall Twelve Mile Creek watershed remediation perspective, the GM West Outfall total PCB results can be compared to other tributaries in various stages of remediation as follows.

(i) Significant contamination was previously identified in the Beaverdams Creek and Lake Gibson area with average concentrations up to approximately 200 ng/L at some sampling locations (Benoit, personal communication 2020). As such, remediation of two sources of contaminated sediment in Beaver Dams Creek has resulted in the removal of 23,109 metric tonnes of PCB contaminated sediment along 1750 m of creek over three cleanup phases (Benoit et al., 2016)

(ii) Clifford Creek results had an average dry event concentration of 88 ng/L (range of 15 to 167 ng/L) and average wet event concentration of 458 ng/L (range of 144 to 795 ng/L) (Benoit and Dove, 2010). These concentrations were related to the Clifford Creek Park which is a former landfill site. The City has outlined a remediation workplan to address the elevated PCB concentrations from the Clifford Creek Park (City of St. Catharines, 2019).

(iii) Carter Creek results had an average dry event concentration of 32 ng/L (range of 25 to 46 ng/L) and average wet event concentration of 93 ng/L (range of 50 to 131 ng/L) (Benoit and Dove, 2010). These concentrations were related to the Garden City Golf Course which is a former landfill site. The City has outlined a workplan to investigate potential PCB sources at the Garden City Golf Course (AECOM, 2018).

In comparison to these Twelve Mile Creek tributaries, the GM West Outfall results are considered a less significant source. The GM West Outfall is not considered a continuous source like these other tributaries. The GM West Outfall total PCB average wet event concentration is 19.7 ng/L versus 458 ng/L and 93 ng/L as noted for Clifford and Carter Creeks respectively. As well, it is anticipated that the PCB loading (kg/day) from the GM West Outfall to Twelve Mile Creek would be less as it is not a continuous discharge, is anticipated to have smaller discharge flows and the average wet event PCB concentration is less.

The PCB results can also be assessed for congener patterns. PCB congeners are any of 209 different molecules of varying degrees of chlorination that are found in PCB mixtures such as Aroclors. The water quality samples were analyzed by the MECP lab using a congener-specific PCB analysis method. From these results, congener patterns can be compared for similarities between sample events and sites. Congener-specific methods can differentiate between sources despite the degradation and weathering of the original PCB mixtures. As well, a comparison of congener profiles between sites can indicate whether the PCB originate from a common source based on data and visual “fingerprinting” (Benoit et al., 2016).

The Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010) included surface water quality results in Twelve Mile Creek at the GM Outfall (Station 206) in 2003. Station 206 is the same outfall location as the GM West Outfall in this assessment, however, Station 206 discharged non-contact cooling water and stormwater at that time. In 2003, Station 206 had a total PCB average of 34 ng/L for wet events and 10 ng/L for dry events. Congener patterns at Station 206 showed a distinct pattern that resembled those of Aroclors 1242 and 1248 which suggested a distinct source from the outfall. In 2000, Station 206 showed an increase in PCB concentrations in caged mussels relative to upstream sites which suggested that PCBs were contributing to exposure at this location. However, caged mussel results at Station 206 in 2003 did not provide a meaningful assessment since most concentrations were below quantification limits. In 2004, General Motors of Canada Ltd. (Spencer, 2004) assessed the plant’s storm sewer discharges as requested by the Ontario Ministry of Environment. GM identified that the plant’s storm sewer discharges were similar to upstream background concentrations in Twelve Mile Creek.

A comparison of congener patterns between the sampling locations can provide an indication of similarities (ie. signatures) and whether the PCB originate from a common source. As an additional assessment, congener patterns between events were compared for locations at which total PCB concentrations exceeded background conditions; the congener patterns were assessed against typical congener profiles for common Aroclors (Figure 2) (Benoit, personal communication 2020).

The GM West Outfall patterns for the snow melt and rain events are relatively similar, however, shifts in peaks of certain congeners may suggest an influence of suspended solids, or weathering of PCBs may have influenced congener profiles between sampling events. Suspended solids concentrations were low during the rain event (2.2 mg/L) suggesting minimal association of the PCBs with suspended solids, and a congener pattern that resembled a mixture of Aroclor 1242 and 1248. Congener patterns during the snow melt event resembled a mixture that included peaks resembling Aroclor 1254, however, the lack of suspended solids collection during the snow melt event preclude any further interpretation. It should also be noted that Aroclors 1242 and 1248 were also noted in samples collected in 2003 at Twelve Mile Creek at the GM Outfall (Benoit and Dove, 2010).

The City West Outfall congener patterns are relatively consistent for both events and suggest a mixture of Aroclors 1254 and 1248 that is different from that found at the GM West Outfall (Benoit, personal communication 2020).

Overall, the congener patterns between the GM West Outfall and the City West Outfall appear different which suggests two different signatures or two different sources. (Benoit, personal communication 2020)

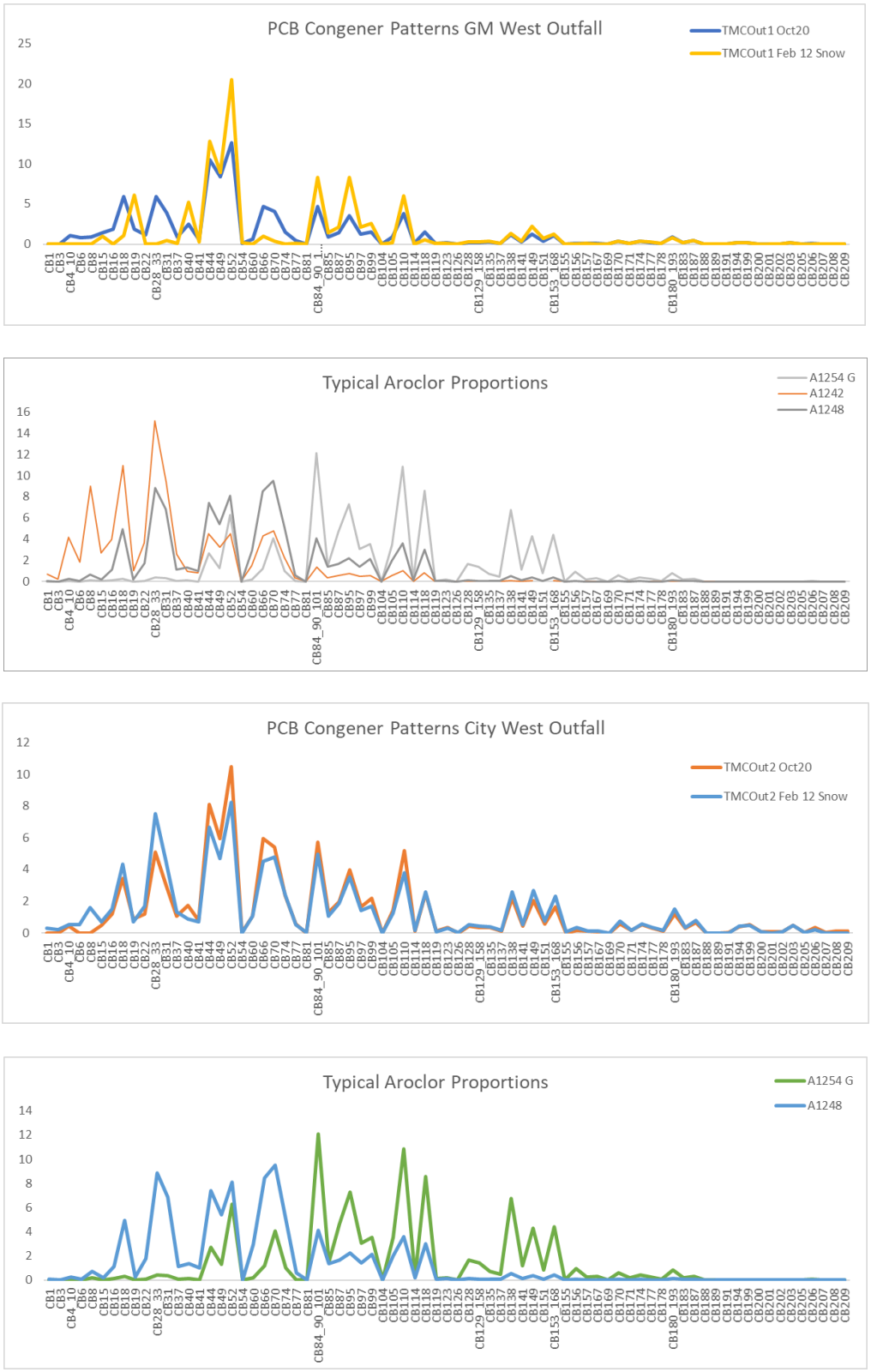

Figure 2: PCB Congener Patterns

PCB congener pattern distribution (%) during snow melt and rain events at GM West Outfall and City West Outfall. PCB congener pattern distributions (%) for Aroclors 1242, 1248 and 1254 presented for comparison purposes since they most closely resembled patterns at these locations. (Benoit, 2020)

8.0 Conclusions

The City of St. Catharines requested that the MECP assess any potential offsite environmental impacts including surface water from the former General Motors property located at 285 Ontario Street in the City of St. Catharines. As such, MECP Technical Support Surface Water completed surface water quality sampling of a former GM storm sewer outfall (GM West Outfall), a City storm sewer outfall (City West Outfall), and various upstream and downstream locations on Twelve Mile Creek. Surface water quality sampling was completed during a snow melt event on February 13, 2020, a dry event on September 23, 2020 and a rain event on October 20, 2020.

Overall, the GM West Outfall and City West Outfall general chemistry, metals, volatile organic compounds (VOC), acid base neutral (semi-volatile) and polycyclic aromatic hydrocarbons (PAH) results are not considered a surface water concern or were within typical ranges for urban stormwater.

MECP Technical Support Groundwater (Awad, personal communication 2020) also completed a review of previous reports and identified that there were no groundwater concerns. The review identified that predicted surface water concentrations in Twelve Mile Creek from the discharge of groundwater from the former GM property and slope area were very unlikely to exceed current Aquatic Protection Values. This is consistent with MECP surface water quality sampling results.

The Twelve Mile Creek total PCB results were all less than the PWQO and would not be considered a surface water concern. As well, the City West Outfall total PCB results would be considered a non-source and reflect typical urban area concentrations.

The GM West Outfall total PCB wet event average concentration exceeded the PWQO and the PCB Threshold. However, it is within the range of Twelve Mile Creek non-source sites for wet events. In comparison to other Twelve Mile Creek tributaries in various stages of PCB remediation, the GM West Outfall is considered a less significant source. The GM West Outfall congener signature is relatively different than the City West Outfall signature which suggests different sources.

9.0 Next Steps

The MECP completed additional PCB and solids sampling at the GM West Outfall and City West Outfall on December 1, 2020. The MECP will complete an addendum to this Technical Memorandum to provide and interpret the additional sampling results.

In addition, the MECP recently became aware of a storm sewer associated with the former GM East Tilt Plate Separator that is connected to the City storm sewer on Lowell Avenue which eventually outlets to Twelve Mile Creek. The East Tilt Plate Separator storm sewer was not identified in the GM Utilities report (CH2M Hill, 2012). On November 23, 2020, the MECP completed sampling of a storm sewer manhole associated with the former East Tilt Plate Separator, a City storm sewer manhole before the outlet to Twelve Mile Creek and Twelve Mile

Creek upstream and downstream of the City outfall. The City outfall was not sampled since it was partially underwater due to the water level of Twelve Mile Creek. The samples will be analysed by the MECP lab for all the parameters discussed in this memorandum. Results and interpretation will be provided in the addendum to the Technical Memorandum.

The Niagara District Office has requested that the current owner of the former GM property update the stormwater works (ie. Tilt Plate Separator) when the development of the property resumes. I am supportive of this action as it will include a consideration to control the source of PCBs on the property to decrease the concentration discharging to Twelve Mile Creek.

10.0 Acknowledgements

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Tables

Table 1: Snow Melt Event February 13, 2020 Sampling Results

General Chemistry	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Alkalinity (CaCO3)	mg/L		103	102	188	242	103	103	101
Conductivity	uS/cm		344	341	899	5370	351	348	352
pH		6.5 - 8.5	8.16	8.16	8.18	7.75	8.18	8.18	8.18

Metals	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Arsenic	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Antimony	mg/L	0.02	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silver	ug/L	0.1	<9	<9	<9	<9	<9	<9	<9
Aluminum	ug/L	75	52.5	54.3	41.7	167	62.4	70.6	53.1
Barium	ug/L		22.5	22.5	36.2	62.7	22.7	22.7	23
Beryllium	ug/L	1100	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	ug/L		<5	<5	<5	<5	<5	<5	<5
Calcium	mg/L		37.5	37.4	102	100	37.6	37.7	35.3
Cadmium	ug/L	0.2	<0.8	<0.8	0.817	<0.8	<0.8	<0.8	<0.8
Cobalt	ug/L	0.9	<1	<1	<1	2.24	<1	<1	<1
Chromium	ug/L	1	<1	<1	<1	2.42	<1	<1	<1
Copper	ug/L	5	2.18	2.23	4.85	35.2	2.25	2.23	1.91
Iron	ug/L	300	52.9	53.2	332	391	56.2	59.8	51.3
Hardness	mg/L		133	133	354	349	135	134	129
Potassium	mg/L		1.56	1.57	9.89	8.37	1.6	1.58	1.59
Lithium	ug/L		7.28	7.48	16.2	25.4	6.31	5.99	<5
Magnesium	mg/L		9.65	9.62	24.1	24.1	10.1	9.67	9.83
Manganese	ug/L		3.05	3.03	31.7	67.7	3.09	3.13	2.86
Molybdenum	ug/L	40	<2	<2	<2	<2	<2	<2	<2
Sodium	mg/L		17.8	17.5	59.4	954	19.9	19.1	19.5
Nickel	ug/L	25	<2	<2	3.7	11.5	<2	<2	<2
Lead	ug/L	25	<7	<7	<7	<7	<7	<7	<7
Tin	ug/L		<9	<9	<9	<9	<9	<9	<9
Strontium	ug/L		207	208	702	593	209	210	209
Titanium	ug/L		1.44	1.64	1.38	0.984	1.9	2.01	1.6
Uranium	ug/L	5	<3	<3	<3	<3	<3	<3	<3
Vanadium	ug/L	6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	ug/L	30	2.38	2.22	20.2	93.3	2.76	7.07	2.49
Zirconium	ug/L	4	<1	<1	<1	<1	<1	<1	<1

Exceeds PWQO and/or CWQG

Note: "<value" means less than the method detection limit

Volatile Organic Compounds	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
1,2-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2,4-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2,3-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,3,5-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzene	ug/L	100	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Isopropyl benzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	ug/L	8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m- and p-xylene	ug/L	2, 30	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	ug/L	40	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Isopropyl toluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Styrene	ug/L	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	ug/L	0.8	<0.2	<0.2	<0.2	**0.4**	<0.2	<0.2	<0.2
3-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
4-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromofluorobenzene	ug/L		**13**	**12**	**12**	**12**	**12**	**11**	**11**
d8-toluene	ug/L		**11**	**11**	**10**	**11**	**10**	**10**	**10**
Diisopropylether	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluorobenzene	ug/L		**5**	**5**	**5**	**5**	**5**	**5**	**5**
Methyl isobutyl ketone	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tert-butyl methyl ether	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Propylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetra-amyl-methyl ether	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,1-trichloroethane	ug/L	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2,2-tetrachloroethane	ug/L	70	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,1,2-tetrachloroethane	ug/L	20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-trichloroethane	ug/L	800	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-dichloroethane	ug/L	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-dichloroethene	ug/L	40	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dichloroethane	ug/L	100	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dichloropropane	ug/L	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
cis-1,3-dichloropropene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,3-dichloropropene	ug/L	7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromodichloromethane	ug/L	200	<0.2	<0.2	<0.2	**0.5**	<0.2	<0.2	<0.2
Bromomethane	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	ug/L	60	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane	ug/L		<0.2	<0.2	<0.2	**0.2**	<0.2	<0.2	<0.2
cis-1,2-dichloroethene	ug/L	200	<0.2	<0.2	**0.3**	<0.2	<0.2	<0.2	<0.2
Chloroethane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	ug/L	700	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	ug/L		<0.2	<0.2	<0.2	**1.6**	<0.2	<0.2	<0.2
Carbon tetrachloride	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dichlorodifluoromethane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichloromethane	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-dichloroethene	ug/L	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	ug/L	50	<0.2	<0.2	**0.2**	**0.4**	<0.2	<0.2	<0.2
Trichloroethene	ug/L	20	<0.2	<0.2	**0.7**	<0.2	<0.2	<0.2	<0.2
Chloroethene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dichlorobenzene	ug/L	2.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-dichlorobenzene	ug/L	2.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-dichlorobenzene	ug/L	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	ug/L	15	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dibromoethane	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trihalomethanes; total	ug/L		<0.2	<0.2	<0.2	**2.4**	<0.2	<0.2	<0.2
Xylenes; total	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Acid Base Neutrals (Semi-Volatiles)	Units	PWQO *CWQG*	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Diphenylamine	ug/L	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrotoluene	ug/L	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	ug/L	10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	ug/L		<10	<10	<10	<10	<10	<10	<10
2,6-dichlorophenol	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-dinitrotoluene	ug/L	6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4,6-dinitro-o-cresol	ug/L	0.2	<10	<10	<10	<10	<10	<10	<10
4-bromophenyl-phenyl ether	ug/L	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-chlorophenyl-phenyl ether	ug/L	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-nitrophenol	ug/L	50	<0.5	<0.5	<0.5	**0.9**	<0.5	<0.5	<0.5
Bis(2-chloroethyl)ether	ug/L	200	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethoxy)methane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroisopropyl)ether	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Butylbenzylphthalate	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis-2-ethylhexylphthalate	ug/L		<10	<10	<10	<10	<10	<10	<10
Camphene	ug/L	2	<0.5	<0.5	<0.5	**0.6**	<0.5	<0.5	<0.5
Di-n-butylphthalate	ug/L	19	<10	<10	<10	<10	<10	<10	<10
Di-n-octylphthalate	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diphenyl ether	ug/L	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
m-cresol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
N-nitroso-di-n-propylamine	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
o-cresol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
p-chloro-m-cresol	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
p-cresol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenol	ug/L	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1-chloronaphthalene	ug/L	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1-methylnaphthalene	ug/L	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-chloronaphthalene	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methylnaphthalene	ug/L	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
5-nitroacenaphthene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/L	***5.8***	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	ug/L	0.0008	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)anthracene	ug/L	0.0004	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	ug/L	***0.015***	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Biphenyl	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	ug/L	0.0002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	ug/L	0.0001	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzo(a,h)anthracene	ug/L	0.002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	ug/L	0.0008	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	ug/L	0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indole	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	ug/L	7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perylene	ug/L	0.00007	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	ug/L	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	ug/L	***0.025***	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-chlorophenol	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,5-tetrachlorophenol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,6-tetrachlorophenol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,5-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,5,6-tetrachlorophenol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

2,4,6-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Polycyclic Aromatic Hydrocarbons	Units	PWQO *CWQG*	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
1-methylnaphthalene	ng/L	2000	<10	<10	<10	<50	<10	<10	<10
2-methylnaphthalene	ng/L	2000	<10	<10	<10	<50	<10	<10	<10
Acenaphthene	ng/L	***5800***	<10	<10	<10	<50	<10	<10	<10
Acenaphthylene	ng/L		<10	<10	<10	<50	<10	<10	<10
Anthracene	ng/L	0.8 / ***12***	<10	<10	<10	<50	<10	<10	<10
Benz(a)anthracene	ng/L	0.4 / ***18***	<20	<20	<20	<100	<20	<20	<20
Benzo(a)pyrene	ng/L	***15***	<1	<1	<1	**33**	<1	<1	<1
Benzo(b)fluoranthene	ng/L		<10	<10	<10	**55**	<10	<10	<10
Benzo(e)pyrene	ng/L		<10	<10	<10	<50	<10	<10	<10
Benzo(k)fluoranthene	ng/L		<10	<10	<10	<50	<10	<10	<10
Chrysene	ng/L	0.1	<10	<10	<10	**93**	<10	<10	<10
Dibenz(a,h)anthracene	ng/L	2	<20	<20	<20	<100	<20	<20	<20
Fluoranthene	ng/L	0.8 / ***40***	<10	<10	<10	**210**	<10	<10	<10
Fluorene	ng/L	200 / ***3000***	<10	<10	<10	<50	<10	<10	<10
Benzo(g,h,i)perylene	ng/L	0.02	<20	<20	<20	<100	<20	<20	<20
Indeno(1,2,3-c,d)pyrene	ng/L		<20	<20	<20	<100	<20	<20	<20
Naphthalene	ng/L	7000/***1100***	<10	<10	<10	<50	<10	<10	<10
Perylene	ng/L	0.7	<10	<10	<10	<50	<10	<10	<10
Phenanthrene	ng/L	30 / ***400***	<10	<10	<10	**130**	<10	<10	<10
Pyrene	ng/L	***25***	<10	<10	<10	**180**	<10	<10	<10

Exceeds PWQO and/or CWQG

Notes: "<value" means less than the method detection limit
"bold italic criteria" means CWQG

Polychlorinated Biphenyls	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
PCB congeners; total	**ng/L**	**1**	**0.111**	**0.066**	**15.627**	**11.0231**	**<mdl**	**<mdl**	**<mdl**
2-monochloroPCB(1)	pg/L		<7.6	<6.2	<5.1	**31**	<4	<3.9	<2.2
4-monochloroPCB(3)	pg/L		<4.6	<5	<3.5	**24**	<4.5	<4	<2
2,3'-dichloroPCB(6)	pg/L		<11	<9	<8.3	**57**	<9	<10	<5
2,4'-dichloroPCB(8)	pg/L		<23	<18	<17	**180**	<17	<15	<15
4,4'-dichloroPCB(15)	pg/L		<11	<17	**150**	**81**	<13	<11	<16
2,2',3-trichloroPCB(16)	pg/L		<11	<9.1	<14	**170**	<6.6	<9.3	<6.4
2,2',5-trichloroPCB(18)	pg/L		<15	<16	**170**	**490**	<14	<15	<15
2,2',6-trichloroPCB(19)	pg/L		<7	<6	**960**	**81**	<6.4	<5.9	<4
2,3,4'-trichloroPCB(22)	pg/L		<6.2	<7.8	<7.9	**190**	<6.4	<5.8	<5.9
2,4',5-trichloroPCB(31)	pg/L		<14	<17	**73**	**510**	<15	<14	<11
3,4,4'-trichloroPCB(37)	pg/L		<7	<9.8	**18**	**150**	<4.8	<5.1	<4.8
2,2',3,3'-tetrachloroPCB(40)	pg/L		<6	<3.1	**820**	**99**	<3	<3.5	<4
2,2',3,4-tetrachloroPCB(41)	pg/L		<6	<5.1	**41**	**77**	<3	<2.5	<4
2,2',3,5'-tetrachloroPCB(44)	pg/L		<14	<15	**2000**	**750**	<11	<9.4	<11
2,2',4,5'-tetrachloroPCB(49)	pg/L		<9.3	<10	**1400**	**530**	<8.5	<6.1	<6.3
2,2',5,5'-tetrachloroPCB(52)	pg/L		<18	<27	**3200**	**930**	<13	<16	<15
2,2',6,6'-tetrachloroPCB(54)	pg/L		<4	<2	**25**	<3.5	<2	<2	<2
2,3,4,4'-tetrachloroPCB(60)	pg/L		<3.8	<7.6	<5.3	**120**	<2.6	<2.3	<1.7
2,3',4,4'-tetrachloroPCB(66)	pg/L		<7.6	<19	**150**	**510**	<7.3	<6.4	<5
2,3',4',5-tetrachloroPCB(70)	pg/L		<10	<24	**56**	**540**	<7.6	<8.1	<7.8

2,4,4',5-tetrachloroPCB(74)	pg/L		<5.7	<10	<18	**270**	<4.3	<3.8	<3.1
3,3',4,4'-tetrachloroPCB(77)	pg/L		<3	<3.8	**19**	**58**	<1.6	<1.2	<1.1
3,4,4',5-tetrachloroPCB(81)	pg/L		<1.7	<1.2	**3.9**	**4.1**	<0.9	<0.76	<0.5
PeClPCB(84)+PeCl(90)+PeCl(101)	pg/L		<17	<38	**1300**	**560**	<13	<12	<11
2,2',3,4,4'-pentachloroPCB(85)	pg/L		<2.9	<8.3	**220**	**120**	<2.9	<2.6	<1.2
2,2',3,4,5'-pentachloroPCB(87)	pg/L		<4.9	<12	**330**	**210**	<3.7	<3.5	<3.9
2,2',3,5',6-pentachloroPCB(95)	pg/L		<10	<19	**1300**	**400**	<8.7	<7.8	<8.6
2,2',3',4,5-pentachloroPCB(97)	pg/L		<4.1	<10	**330**	**160**	<2.7	<3.1	<2.9
2,2',4,4',5-pentachloroPCB(99)	pg/L		<3.9	<12	**400**	**190**	<3.7	<3.5	<2.8
2,2',4,6,6'-pentachloroPCB(104)	pg/L		<0.95	<1.3	<3	<3	<1	<0.9	<0.7
2,3,3',4,4'-pentachloroPCB(105)	pg/L		<6	<12	**29**	**140**	<2.7	<3.6	<2.8
2,3,3',4',6-pentachloroPCB(110)	pg/L		<12	<30	**940**	**430**	<8.3	<10	<8.8
2,3,4,4',5-pentachloroPCB(114)	pg/L		<2	<3.1	**5.6**	**19**	<1	<1	<0.8
2,3',4,4',5-pentachloroPCB(118)	pg/L		<8.8	**22**	**89**	**290**	<5.6	<6.3	<5.1
2,3',4,4',6-pentachloroPCB(119)	pg/L		<0.98	<0.8	**9.3**	**8.8**	<0.9	<0.7	<0.5
2',3,4,4',5-pentachloroPCB(123)	pg/L		<2.8	<4.1	**19**	**31**	<1.2	<1.4	<0.8
3,3',4,4',5-pentachloroPCB(126)	pg/L		<3.8	<2	<2	**5.2**	<1	<1	<0.9
2,2',3,3',4,4'-hexachloroPCB(128)	pg/L		<6.5	<6.1	**43**	**58**	<2.3	<1.5	<1.5
2,2',3,3',5,6'-hexachloroPCB(135)	pg/L		<4.2	<5.5	**54**	**46**	<1.9	<1.4	<1.9
2,2',3,4,4',5-hexachloroPCB(137)	pg/L		<1.7	<3.3	**11**	**16**	<2	<0.7	<0.5
2,2',3,4,4',5'-hexachloroPCB(138)	pg/L		<21	**32**	**210**	**290**	<6.8	<7.5	<6.1
2,2',3,4,5,5'-hexachloroPCB(141)	pg/L		<4.6	<6.9	**53**	**61**	<2	<1.4	<1.1
2,2',3,4',5',6-hexachloroPCB(149)	pg/L		<13	<35	**340**	**300**	<6.8	<6.4	<8.5
2,2',3,5,5',6-hexachloroPCB(151)	pg/L		<8	<12	**110**	**86**	<3	<2.6	<2.1
2,2',4,4',6,6'-hexachloroPCB(155)	pg/L		<1.1	<0.74	<0.8	**6.8**	<0.41	<0.8	<0.36
2,3,3',4,4',5-hexachloroPCB(156)	pg/L		**7.7**	<4.4	**6.5**	**37**	<2	<0.97	<1
2,3,3',4,4',5'-hexachloroPCB(157)	pg/L		<4.2	<2.7	**8.1**	**13**	<2	<0.7	<0.44
22'33'45(129)+233'44'6-HxClPCB(158)	pg/L		<6.2	<7.7	**37**	**51**	<2.4	<1.4	<1.1
2,3',4,4',5,5'-hexachloroPCB(167)	pg/L		<4.2	<2	**6.6**	**14**	<1	<0.81	<0.59
22'44'55'(153)+23'44'5'6-HxClPCB(168)	pg/L		<16	<29	**190**	**260**	<6	<5.8	<6.5
3,3',4,4',5,5'-hexachloroPCB(169)	pg/L		<2	<2	<1	<4	<2	<0.9	<0.6
2,2',3,3',4,4',5-heptachloroPCB(170)	pg/L		**27**	<8	**59**	**82**	<1.6	<1.9	<2.9
2,2',3,3',4,4',6-heptachloroPCB(171)	pg/L		<4.7	<2.8	**15**	**18**	<0.9	<0.5	<1.2
2,2',3,3',4,5,6'-heptachloroPCB(174)	pg/L		<9.9	<8.6	**60**	**63**	<2.2	<2	<2.5
2,2',3,3',4',5,6-heptachloroPCB(177)	pg/L		<6.4	<4.2	**36**	**38**	<1.5	<1.4	<1.2
2,2',3,3',5,5',6-heptachloroPCB(178)	pg/L		<3	<3.2	**13**	**19**	<0.8	<1.1	<0.52
2,2',3,4,4',5',6-heptachloroPCB(183)	pg/L		<4.4	<4.7	**33**	**36**	<1	<0.87	<1.3
2,2',3,4',5,5',6-heptachloroPCB(187)	pg/L		<7.8	**12**	**70**	**89**	<1.8	<2.2	<2
2,2',3,4',5,6,6'-heptachloroPCB(188)	pg/L		<2	<0.88	<0.52	<2	<0.5	<0.4	<0.3
2,3,3',4,4',5,5'-heptachloroPCB(189)	pg/L		<2.9	<1.6	<3	<5.1	<1.2	<0.5	<0.5
2,3,3',4,4',5',6-heptachloroPCB(191)	pg/L		<2.2	<1.2	<2.7	<4	<0.7	<0.4	<0.3
22'344'55'(180)+233'4'55'6-HpClPCB(193)	pg/L		**40**	<14	**120**	**170**	<3.5	<2.9	<4
2,2',3,3',4,4',5,5'-octachloroPCB(194)	pg/L		**16**	<4.2	**30**	**47**	<2	<2.8	<2.7
2,2',3,3',4,5,5',6'-octachloroPCB(199)	pg/L		**16**	<6	**31**	**56**	<2.1	<1.7	<2.5
2,2',3,3',4,5,6,6'-octachloroPCB(200)	pg/L		<4	<0.6	<4.4	**7.4**	<0.9	<0.6	<0.5
2,2',3,3',4,5',6,6'-octachloroPCB(201)	pg/L		<2.4	<1.9	<3.5	<6.7	<0.9	<0.6	<0.5
2,2',3,3',5,5',6,6'-octachloroPCB(202)	pg/L		<2.2	<2	<6	**9.7**	<0.94	<0.6	<0.4
2,2',3,4,4',5,5',6-octachloroPCB(203)	pg/L		**12**	<4.7	**33**	**53**	<2.5	<1.4	<1.8
2,3,3',4,4',5,5',6-octachloroPCB(205)	pg/L		<2.1	<1.1	<2	**5.1**	<1	<0.9	<0.6
22'33'44'55'6-nonachloroPCB(206)	pg/L		<6.3	<1.9	<7.5	**24**	<2	<1	<0.77
22'33'44'566'-nonachloroPCB(207)	pg/L		<1.4	<0.7	<1.3	<4.7	<1	<0.6	<0.4
22'33'455'66'-nonachloroPCB(208)	pg/L		<1.6	<2	<1.4	<6.3	<1.1	<0.7	<0.44
DecachloroPCB(209)	pg/L		<1.9	<2.9	<2.5	<7.5	<2.5	<2	<2.5
244'-triClPCB(28)+2'34-triClPCB(33)	pg/L		<26	<33	<66	**850**	<23	<21	<22
2,2'-dichloroPCB(4)+2,6-dichloroPCB(10)	pg/L		<18	<28	<26	**57**	<11	<12	<13

Exceeds PWQO and/or CWQG

Note: "<value" means less than the method detection limit

Table 2: Dry Event September 23, 2020 Sampling Results

General Chemistry	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Alkalinity (CaCO3)	mg/L		94.2	96		96.3	95.8	94.2	95.2
Conductivity	uS/cm		280	277		288	282	280	281
pH		6.5 - 8.5	8.33	8.31		8.35	8.33	8.33	8.33
Suspended Solids	mg/L		6.2	6.6		6.2	5.9	5.4	7.7
Total Solids	mg/L		178	173		174	177	174	174
Dissolved Solids	mg/L		172	166		168	171	169	166

Metals	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Arsenic	mg/L	0.1	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
Antimony	mg/L	0.02	<0.0005	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.1	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005
Silver	ug/L	0.1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Aluminum	ug/L	75	91.1	131		81.3	102	127	133
Barium	ug/L		22.2	22.2		23.1	22.1	22.5	22.4
Beryllium	ug/L	1100	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1
Bismuth	ug/L		<5	<5		<5	<5	<5	<5
Calcium	mg/L		30.5	31		33.4	31	30.5	30.7
Cadmium	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Cobalt	ug/L	0.9	<1	<1		<1	<1	<1	<1
Chromium	ug/L	1	<1	<1		<1	<1	<1	<1
Copper	ug/L	5	2.11	2.11		2.23	2.04	2.04	2.02
Iron	ug/L	300	92.7	112		86.2	96.5	112	111
Hardness	mg/L		112	114		124	114	112	113
Potassium	mg/L		1.49	1.5		1.98	1.52	1.5	1.5
Lithium	ug/L		<5	<5		6.71	5.39	<5	<5
Magnesium	mg/L		8.73	8.78		9.74	8.82	8.77	8.75
Manganese	ug/L		5.51	5.91		5.45	5.38	5.49	5.56
Molybdenum	ug/L	40	1	1		1.1	0.9	1	0.9
Sodium	mg/L		11.3	11.1		17.8	11.6	11.1	11.1
Nickel	ug/L	25	<2	<2		<2	<2	<2	<2
Lead	ug/L	25	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Tin	ug/L		<9	<9		<9	<9	<9	<9
Strontium	ug/L		164	164		187	166	162	163
Titanium	ug/L		4.08	5.84		3.14	3.77	4.84	7.13
Uranium	ug/L	5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Vanadium	ug/L	6	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Zinc	ug/L	30	<2	<2		<2	<2	<2	<2
Zirconium	ug/L	4	<1	<1		<1	<1	<1	<1

Exceeds PWQO and/or CWQG

Note: "<value" means less than the method detection limit

Volatile Organic Compounds	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
1,2-diethylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,2,4-trimethylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,3-diethylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,2,3-trimethylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,4-diethylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,3,5-trimethylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Benzene	ug/L	100	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Isopropyl benzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Ethylbenzene	ug/L	8	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
2-ethyltoluene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
m- and p-xylene	ug/L	2, 30	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
o-xylene	ug/L	40	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Isopropyl toluene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Styrene	ug/L	4	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Toluene	ug/L	0.8	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
3-ethyltoluene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
4-ethyltoluene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Bromofluorobenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
d8-toluene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Diisopropylether	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Fluorobenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Methyl isobutyl ketone	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Tert-butyl methyl ether	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Propylbenzene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Tetra-amyl-methyl ether	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,1,1-trichloroethane	ug/L	10	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,1,2,2-tetrachloroethane	ug/L	70	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,1,1,2-tetrachloroethane	ug/L	20	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,1,2-trichloroethane	ug/L	800	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,1-dichloroethane	ug/L	200	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,1-dichloroethene	ug/L	40	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,2-dichloroethane	ug/L	100	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,2-dichloropropane	ug/L	0.7	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
cis-1,3-dichloropropene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
trans-1,3-dichloropropene	ug/L	7	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Bromodichloromethane	ug/L	200	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Bromomethane	ug/L	0.9	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Bromoform	ug/L	60	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Dibromochloromethane	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
cis-1,2-dichloroethene	ug/L	200	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Chloroethane	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Chloromethane	ug/L	700	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Chloroform	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Carbon tetrachloride	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Dichlorodifluoromethane	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Dichloromethane	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
trans-1,2-dichloroethene	ug/L	200	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	ug/L	50	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Trichloroethene	ug/L	20	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Chloroethene	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,2-dichlorobenzene	ug/L	2.5	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,3-dichlorobenzene	ug/L	2.5	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,4-dichlorobenzene	ug/L	4	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Chlorobenzene	ug/L	15	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
1,2-dibromoethane	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Trihalomethanes; total	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2
Xylenes; total	ug/L		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2

Acid Base Neutrals (Semi-Volatiles)	Units	PWQO *CWQG*	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Diphenylamine	ug/L	3	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,4-dinitrotoluene	ug/L	4	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	ug/L	10	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	ug/L		<10	<10		<10	<10	<10	<10
2,6-dichlorophenol	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,6-dinitrotoluene	ug/L	6	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
4,6-dinitro-o-cresol	ug/L	0.2	<10	<10		<10	<10	<10	<10
4-bromophenyl-phenyl ether	ug/L	0.05	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
4-chlorophenyl-phenyl ether	ug/L	0.05	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
4-nitrophenol	ug/L	50	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethyl)ether	ug/L	200	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethoxy)methane	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Bis(2-chloroisopropyl)ether	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Butylbenzylphthalate	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Bis-2-ethylhexylphthalate	ug/L		<10	<10		<10	<10	<10	<10
Camphene	ug/L	2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Di-n-butylphthalate	ug/L	19	<10	<10		<10	<10	<10	<10
Di-n-octylphthalate	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Diphenyl ether	ug/L	0.03	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
m-cresol	ug/L	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
N-nitroso-di-n-propylamine	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
o-cresol	ug/L	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
p-chloro-m-cresol	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
p-cresol	ug/L	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Phenol	ug/L	5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
1-chloronaphthalene	ug/L	0.1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
1-methylnaphthalene	ug/L	2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2-chloronaphthalene	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2-methylnaphthalene	ug/L	2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
5-nitroacenaphthene	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/L	***5.8***	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Acenaphthylene	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Anthracene	ug/L	0.0008	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Benzo(a)anthracene	ug/L	0.0004	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	ug/L	***0.015***	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Biphenyl	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	ug/L	0.0002	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Chrysene	ug/L	0.0001	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Dibenzo(a,h)anthracene	ug/L	0.002	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Fluoranthene	ug/L	0.0008	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Fluorene	ug/L	0.2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	ug/L	0.00002	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Indole	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Naphthalene	ug/L	7	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Perylene	ug/L	0.00007	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Phenanthrene	ug/L	0.03	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Pyrene	ug/L	***0.025***	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2-chlorophenol	ug/L		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,3,4-trichlorophenol	ug/L	18	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,3,4,5-tetrachlorophenol	ug/L	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,3,4,6-tetrachlorophenol	ug/L	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,3,5-trichlorophenol	ug/L	18	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,3,5,6-tetrachlorophenol	ug/L	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
2,4,5-trichlorophenol	ug/L	18	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5

2,4,6-trichlorophenol	ug/L	18	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	ug/L	0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5

Polycyclic Aromatic Hydrocarbons	Units	PWQO *CWQG*	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
1-methylnaphthalene	ng/L	2000	<10	<10		<10	<10	<10	<10
2-methylnaphthalene	ng/L	2000	<10	<10		<10	<10	<10	<10
Acenaphthene	ng/L	***5800***	<10	<10		<10	<10	<10	<10
Acenaphthylene	ng/L		<10	<10		<10	<10	<10	<10
Anthracene	ng/L	0.8 / ***12***	<10	<10		<10	<10	<10	<10
Benz(a)anthracene	ng/L	0.4 / ***18***	<20	<20		<20	<20	<20	<20
Benzo(a)pyrene	ng/L	***15***	<2	<2		<2	<2	<2	<2
Benzo(b)fluoranthene	ng/L		<10	<10		<10	<10	<10	<10
Benzo(e)pyrene	ng/L		<10	<10		<10	<10	<10	<10
Benzo(k)fluoranthene	ng/L		<10	<10		<10	<10	<10	<10
Chrysene	ng/L	0.1	<10	<10		<10	<10	<10	<10
Dibenz(a,h)anthracene	ng/L	2	<20	<20		<20	<20	<20	<20
Fluoranthene	ng/L	0.8 / ***40***	<10	<10		<10	<10	<10	<10
Fluorene	ng/L	200 / ***3000***	<10	<10		<10	<10	<10	<10
Benzo(g,h,i)perylene	ng/L	0.02	<20	<20		<20	<20	<20	<20
Indeno(1,2,3-c,d)pyrene	ng/L		<20	<20		<20	<20	<20	<20
Naphthalene	ng/L	7000/***1100***	<10	<10		<10	<10	<10	<10
Perylene	ng/L	0.7	<10	<10		<10	<10	<10	<10
Phenanthrene	ng/L	30 / ***400***	<10	<10		<10	<10	<10	<10
Pyrene	ng/L	***25***	<10	<10		<10	<10	<10	<10

Exceeds PWQO and/or CWQG

Notes: "<value" means less than the method detection limit
"bold italic criteria" means CWQG

Polychlorinated Biphenyls	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
PCB congeners; total	**ng/L**	**1**	**0.2755**	**0.08574**		**0.9152**	**0.092**	**0.2078**	**0.214**
2-monochloroPCB(1)	pg/L		<4	<3.8		**7**	<4.2	<4.4	<3.1
4-monochloroPCB(3)	pg/L		<3.1	<2.8		<2.6	<3.6	<2.4	<2
2,3'-dichloroPCB(6)	pg/L		<7.1	<5.7		<7.8	<9.1	<16	<8.9
2,4'-dichloroPCB(8)	pg/L		<23	<16		<19	<17	<19	<18
4,4'-dichloroPCB(15)	pg/L		<13	<9.4		<12	<12	<10	<9
2,2',3-trichloroPCB(16)	pg/L		<7.9	<7.7		<10	<5.9	<7.2	<7.4
2,2',5-trichloroPCB(18)	pg/L		<25	<23		**40**	<22	<28	<24
2,2',6-trichloroPCB(19)	pg/L		**6.9**	**4.6**		**9.3**	**5.5**	**6.2**	**4.8**
2,3,4'-trichloroPCB(22)	pg/L		<7.8	<6.3		<12	<7.5	<6.8	<7.7
2,4',5-trichloroPCB(31)	pg/L		<24	<22		**38**	<23	<26	<24
3,4,4'-trichloroPCB(37)	pg/L		<6.3	<5.6		**11**	<6.7	<5.4	<6
2,2',3,3'-tetrachloroPCB(40)	pg/L		<3.5	<3.7		**10**	<4.2	<3	<3.6
2,2',3,4-tetrachloroPCB(41)	pg/L		<3	<2.1		<4	<2.3	<3	<3
2,2',3,5'-tetrachloroPCB(44)	pg/L		**22**	<16		**49**	<16	<20	**23**
2,2',4,5'-tetrachloroPCB(49)	pg/L		<16	**17**		**38**	<15	<15	<22
2,2',5,5'-tetrachloroPCB(52)	pg/L		**34**	**30**		**74**	**32**	**35**	**31**
2,2',6,6'-tetrachloroPCB(54)	pg/L		<2	<1		<2	<2	<2	<1
2,3,4,4'-tetrachloroPCB(60)	pg/L		<3	<2.6		**6.6**	<2.7	<3.6	<3
2,3',4,4'-tetrachloroPCB(66)	pg/L		**14**	<12		**40**	**14**	**16**	**15**
2,3',4',5-tetrachloroPCB(70)	pg/L		**21**	<15		**44**	<16	**18**	**18**

2,4,4',5-tetrachloroPCB(74)	pg/L		**8.4**	<6.2		**18**	<6.8	**9.1**	**9**
3,3',4,4'-tetrachloroPCB(77)	pg/L		**1.7**	<1.2		**4.9**	<1	**1.4**	<1.4
3,4,4',5-tetrachloroPCB(81)	pg/L		<0.5	<0.9		<0.8	<0.9	<0.8	<1
PeClPCB(84)+PeCl(90)+PeCl(101)	pg/L		**34**	<25		**57**	<25	<31	<28
2,2',3,4,4'-pentachloroPCB(85)	pg/L		<3.4	<3.8		**11**	<3.9	<3.6	<4.1
2,2',3,4,5'-pentachloroPCB(87)	pg/L		**8.9**	<7.6		**20**	<8.2	**8.9**	**9.5**
2,2',3,5',6-pentachloroPCB(95)	pg/L		<22	<20		**40**	<21	<20	<23
2,2',3',4,5-pentachloroPCB(97)	pg/L		**7.4**	<4.6		**15**	<6.9	<6	<7.2
2,2',4,4',5-pentachloroPCB(99)	pg/L		**9.3**	<7.6		**18**	<6.8	<8.2	<8.5
2,2',4,6,6'-pentachloroPCB(104)	pg/L		<1	<0.8		<0.5	<0.7	<0.6	<0.8
2,3,3',4,4'-pentachloroPCB(105)	pg/L		**6.9**	<5.6		**16**	<5.9	**7**	**6.7**
2,3,3',4',6-pentachloroPCB(110)	pg/L		**26**	<20		**52**	**21**	**24**	**25**
2,3,4,4',5-pentachloroPCB(114)	pg/L		<0.8	<0.7		**1.7**	<1	<1.1	<1
2,3',4,4',5-pentachloroPCB(118)	pg/L		**18**	<12		**32**	<12	<16	<16
2,3',4,4',6-pentachloroPCB(119)	pg/L		<0.6	<0.6		<0.9	<1	<0.8	<1
2',3,4,4',5-pentachloroPCB(123)	pg/L		<2	<2		<3.5	<2.2	<1.8	<1.7
3,3',4,4',5-pentachloroPCB(126)	pg/L		<0.9	<0.8		<0.87	<1	<0.8	<1
2,2',3,3',4,4'-hexachloroPCB(128)	pg/L		<2.8	<2.4		**6.9**	<2.6	<3.7	<2.9
2,2',3,3',5,6'-hexachloroPCB(135)	pg/L		<3.1	<3		**4.8**	<3.3	**4.3**	<3.9
2,2',3,4,4',5-hexachloroPCB(137)	pg/L		<1.1	<0.8		**2.6**	<0.79	<1.1	<1
2,2',3,4,4',5'-hexachloroPCB(138)	pg/L		**20**	<17		**32**	<15	**18**	**19**
2,2',3,4,5,5'-hexachloroPCB(141)	pg/L		<3.8	<3.4		**7.1**	<3.1	**4.7**	<4
2,2',3,4',5',6-hexachloroPCB(149)	pg/L		<22	<18		**33**	<19	<23	<22
2,2',3,5,5',6-hexachloroPCB(151)	pg/L		<7.2	<7.8		<11	<5.5	<7.3	<6.6
2,2',4,4',6,6'-hexachloroPCB(155)	pg/L		<0.6	<0.3		<0.32	<2	<0.2	<0.4
2,3,3',4,4',5-hexachloroPCB(156)	pg/L		<2	**1.3**		**3.4**	**1.5**	**1.8**	**2**
2,3,3',4,4',5'-hexachloroPCB(157)	pg/L		<0.92	**0.87**		<1.5	<0.71	<0.98	<1
22'33'45(129)+233'44'6-HxClPCB(158)	pg/L		<4	<2.3		**6.7**	<2.2	<3.4	<4.1
2,3',4,4',5,5'-hexachloroPCB(167)	pg/L		<1	<0.86		**1.9**	<0.58	<0.6	<0.95
22'44'55'(153)+23'44'5'6-HxClPCB(168)	pg/L		**19**	<14		**31**	<14	**17**	**18**
3,3',4,4',5,5'-hexachloroPCB(169)	pg/L		<0.9	<0.8		<0.6	<0.5	<0.7	<1
2,2',3,3',4,4',5-heptachloroPCB(170)	pg/L		<3	**4.6**		**6.6**	<3.5	<3.9	<3.4
2,2',3,3',4,4',6-heptachloroPCB(171)	pg/L		<2	<0.99		<2.5	<1	<2	<1.6
2,2',3,3',4,5,6'-heptachloroPCB(174)	pg/L		<3.6	<3.9		**8.2**	<3.4	<5.9	**6**
2,2',3,3',4',5,6-heptachloroPCB(177)	pg/L		<2.5	<2.4		**4.8**	<1.4	<2.3	**3.1**
2,2',3,3',5,5',6-heptachloroPCB(178)	pg/L		<2	**0.77**		<1.4	<0.7	<1.4	<1.1
2,2',3,4,4',5',6-heptachloroPCB(183)	pg/L		<3.1	<3.1		**4.7**	<1.9	<3.2	<3.3
2,2',3,4',5,5',6-heptachloroPCB(187)	pg/L		<5.1	<5.8		**11**	<4.4	**6.6**	**6.9**
2,2',3,4',5,6,6'-heptachloroPCB(188)	pg/L		<1	<0.5		<0.6	<0.6	<0.7	<0.7
2,3,3',4,4',5,5'-heptachloroPCB(189)	pg/L		<0.7	<0.6		<0.6	<0.5	<0.5	<0.5
2,3,3',4,4',5',6-heptachloroPCB(191)	pg/L		<1	<0.4		<0.5	<0.6	<0.7	<0.8
22'344'55'(180)+233'4'55'6-HpClPCB(193)	pg/L		<7.1	**9.6**		**15**	<5.8	**11**	<8.2
2,2',3,3',4,4',5,5'-octachloroPCB(194)	pg/L		<2.5	<3.5		<4	<2	<3	<2.1
2,2',3,3',4,5,5',6'-octachloroPCB(199)	pg/L		<3.2	<2.3		<5.4	<2.4	<5.2	<3.9
2,2',3,3',4,5,6,6'-octachloroPCB(200)	pg/L		<0.82	<0.73		<0.9	<0.8	<0.95	<1
2,2',3,3',4,5',6,6'-octachloroPCB(201)	pg/L		<0.6	<0.5		<0.95	<0.8	<0.66	<1
2,2',3,3',5,5',6,6'-octachloroPCB(202)	pg/L		<1.8	<0.65		<1.1	<0.74	<0.99	<1
2,2',3,4,4',5,5',6-octachloroPCB(203)	pg/L		<1.8	<2.8		<3.7	<1.2	<3.3	<2.8
2,3,3',4,4',5,5',6-octachloroPCB(205)	pg/L		<0.7	<0.5		<0.5	<0.5	<0.9	<0.9
22'33'44'55'6-nonachloroPCB(206)	pg/L		<1	<1.1		<1.7	<0.9	**1.8**	<1
22'33'44'566'-nonachloroPCB(207)	pg/L		<0.6	<0.5		<0.6	<0.6	<0.7	<0.7
22'33'455'66'-nonachloroPCB(208)	pg/L		<0.73	<0.65		<0.65	<0.6	<0.81	<0.8
DecachloroPCB(209)	pg/L		<2	<1.8		<3.2	<2.1	<2.5	<1.6
244'-triClPCB(28)+2'34-triClPCB(33)	pg/L		<38	<34		**60**	<32	<37	<39
2,2'-dichloroPCB(4)+2,6-dichloroPCB(10)	pg/L		**18**	**17**		**23**	**18**	**17**	**17**

Exceeds PWQO

Note: "<value" means less than the method detection limit

Table 3: Rain Event October 20, 2020 Sampling Results

General Chemistry	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Alkalinity (CaCO3)	mg/L		98.4	97	133	214	96.9	97.6	96.7
Conductivity	uS/cm		290	292	525	1380	290	289	291
pH		6.5 - 8.5	8.23	8.24	8.2	8.31	8.25	8.25	8.26
Suspended Solids	mg/L		12.4	10.7	2.2	2.2	11.4	11.2	11.2
Total Solids	mg/L		181	183	339	860	179	179	176
Dissolved Solids	mg/L		168	172	336	857	167	167	164

Metals	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Arsenic	mg/L	0.1	<0.001	<0.001	<0.001	0.0011	<0.001	<0.001	<0.001
Antimony	mg/L	0.02	<0.0005	<0.0005	0.002	0.0019	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	ug/L	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aluminum	ug/L	75	145	174	33.2	65.6	165	180	180
Barium	ug/L		22.4	22.7	34.2	42.9	23	22.9	22.8
Beryllium	ug/L	1100	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	ug/L		<5	<5	<5	<5	<5	<5	<5
Calcium	mg/L		33.2	33	53.3	83	31.5	31.6	32
Cadmium	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	ug/L	0.9	<1	<1	<1	<1	<1	<1	<1
Chromium	ug/L	1	<1	<1	1.26	2.37	<1	<1	<1
Copper	ug/L	5	2.63	2.53	7.08	8.46	2.25	2.31	2.41
Iron	ug/L	300	126	142	55.1	74.7	130	148	145
Hardness	mg/L		120	119	193	320	115	115	117
Potassium	mg/L		1.59	1.61	7.12	13.9	1.61	1.63	1.61
Lithium	ug/L		6.49	<5	15.9	42.5	<5	<5	5.67
Magnesium	mg/L		8.93	8.95	14.6	27.3	8.85	8.85	8.9
Manganese	ug/L		8.7	8.44	8.99	4.49	8.32	8.67	8.72
Molybdenum	ug/L	40	0.9	0.9	3	5.2	0.9	0.9	0.9
Sodium	mg/L		11.3	11.3	30.6	157	11.2	11.5	11
Nickel	ug/L	25	<2	<2	<2	2.4	<2	<2	<2
Lead	ug/L	25	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Tin	ug/L		<9	<9	<9	<9	<9	<9	<9
Strontium	ug/L		165	163	358	612	163	166	164
Titanium	ug/L		4.95	6.4	1.54	2.41	6.47	6.34	6.59
Uranium	ug/L	5	<0.5	<0.5	0.6	1.4	<0.5	<0.5	<0.5
Vanadium	ug/L	6	<0.5	<0.5	0.5	1.3	<0.5	<0.5	<0.5
Zinc	ug/L	30	4.8	3.1	17.6	15	2.43	<2	3.2
Zirconium	ug/L	4	<1	<1	<1	<1	<1	<1	<1

Exceeds PWQO and/or CWQG

Note: "<value" means less than the method detection limit

Volatile Organic Compounds	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
1,2-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2,4-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2,3-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,3,5-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzene	ug/L	100	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Isopropyl benzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	ug/L	8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m- and p-xylene	ug/L	2, 30	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	ug/L	40	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Isopropyl toluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Styrene	ug/L	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	ug/L	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
3-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
4-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromofluorobenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
d8-toluene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Diisopropylether	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluorobenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methyl isobutyl ketone	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tert-butyl methyl ether	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Propylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetra-amyl-methyl ether	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,1-trichloroethane	ug/L	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2,2-tetrachloroethane	ug/L	70	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,1,2-tetrachloroethane	ug/L	20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-trichloroethane	ug/L	800	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-dichloroethane	ug/L	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-dichloroethene	ug/L	40	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dichloroethane	ug/L	100	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dichloropropane	ug/L	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
cis-1,3-dichloropropene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,3-dichloropropene	ug/L	7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromodichloromethane	ug/L	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromomethane	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	ug/L	60	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
cis-1,2-dichloroethene	ug/L	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroethane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	ug/L	700	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon tetrachloride	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dichlorodifluoromethane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichloromethane	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-dichloroethene	ug/L	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	ug/L	50	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene	ug/L	20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroethene	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dichlorobenzene	ug/L	2.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-dichlorobenzene	ug/L	2.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-dichlorobenzene	ug/L	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	ug/L	15	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-dibromoethane	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Trihalomethanes; total	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Xylenes; total	ug/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Acid Base Neutrals (Semi-Volatiles)	Units	PWQO *CWQG*	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Diphenylamine	ug/L	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrotoluene	ug/L	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	ug/L	10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	ug/L		<10	<10	<10	<10	<10	<10	<10
2,6-dichlorophenol	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-dinitrotoluene	ug/L	6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4,6-dinitro-o-cresol	ug/L	0.2	<10	<10	<10	<10	<10	<10	<10
4-bromophenyl-phenyl ether	ug/L	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-chlorophenyl-phenyl ether	ug/L	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-nitrophenol	ug/L	50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethyl)ether	ug/L	200	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethoxy)methane	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroisopropyl)ether	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Butylbenzylphthalate	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis-2-ethylhexylphthalate	ug/L		<10	<10	<10	<10	<10	<10	<10
Camphene	ug/L	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butylphthalate	ug/L	19	<10	<10	<10	<10	<10	<10	<10
Di-n-octylphthalate	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diphenyl ether	ug/L	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
m-cresol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
N-nitroso-di-n-propylamine	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
o-cresol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
p-chloro-m-cresol	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
p-cresol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenol	ug/L	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1-chloronaphthalene	ug/L	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1-methylnaphthalene	ug/L	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-chloronaphthalene	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methylnaphthalene	ug/L	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
5-nitroacenaphthene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/L	***5.8***	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	ug/L	0.0008	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)anthracene	ug/L	0.0004	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	ug/L	***0.015***	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Biphenyl	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	ug/L	0.0002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	ug/L	0.0001	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzo(a,h)anthracene	ug/L	0.002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	ug/L	0.0008	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	ug/L	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	ug/L	0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indole	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	ug/L	7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perylene	ug/L	0.00007	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	ug/L	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	ug/L	***0.025***	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-chlorophenol	ug/L		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,5-tetrachlorophenol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,4,6-tetrachlorophenol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,5-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,3,5,6-tetrachlorophenol	ug/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

2,4,6-trichlorophenol	ug/L	18	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Polycyclic Aromatic Hydrocarbons	**Units**	**PWQO *CWQG***	**TMC Upstr Far**	**TMC Upstream**	**GM West Outfall**	**City West Outfall**	**TMC Downstr**	**TMC Downstream Far**	
1-methylnaphthalene	ng/L	2000	<10	<10	<10	<10	<10	<10	<10
2-methylnaphthalene	ng/L	2000	<10	<10	<10	<10	<10	<10	<10
Acenaphthene	ng/L	***5800***	<10	<10	<10	<10	<10	<10	<10
Acenaphthylene	ng/L		<10	<10	<10	<10	<10	<10	<10
Anthracene	ng/L	0.8 / ***12***	<10	<10	<10	<10	<10	<10	<10
Benz(a)anthracene	ng/L	0.4 / ***18***	<20	<20	<20	<20	<20	<20	<20
Benzo(a)pyrene	ng/L	***15***	<2	<2	**4**	<2	<2	<2	<2
Benzo(b)fluoranthene	ng/L		<10	<10	<10	<10	<10	<10	<10
Benzo(e)pyrene	ng/L		<10	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	ng/L		<10	<10	<10	<10	<10	<10	<10
Chrysene	ng/L	0.1	<10	<10	<10	<10	<10	<10	<10
Dibenz(a,h)anthracene	ng/L	2	<20	<20	<20	<20	<20	<20	<20
Fluoranthene	ng/L	0.8 / ***40***	<10	<10	**13**	<10	<10	<10	<10
Fluorene	ng/L	200 / ***3000***	<10	<10	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene	ng/L	0.02	<20	<20	<20	<20	<20	<20	<20
Indeno(1,2,3-c,d)pyrene	ng/L		<20	<20	<20	<20	<20	<20	<20
Naphthalene	ng/L	7000/***1100***	<10	<10	<10	<10	<10	<10	<10
Perylene	ng/L	0.7	<10	<10	<10	<10	<10	<10	<10
Phenanthrene	ng/L	30 / ***400***	<10	<10	<10	<10	<10	<10	<10
Pyrene	ng/L	***25***	<10	<10	**12**	<10	<10	<10	<10

Exceeds PWQO and/or CWQG

Notes: "<value" means less than the method detection limit
"bold italic criteria" means CWQG

Polychlorinated Biphenyls	**Units**	**PWQO**	**TMC Upstr Far**	**TMC Upstream**	**GM West Outfall**	**City West Outfall**	**TMC Downstr**	**TMC Downstream Far**	
PCB congeners; total	**ng/L**	**1**	**0.3545**	**0.6017**	**23.694**	**9.2618**	**0.2892**	**0.547**	**0.3449**
2-monochloroPCB(1)	pg/L		<5	<4.3	<15	<4.7	<4.3	<6.2	<3.4
4-monochloroPCB(3)	pg/L		<3.7	<2.4	<4.3	<4.1	<3.1	<5.2	<2.7
2,3'-dichloroPCB(6)	pg/L		**17**	<6.3	**180**	<14	<7.1	<8.7	<7.2
2,4'-dichloroPCB(8)	pg/L		<21	<18	**210**	<29	<19	<19	<15
4,4'-dichloroPCB(15)	pg/L		<17	<13	**330**	**45**	<9	<9.2	<12
2,2',3-trichloroPCB(16)	pg/L		<9.1	<8.2	**430**	**110**	<7.7	<7.9	<6.8
2,2',5-trichloroPCB(18)	pg/L		<25	<23	**1400**	**320**	<26	<22	<22
2,2',6-trichloroPCB(19)	pg/L		**7.3**	<6.3	**440**	**81**	<6.7	**7.4**	<6.9
2,3,4'-trichloroPCB(22)	pg/L		<8.3	<8.9	**280**	**110**	<8.3	<9.2	<8
2,4',5-trichloroPCB(31)	pg/L		<27	<26	**930**	**280**	<25	<25	<24
3,4,4'-trichloroPCB(37)	pg/L		<7.6	<7.1	**220**	**100**	<7.6	**8.5**	<5.6
2,2',3,3'-tetrachloroPCB(40)	pg/L		<4.7	**4.5**	**580**	**160**	<6	<7.4	**6.5**
2,2',3,4-tetrachloroPCB(41)	pg/L		<3.2	<5.2	**130**	**72**	**4.6**	<6.1	<4
2,2',3,5'-tetrachloroPCB(44)	pg/L		**32**	**30**	**2500**	**750**	**26**	**30**	**32**
2,2',4,5'-tetrachloroPCB(49)	pg/L		**27**	**28**	**2000**	**550**	**22**	**25**	**26**
2,2',5,5'-tetrachloroPCB(52)	pg/L		**46**	**51**	**3000**	**970**	<45	<43	**46**
2,2',6,6'-tetrachloroPCB(54)	pg/L		<0.7	<3	**19**	**3.5**	<1	<4.2	<2
2,3,4,4'-tetrachloroPCB(60)	pg/L		**5.6**	**6.1**	**140**	**98**	<3.2	**6.3**	**3.9**
2,3',4,4'-tetrachloroPCB(66)	pg/L		**22**	**26**	**1100**	**550**	**18**	**19**	**20**
2,3',4',5-tetrachloroPCB(70)	pg/L		**27**	**30**	**970**	**500**	**23**	**25**	**28**
2,4,4',5-tetrachloroPCB(74)	pg/L		**10**	**13**	**360**	**220**	**10**	**13**	**14**

3,3',4,4'-tetrachloroPCB(77)	pg/L		<4	**2.8**	**110**	**51**	**1.8**	**4.6**	**2.1**
3,4,4',5-tetrachloroPCB(81)	pg/L		<4	<0.7	<5	<3	<1	**3.6**	<1
PeClPCB(84)+PeCl(90)+PeCl(101)	pg/L		<41	**60**	**1100**	**530**	<44	<51	<44
2,2',3,4,4'-pentachloroPCB(85)	pg/L		<4.6	**11**	**220**	**120**	**5.5**	**9.2**	**6.6**
2,2',3,4,5'-pentachloroPCB(87)	pg/L		**13**	**21**	**330**	**180**	**15**	**17**	**14**
2,2',3,5',6-pentachloroPCB(95)	pg/L		<28	<35	**840**	**370**	<24	<27	<27
2,2',3',4,5-pentachloroPCB(97)	pg/L		**11**	**15**	**290**	**150**	**9.2**	**13**	**9.4**
2,2',4,4',5-pentachloroPCB(99)	pg/L		**13**	**18**	**360**	**200**	**12**	**15**	**11**
2,2',4,6,6'-pentachloroPCB(104)	pg/L		<0.9	<0.7	<0.6	<0.83	<1	**3.9**	<0.9
2,3,3',4,4'-pentachloroPCB(105)	pg/L		**11**	**15**	**200**	**130**	**11**	**14**	**11**
2,3,3',4',6-pentachloroPCB(110)	pg/L		**36**	**53**	**900**	**480**	**35**	**40**	**37**
2,3,4,4',5-pentachloroPCB(114)	pg/L		<5	<4	**17**	**12**	<5	<5	<7
2,3',4,4',5-pentachloroPCB(118)	pg/L		**24**	**37**	**360**	**230**	**27**	**30**	**24**
2,3',4,4',6-pentachloroPCB(119)	pg/L		<0.8	<0.86	**16**	**9.2**	<0.76	**3.7**	<2
2',3,4,4',5-pentachloroPCB(123)	pg/L		<5	**3.8**	**51**	**31**	<7	**6**	<7
3,3',4,4',5-pentachloroPCB(126)	pg/L		<6	<5	**9.8**	<2	<7	<6	<7
2,2',3,3',4,4'-hexachloroPCB(128)	pg/L		**4**	**7.3**	**51**	**41**	**5.8**	**7.6**	**4**
2,2',3,3',5,6'-hexachloroPCB(135)	pg/L		<4	<6.9	**54**	**30**	<4.3	**8.1**	<4.6
2,2',3,4,4',5-hexachloroPCB(137)	pg/L		<1.5	<2.2	**14**	**12**	<1.9	**5**	<1.5
2,2',3,4,4',5'-hexachloroPCB(138)	pg/L		**27**	**40**	**280**	**200**	**27**	**33**	**25**
2,2',3,4,5,5'-hexachloroPCB(141)	pg/L		<5.2	**8.4**	**59**	**38**	<4.5	<7.5	<4.9
2,2',3,4',5',6-hexachloroPCB(149)	pg/L		<24	<38	**290**	**190**	<24	<31	<23
2,2',3,5,5',6-hexachloroPCB(151)	pg/L		<6.7	<13	**88**	**54**	<7.7	<13	<6.7
2,2',4,4',6,6'-hexachloroPCB(155)	pg/L		<0.4	<0.4	<0.31	<0.85	<0.6	**3.5**	<0.4
2,3,3',4,4',5-hexachloroPCB(156)	pg/L		**3.3**	**3.6**	**22**	**14**	**3.1**	**5.9**	**2.8**
2,3,3',4,4',5'-hexachloroPCB(157)	pg/L		**1.2**	**1.9**	**14**	**9.2**	**1.8**	**4.6**	**1.3**
22'33'45(129)+233'44'6-HxClPCB(158)	pg/L		**4.9**	**8**	**50**	**33**	**5**	**13**	**6.2**
2,3',4,4',5,5'-hexachloroPCB(167)	pg/L		<1.4	**1.6**	**14**	**8.6**	**1.5**	**5**	<1.6
22'44'55'(153)+23'44'5'6-HxClPCB(168)	pg/L		<19	**35**	**250**	**150**	<23	**31**	<20
3,3',4,4',5,5'-hexachloroPCB(169)	pg/L		<1	<0.8	<2	<1	<0.8	**4.4**	<0.9
2,2',3,3',4,4',5-heptachloroPCB(170)	pg/L		<5	**6.5**	**90**	**53**	**5.5**	**9**	<4.5
2,2',3,3',4,4',6-heptachloroPCB(171)	pg/L		<1.9	**2.8**	**24**	**16**	**1.4**	**5**	<1.9
2,2',3,3',4,5,6'-heptachloroPCB(174)	pg/L		<4.1	**10**	**85**	**50**	**5.3**	**8.4**	**5.4**
2,2',3,3',4',5,6-heptachloroPCB(177)	pg/L		<2	**5**	**50**	**29**	<3.3	**6.2**	<2.1
2,2',3,3',5,5',6-heptachloroPCB(178)	pg/L		<1.3	**2.9**	**21**	**11**	<1.4	**4.7**	<1
2,2',3,4,4',5',6-heptachloroPCB(183)	pg/L		**3.1**	**5.2**	**44**	**27**	**3.5**	**6.4**	<1.9
2,2',3,4',5,5',6-heptachloroPCB(187)	pg/L		<7.3	**11**	**100**	**59**	<7	**8.6**	<5.2
2,2',3,4',5,6,6'-heptachloroPCB(188)	pg/L		<0.7	<0.9	**1**	<0.61	<0.9	**4**	<0.8
2,3,3',4,4',5,5'-heptachloroPCB(189)	pg/L		<0.5	<0.5	**3.2**	<3.1	<0.6	<3.5	<0.5
2,3,3',4,4',5',6-heptachloroPCB(191)	pg/L		<0.8	<1	**4.7**	**2.8**	<1	<4	<0.8
22'344'55'(180)+233'4'55'6-HpClPCB(193)	pg/L		**9.1**	**17**	**210**	**110**	**9.2**	**19**	**8.7**
2,2',3,3',4,4',5,5'-octachloroPCB(194)	pg/L		<4	<3.5	**46**	**35**	<2.6	**6.6**	<3.5
2,2',3,3',4,5,5',6'-octachloroPCB(199)	pg/L		<2.8	**4.6**	**52**	**49**	<3.1	**7.9**	<3.6
2,2',3,3',4,5,6,6'-octachloroPCB(200)	pg/L		<0.64	<1.4	**5.7**	**4.8**	<0.9	**4.3**	<1
2,2',3,3',4,5',6,6'-octachloroPCB(201)	pg/L		<0.6	<1.1	**5.9**	**4.9**	<0.8	**5.1**	<1
2,2',3,3',5,5',6,6'-octachloroPCB(202)	pg/L		<2.3	<1.5	**9.2**	**8.5**	<1.3	**4.6**	<1
2,2',3,4,4',5,5',6-octachloroPCB(203)	pg/L		<1.8	**5.7**	**50**	**44**	<2.3	**7.6**	<2.5
2,3,3',4,4',5,5',6-octachloroPCB(205)	pg/L		<0.5	<0.5	**2.6**	**2.5**	<0.7	**4.6**	<0.5
22'33'44'55'6-nonachloroPCB(206)	pg/L		<2.2	<1.8	**15**	**30**	<1.9	**4.8**	<1.8
22'33'44'566'-nonachloroPCB(207)	pg/L		<0.7	<0.7	**2**	**3.8**	<0.8	**3.9**	<0.6
22'33'455'66'-nonachloroPCB(208)	pg/L		<0.8	<1.1	**3.9**	**10**	<0.9	**4.7**	<0.77
DecachloroPCB(209)	pg/L		<1.8	<2.7	<3.5	**10**	<2	**6.3**	<3
244'-triClPCB(28)+2'34-triClPCB(33)	pg/L		<42	<40	**1400**	**470**	<40	<39	<38
2,2'-dichloroPCB(4)+2,6-dichloroPCB(10)	pg/L		<20	<20	**260**	**39**	<15	<22	<21

Exceeds PWQO

Note: "<value" means less than the method detection limit

Appendices

Appendix A: Review of Coalition for a Better St. Catharines September 14, 2020 Letter

Introduction

On February 13, 2020 MECP Technical Support Surface Water completed surface water sampling of Twelve Mile Creek and storm sewer outfalls during a snow melt event near the former General Motors (GM) Property at 285 Ontario Street in the City of St. Catharines. The surface water quality results were briefly presented in a July 16, 2020 MECP memorandum from Michael Spencer, Technical Support Section.

In a September 14, 2020 letter to Phil Hull, MECP Niagara District Office from Dennis Van Meer, Coalition for a Better St. Catharines, the Coalition for a Better St. Catharines provided comments on the surface water quality results and sampling program contained in the July 16, 2020 MECP memorandum.

As such, the following discussion and interpretation was completed to address these comments.

Review of Coalition for a Better St. Catharines September 14, 2020 Letter

1. The September 14, 2020 letter from Coalition for a Better St. Catharines stated:

   Taking surface runoff samples at a time when ambient temperatures were above freezing and the ground still frozen represent possibly a 'best case' dilution of contaminants leaving the site. A more rigorous inspection sampling needs to take into account the migration of contaminants in groundwater and soil especially in the spring when groundwater comes to the surface and runs downslope into Twelve Mile Creek and perhaps also migrates to the surrounding residential community.

   As identified in the July 16, 2020 MECP memorandum, the February 13, 2020 sampling occurred during a snow melt event with runoff and discharge from the storm sewers since the average daily temperature was above freezing (St. Catharines Met Station Id. 6137304). During sampling, the top layer of the ground adjacent to Twelve Mile Creek was not frozen. As well, the majority of the former GM property is impervious (concrete, asphalt, building) so the snow melt created runoff to carry potential contaminants to the storm sewer and storm sewer outfall that was sampled.

   A surface water sampling program has now been completed for snow melt, dry and rain events. Overall, the storm sewer outfall snow melt event results had more detections of metals and PAH that exceeded the PWQO and/or CWQG; and more detections of volatile organic compounds and acid base neutral than the October 20, 2020 rain event results.

   MECP Technical Support Groundwater completed a review of previous reports and identified that there were no groundwater concerns since there is no groundwater receptor to the west of the site except Twelve Mile Creek. Based on the modelling results, the predicted surface water concentrations in Twelve Mile Creek from the discharge of

groundwater from the former GM property and slope area were very unlikely to exceed current Aquatic Protection Values ("Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario, Ministry of Environment, April 15, 2011"). This is consistent with MECP surface water quality sampling results.

2. The September 14, 2020 letter from Coalition for a Better St. Catharines overall identified human health concerns (ingestion, inhalation, dermal contact) in regards to the metals and polycyclic aromatic hydrocarbons surface water quality results. This Technical Memorandum interpreted the results with various surface water quality criteria including typical urban stormwater quality. The storm sewer outfalls are not a typical or easily accessible point of human contact, however, the surface water quality results have been provided to the Niagara Region Public Health.

3. The following comments are contained under the specific metal headings from the September 14, 2020 letter from Coalition for a Better St. Catharines.

Aluminium: PWQO guidelines: ug/L 75 sample 167 = 223% over PWQO guidelines

	PWQO	TMC1	TMCOut1	TMCOut2	TMC2
Aluminum (ug/L)	75	54.3	41.7	167	62.4

The aluminum PWQO is 75 ug/L. The GM West Outfall (TMCOut1) result of 41.7 ug/L was less than the PWQO. The City West Outfall (TMCOut2) result of 167 ug/L exceeded the PWQO. These aluminum results are discussed in Section 6.1(ii) of this Technical Memorandum from a surface water quality perspective.

Cadmium PWQO guidelines: ug/L = .2 sample: 817 = 409% over the PWQO guidelines

	PWQO	TMC1	TMCOut1	TMCOut2	TMC2
Cadmium (ug/L)	0.2	0.474	0.817	0.574	0.52

The cadmium PWQO is 0.2 ug/L. The GM West Outfall (TMCOut1) result of 0.817 ug/L and the City West Outfall (TMCOut2) result of 0.574 ug/L both exceeded the PWQO. As well, Twelve Mile Creek immediately upstream (0.474 ug/L) and immediately downstream (0.52 ug/L) exceeded the PWQO.

The GM West Outfall and City West Outfall cadmium results were less than observed urban stormwater cadmium concentrations (1 to 24 ug/L) in the MECP document "Stormwater Management Planning and Design Manual, March 2003". The City West Outfall result was within the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 0.732 ug/L at Walkers Creek at Lakeshore Road and Spring Garden Creek at Lakeshore Road) contained in the Ministry of Environment and Climate Change/Environment Canada report "Twelve Mile Creek – Old Welland Canal Trackdown Study (2003 – 2006), Technical Memorandum, March 2010", while the GM West Outfall result was only slightly higher.

Twelve Mile Creek downstream of the outfalls was similar to upstream. The immediately upstream Twelve Mile Creek location (TMC1) result was 0.474 ug/L and the immediately downstream (TMC2) result was 0.52 ug/L which was still less than the PWQO.

Chromium PWQO guidelines ug/l =1 sample = 2.42 = 242% over PWQO guidelines

	PWQO	TMC1	TMCOut1	TMCOut2	TMC2
Chromium (ug/L)	1	0.148	0.707	2.42	0.348

The chromium PWQO is 1 ug/L. The GM West Outfall (TMCOut1) result of 0.707 ug/L was less than the PWQO. The City West Outfall (TMCOut2) result of 2.42 ug/L exceeded the PWQO.

The MECP document "Stormwater Management Planning and Design Manual, March 2003" does not contain chromium in the list of observed urban stormwater concentrations. However, the City West Outfall chromium result (2.42 ug/L) was only slightly higher than the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 2.32 ug/L at Walkers Creek at Lakeshore Road and Spring Garden Creek at Lakeshores Road).

The immediately upstream Twelve Mile Creek location (TMC1) result was 0.148 ug/L and the immediately downstream (TMC2) result was 0.348 ug/L. While the Twelve Mile Creek result downstream of the outfalls was higher than upstream, the downstream result was still less than the PWQO.

Cobalt PWQO guidelines ug/l = .9 sample = 2.24 = 250% over PWQO guidelines

	PWQO	TMC1	TMCOut1	TMCOut2	TMC2
Cobalt (ug/L)	0.9	0.53	0.528	2.24	0.534

The cobalt PWQO is 0.9 ug/l. The GM West Outfall (TMCOut1) result of 0.528 ug/L was less than the PWQO. The City West Outfall (TMCOut2) result of 2.24 ug/L exceeded the PWQO.

The MECP document "Stormwater Management Planning and Design Manual, March 2003" does not contain cobalt in the list of observed urban stormwater concentrations. However, Twelve Mile Creek downstream of the outfalls was similar to upstream. The immediately upstream Twelve Mile Creek location (TMC1) result was 0.53 ug/L and the immediately downstream (TMC2) result was 0.534 ug/L which was still less than the PWQO.

Copper PWQO guidelines ug/l = 5, sample = 35 = 700% over PWQO guidelines

	PWQO	TMC1	TMCOut1	TMCOut2	TMC2
Copper (ug/L)	5	2.23	4.85	35.2	2.25

The copper PWQO is 5 ug/l. The GM West Outfall (TMCOut1) result of 4.85 ug/L was less than the PWQO. The City West Outfall (TMCOut2) result of 35.2 ug/L exceeded the PWQO. These copper results are discussed in Section 6.1(ii) of this Technical Memorandum from a surface water quality perspective.

Zinc: PWQO guidelines ug/l =30, sample = 93 = 311% over PWQO guidelines

	PWQO	TMC1	TMCOut1	TMCOut2	TMC2
Zinc (ug/L)	30	2.22	20.2	93.3	2.76

The zinc PWQO is 30 ug/L. The GM West Outfall (TMCOut1) result of 20.2 ug/L was less than the PWQO. The City West Outfall (TMCOut2) result of 93.3 ug/L exceeded the PWQO. These zinc results are discussed in Section 6.1(ii) of this Technical Memorandum from a surface water quality perspective.

4. The September 14, 2020 letter contained comments on the City West Outfall polycyclic aromatic hydrocarbons (PAH) results that exceeded the PWQO and/or CWQG for benzo(a)pyrene, chrysene, fluoranthene, phenanthrene and pyrene. These PAH results are discussed in Section 6.1(v) of this Technical Memorandum from a surface water quality perspective.

February 13, 2020 Metals Results as Presented in July 16, 2020 MECP Memorandum

Metals	Units	PWQO	TMC Upstr Far	TMC Upstream	GM West Outfall	City West Outfall	TMC Downstr	TMC Downstream Far	
Arsenic	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Antimony	mg/L	0.02	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silver	ug/L	0.1	0	0	0	0	0	0	0
Aluminum	ug/L	75	52.5	54.3	41.7	167	62.4	70.6	53.1
Barium	ug/L		22.5	22.5	36.2	62.7	22.7	22.7	23
Beryllium	ug/L	1100	0.0254	0.0318	0.0303	0	0.0417	0.0258	0.0265
Bismuth	ug/L		0	0	0	0	0	0	0
Calcium	mg/L		37.5	37.4	102	100	37.6	37.7	35.3
Cadmium	ug/L	0.2	0.238	0.474	0.817	0.574	0.52	0.551	0.624
Cobalt	ug/L	0.9	0.44	0.53	0.528	2.24	0.534	0.565	0.38
Chromium	ug/L	1	0.153	0.148	0.707	2.42	0.348	0.336	0
Copper	ug/L	5	2.18	2.23	4.85	35.2	2.25	2.23	1.91
Iron	ug/L	300	52.9	53.2	332	391	56.2	59.8	51.3
Hardness	mg/L		133	133	354	349	135	134	129
Potassium	mg/L		1.56	1.57	9.89	8.37	1.6	1.58	1.59
Lithium	ug/L		7.28	7.48	16.2	25.4	6.31	5.99	4.04
Magnesium	mg/L		9.65	9.62	24.1	24.1	10.1	9.67	9.83
Manganese	ug/L		3.05	3.03	31.7	67.7	3.09	3.13	2.86
Molybdenum	ug/L	40	0	0.276	1.92	0	0.0833	0.216	0.953
Sodium	mg/L		17.8	17.5	59.4	954	19.9	19.1	19.5
Nickel	ug/L	25	0.879	0.416	3.7	11.5	0.854	0.795	0.504
Lead	ug/L	25	0	0	0	0	0	0	0
Tin	ug/L		0	0	0	0	0	0	0
Strontium	ug/L		207	208	702	593	209	210	209
Titanium	ug/L		1.44	1.64	1.38	0.984	1.9	2.01	1.6
Uranium	ug/L	5	0.893	1.38	0.642	2.41	0.0885	1.05	0.586
Vanadium	ug/L	6	0.14	0.184	0.0255	0	0.192	0.219	0.32
Zinc	ug/L	30	2.38	2.22	20.2	93.3	2.76	7.07	2.49
Zirconium	ug/L	4	0	0	0	0	0	0	0

Exceeds PWQO

Appendix B: Certificates of Analysis

MECP lab certificates of analysis for the February 13 (C263915), September 23 (C266658) and October 20, 2020 (C267160) surface water quality sampling available upon request.

Ministry of the Environment,
Conservation and Parks

Water and Air Monitoring Results 282 & 285 Ontario St.

St. Catharines City Council

December 22, 2020

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Ontario

Purpose

- To provide St. Catharines City Council with the results from the ministry's surface water and air monitoring surveys conducted to assess for any off-site impacts from the former GM site.

Agenda

- Overview of the Ministry of the Environment, Conservation and Parks' (MECP) role
- Site background
- Surface water monitoring results
- Air survey results
- Public Health Unit review of results

MECP Role and Brownfield Development Process

Ministry Role

- Respond to complaints and reports of pollution incidents and assess potential impacts to human health or the natural environment.
- Where there is evidence that indicates off-site impacts from a property, the ministry will use its authority to require action be taken by the property owner.
- Review submissions related to brownfield risk assessments and/or Records of Site Condition and ensure that the owners and responsible parties of contaminated sites in Ontario follow applicable regulations and guidelines to protect human health and the environment.

Brownfield Development Process

- Brownfield remediations are proponent driven.
- If a property owner wishes to convert a brownfield property from industrial/commercial or community use to a more sensitive land-use, such as residential, the property owner must file a Record of Site Condition (RSC) with the ministry prior to proceeding with the change in land-use.
- Filing an RSC ensures that any potential on-site risks to human health or the environment are identified and appropriately addressed before the land-use change.
- In Order to file an RSC, a proponent may choose to clean-up a site to ministry standards or conduct a risk assessment and recommend risk management measures to protect human health and the environment.

Ontario

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

Background

- General Motors began operations at this site in 1929. The site closed in 2010.
- On-site oil/grit separators are used to collect and treat stormwater before being discharged off-site. The west separator discharges directly to 12 Mile Creek. The east discharges to the municipal sewer.
- Municipal catch basins and sewers direct city road run-off stormwater to Twelve Mile Creek.
- The ministry inspected the site regularly during operation.
- The site was purchased in 2014 by Bayshore Group Inc. for brownfield redevelopment.
- PCBs, hazardous and liquid industrial wastes were removed from the site prior to demolition activities
- The ministry received five complaints during the initial demolition phase (2015 – 2017) related predominantly to dust. The ministry required the company to implement dust management measures.
- The City of St. Catharines contacted the ministry in January 2020 as a result of concerns raised by the community and requested ministry assistance to assess concerns regarding off-site impacts due to dust and run-off from the site.

0.3 0 0.13 0.3 Kilometers

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Surface Water Monitoring Survey

Sampling Events	Parameters Tested
February 13, 2020 – snow melt September 23, 2020 – dry event October 20, 2020 – rain event November 23, 2020 – rain event (results pending) December 1, 2020 – rain event (results pending)	General chemistry, **Metals*** Volatile Organic Compounds Acid base neutrals (semi-volatiles) **Polycyclic aromatic hydrocarbons (PAH)*** **Polychlorinated biphenyls (PCB)***

- Parameters were selected based on review of environmental assessment reports for the property.
- Analysis results were compared to the following benchmarks, where applicable:
  - Provincial Water Quality Objectives (PWQO)
  - Canadian Water Quality Guidelines (CWQG)
  - Typical urban stormwater and dry weather water quality
  - Twelve Mile Creek Trackdown monitoring data

***Results indicated exceedances of metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs).**

How are Provincial Water Quality Objectives (PWQOs) set?

Review of global aquatic toxicological literature

Determine range of concentrations where effects are observed
(e.g., toxicity, bioaccumulation, mutagenicity, odour etc…)

Select the lowest effect level

(e.g., Effects occur between concentrations of 10 – 100ug/L – select 10ug/L as lowest effect level)

Add in a safety factor

(e.g., Lowest effect level of 10ug/L divided by safety factor of 10 = PQWO of 1 ug/L)

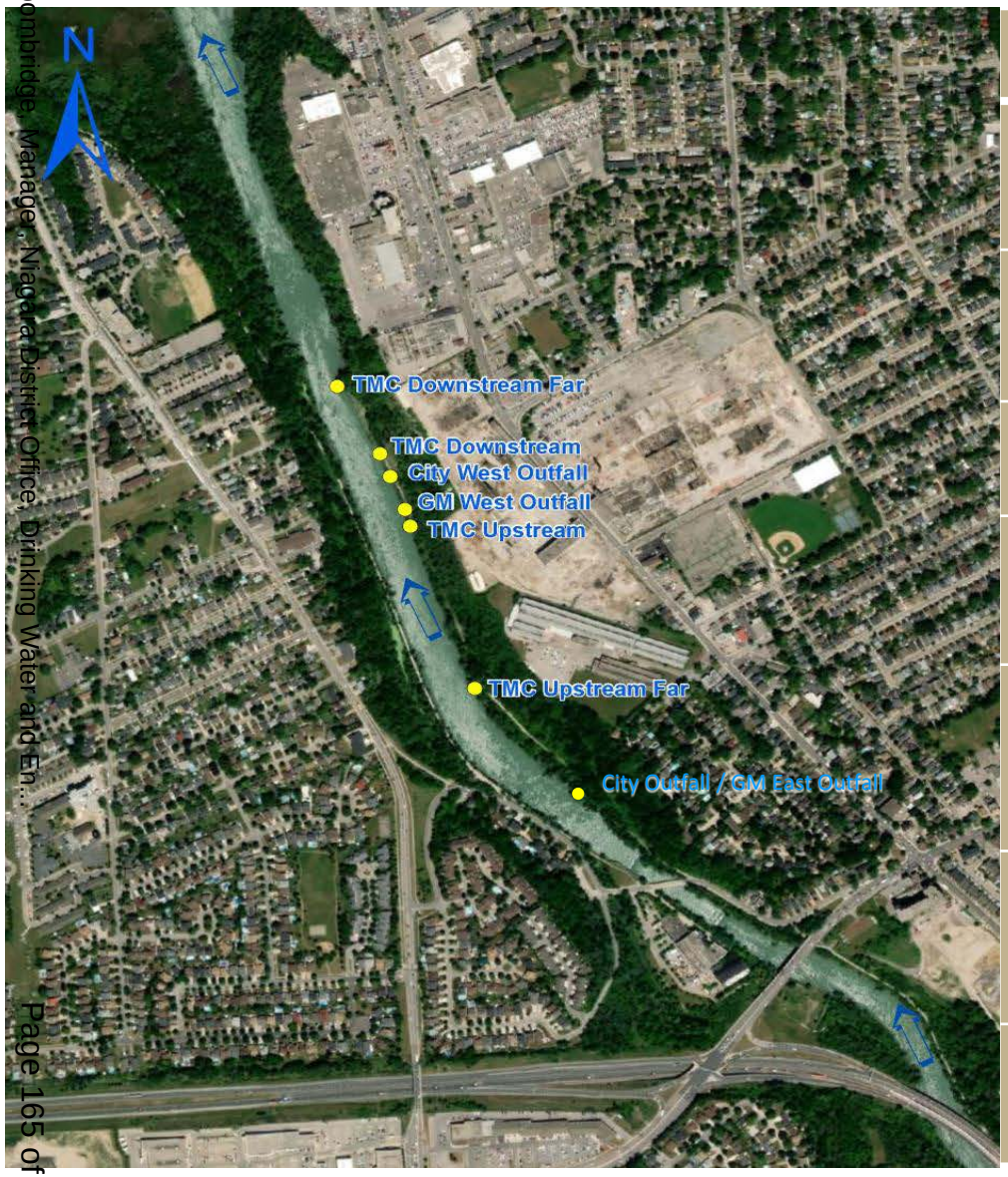
***PWQOs are not set considering laboratory detection limits and may be lower than can be detected.**

Urban Stormwater Quality

Urban stormwater is expected to contain contaminants such as metals and Polycyclic Aromatic Hydrocarbons (PAHs) due to:

- vehicular traffic accounts for much of the buildup of contaminants on road surfaces (tire wear, brake pad wear, engine oil and lubricant drippings, corrosion)
- asphalt pavement deterioration
- road and driveway maintenance (asphalt repair, road salting, driveway sealant)
- industrial and commercial activities (loading/unloading areas, storage, vehicle maintenance); and
- air pollution fallout (vehicle emissions, industrial sources, wind erosion)

Surface Water Monitoring Locations



Sample Location	Location Description
TMC Downstream Far	Twelve Mile Creek downstream of the former GM Property and located just upstream of an old railway bridge abutment
TMC Downstream	Twelve Mile Creek downstream of storm sewer outfalls and adjacent to the former GM Property
City West Outfall	Municipal storm sewer outfall (two drain outlets)
GM West Outfall	Storm sewer outfall from the west plant oil/grit separator on the former GM property
TMC Upstream	Twelve Mile Creek adjacent to the former GM Property and appropriately 20m upstream of GM West Outfall. Location across from groundwater monitoring well
TMC Upstream Far	Twelve Mile Creek upstream of the former GM Property
City Outfall / GM East Outfall	Municipal storm sewer outfall that receives east plant stormwater discharge

Kim Groombridge, Manager, Niagara District Office, Drinking Water and En...

AGENDA ITEM #3.1

Ontario

Overview of Metal Sampling Results

City Municipal Storm Sewer Outfall:

- Aluminum, chromium, cobalt, copper, iron and zinc exceeded PWQO in the snow melt event.
- Chromium and copper exceeded the PWQO from the City outfall in the rain event.
- **The metal concentrations in the municipal storm sewer is considered <u>typical of urban stormwater.</u>**

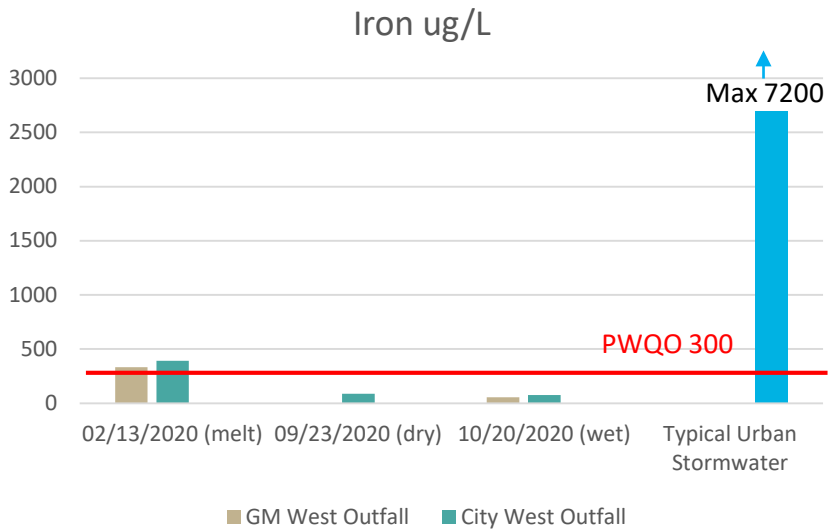
Former GM West Outfall:

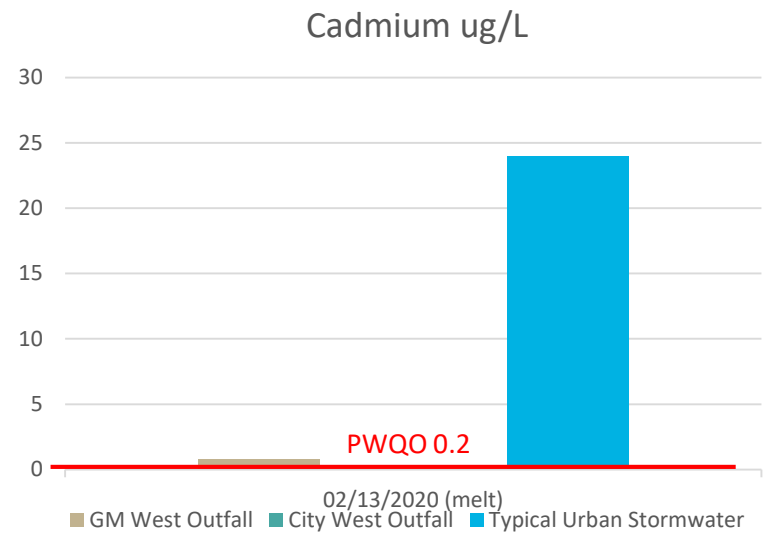
- Iron and cadmium exceeded the PWQO during the snow melt event.
- Chromium and copper exceeded the PWQO in the rain event.
- No ongoing discharge during dry weather
- **The metals in the former GM West outfall are either not a surface water concern or were <u>lower than typical urban stormwater</u>.**

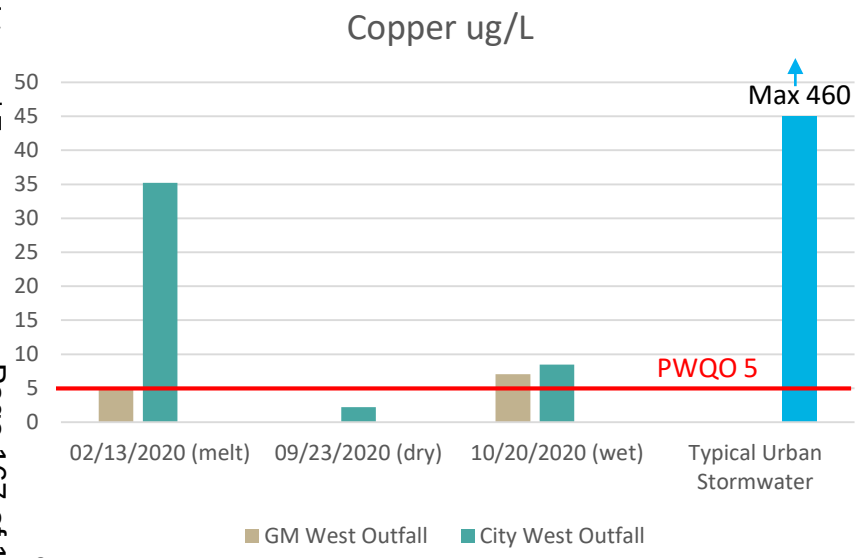
Twelve Mile Creek – Upstream and Downstream:

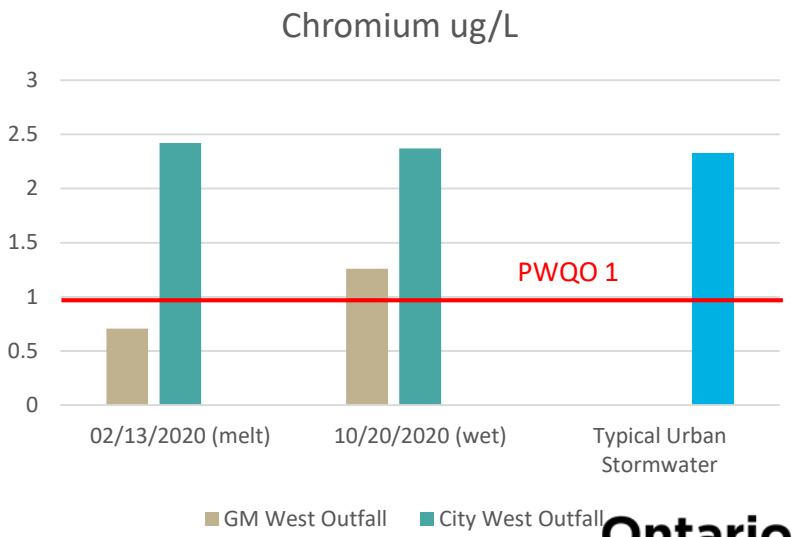
- Aluminum concentrations during the dry and rain events exceeded PWQO in both the upstream and downstream creek samples. This is not a concern as aluminum levels are naturally elevated in the watershed due to geological features on the area.
- **All other metal concentrations in the upstream and downstream creek samples were <u>below PWQOs and are not a surface water concern</u>.**

Metals Exceeding PWQO – Former GM West Outfall









St. Catharines City Council presentation

Ontario

PAH exceeding PWQO – City Storm Sewer

PAHs are chemicals that occur naturally in coal, crude oil, and gasoline and are also produced when coal, oil, gas, wood, garbage, and tobacco are burned. Many urban sources of PAH come from vehicles, asphalt, engine oil drips and tire wear.

The city storm sewer did exceed several PAH PWQOs, however, these results were <u>below values typically seen in urban roadway runoff</u>.

The former GM West outfall discharge PAH concentrations were <u>below PWQO/CWQG for all sample events and are not a concern</u>.

Twelve Mile Creek up and downstream results were <u>all below PAH PWQOs</u>.

PAH (ng/L)	Former GM outfall	City storm sewer	Urban Street Runoff (mean)	PWQO/**CWQG**
Benzo(a)pyrene	4 (wet event)	33 (snow melt)	290	**15**
Chrysene	<detection limit	93 (snow melt)	230	0.1
Fluoranthene	13 (wet event)	210 (snow melt)	640	.8/**40**
Phenanthrene	<detection limit	130 (snow melt)	310	30/**400**
Pyrene	12 (wet event)	180 (snow melt)	500	**25**

Polychlorinated Biphenyls (PCBs)

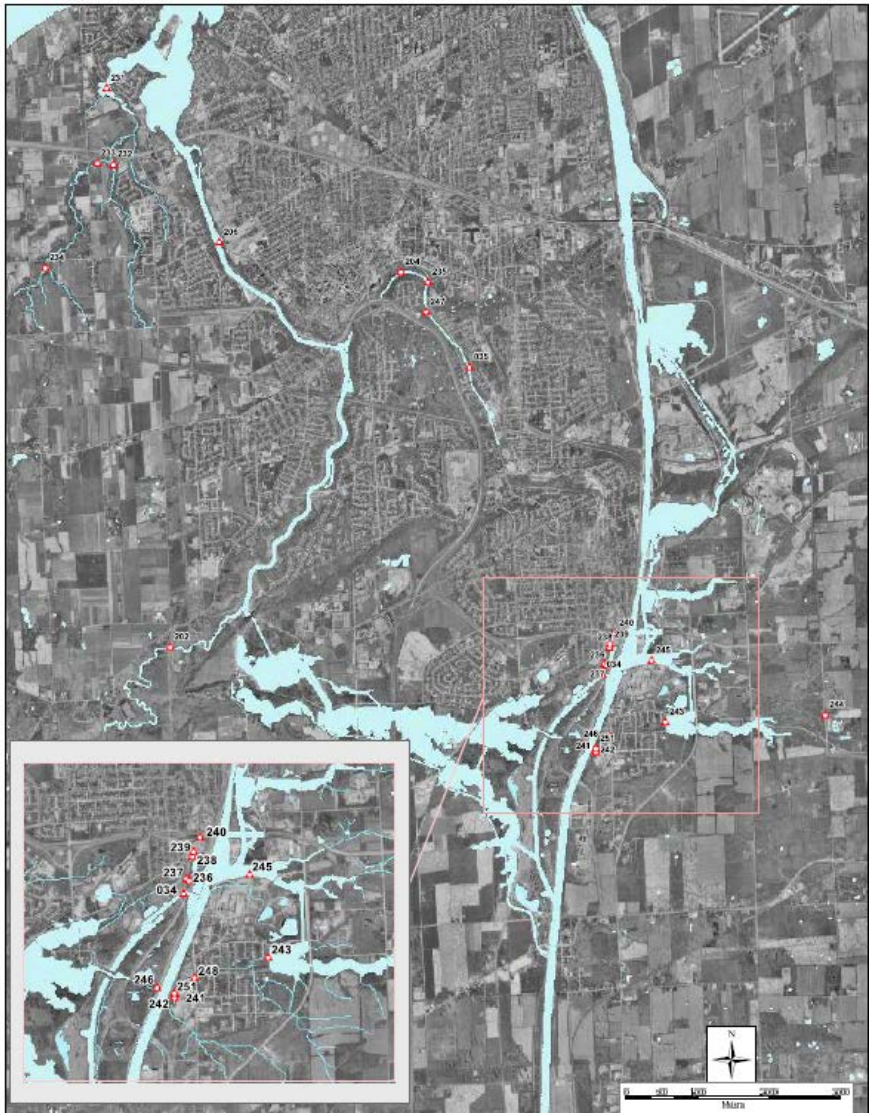
- PCBs were used as coolants and lubricants in electrical equipment and widely used in many industrial materials, such as caulk, paint, sealants, gasket materials and even carbonless copy paper.

- Although banned in 1977, due to its persistence and widespread use, it is found in waterways throughout the country.

- To minimize exposure to PCBs in the environment, the ministry's Guide to Eating Ontario Fish provides consumption advice based on guidelines provided by Health Canada.

https://www.ontario.ca/environment-and-energy/eating-ontario-fish

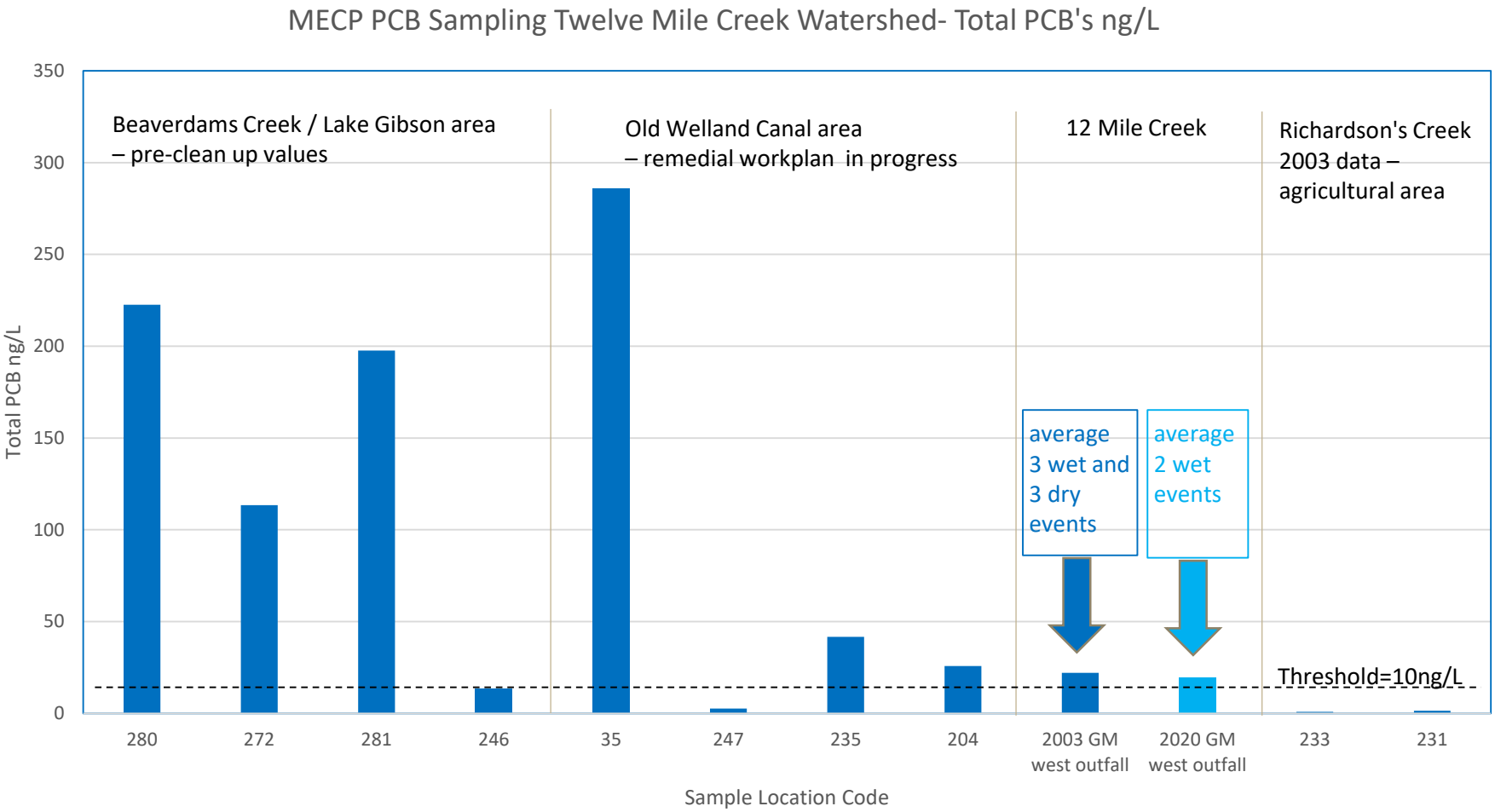
PCB Project Trackdown - Twelve Mile Creek



- The ministry has been conducting investigative PCB trackdown monitoring in the Twelve Mile Creek Watershed since 2000.
- The trackdown resulted in 4 large remedial projects for significant sources of PCB contaminated sediments found in the upper reaches of the Twelve Mile Creek watershed.
- Work is also ongoing to address PCB sources to Twelve Mile Creek from historic landfills, upstream of the former General Motors property.
- Former GM site discharge monitored as part of the PCB trackdown studies and was found to contain typical urban stormwater concentrations of PCBs.
- Updates to stormwater management for the former GM property are required as part of the development activities including controlling PCB concentrations in the discharge.

Ontario

PCBs in Twelve Mile Creek Watershed - 2003



- Efforts to control PCBs are warranted where a source can be identified.
- Bayshore has been instructed to update the stormwater controls on-site as part of the development of the property. Controlling the source of PCBs in the stormwater will be part of this work.

Ontario

Air Monitoring Survey - Parameter Selection

The air survey was designed to address resident concerns about potential dust impacts.

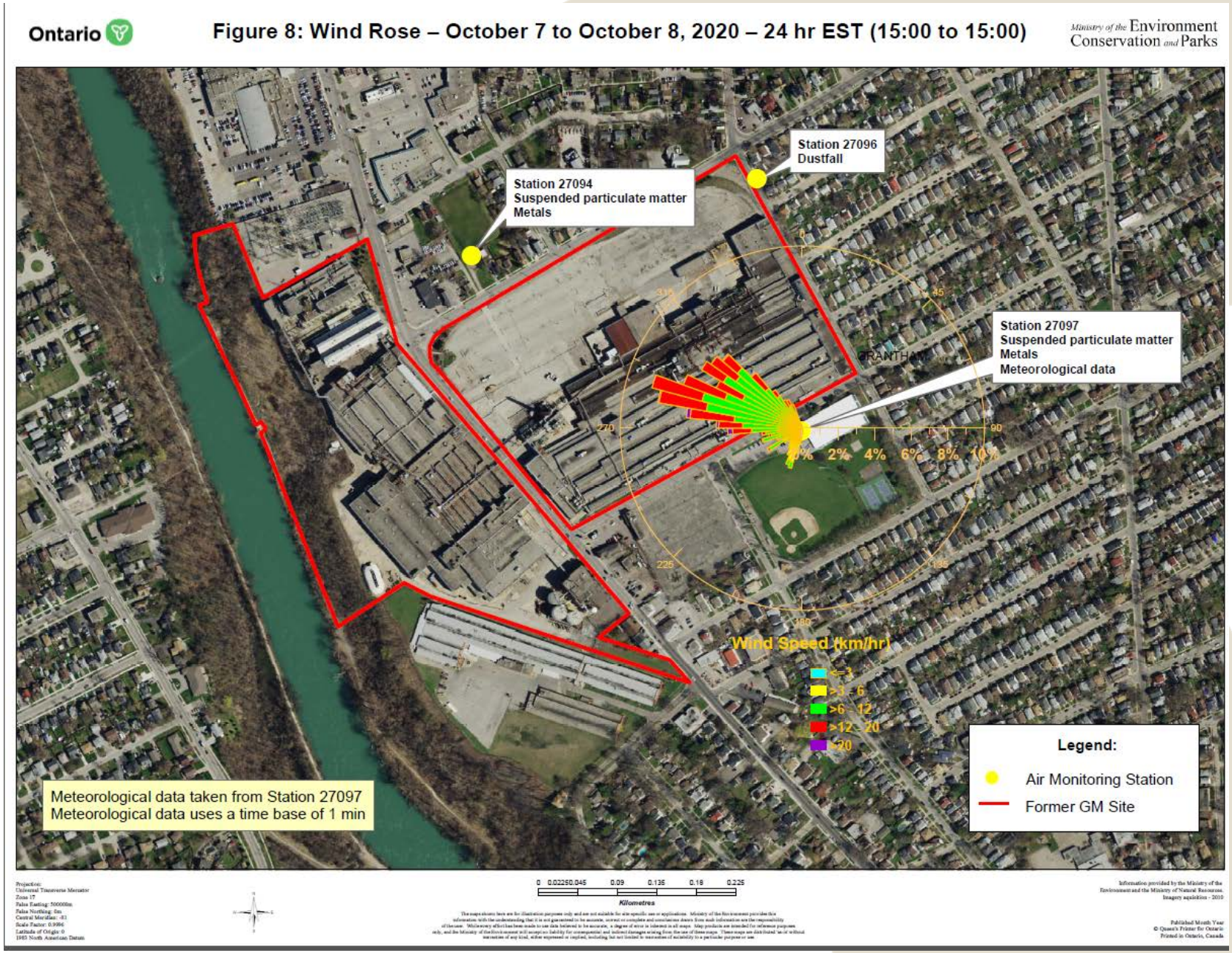
- Suspended particulate (dust) was measured by drawing a known volume of air through a filter for 24 hours to quantify the amount of dust in the air.
  - Metals were a potential component of the dust due to past operations and demolition activities and were also measured.
- Dustfall samples were collected monthly for a 3-month period
  - A dustfall sampler collects particles in the air that settle over a given area under the influence of gravity.
- Microscopic particle identification was conducted to determine the dust particle composition.
- Samples that had microscopic fibers identified were submitted for asbestos analysis.

Air Monitoring Survey

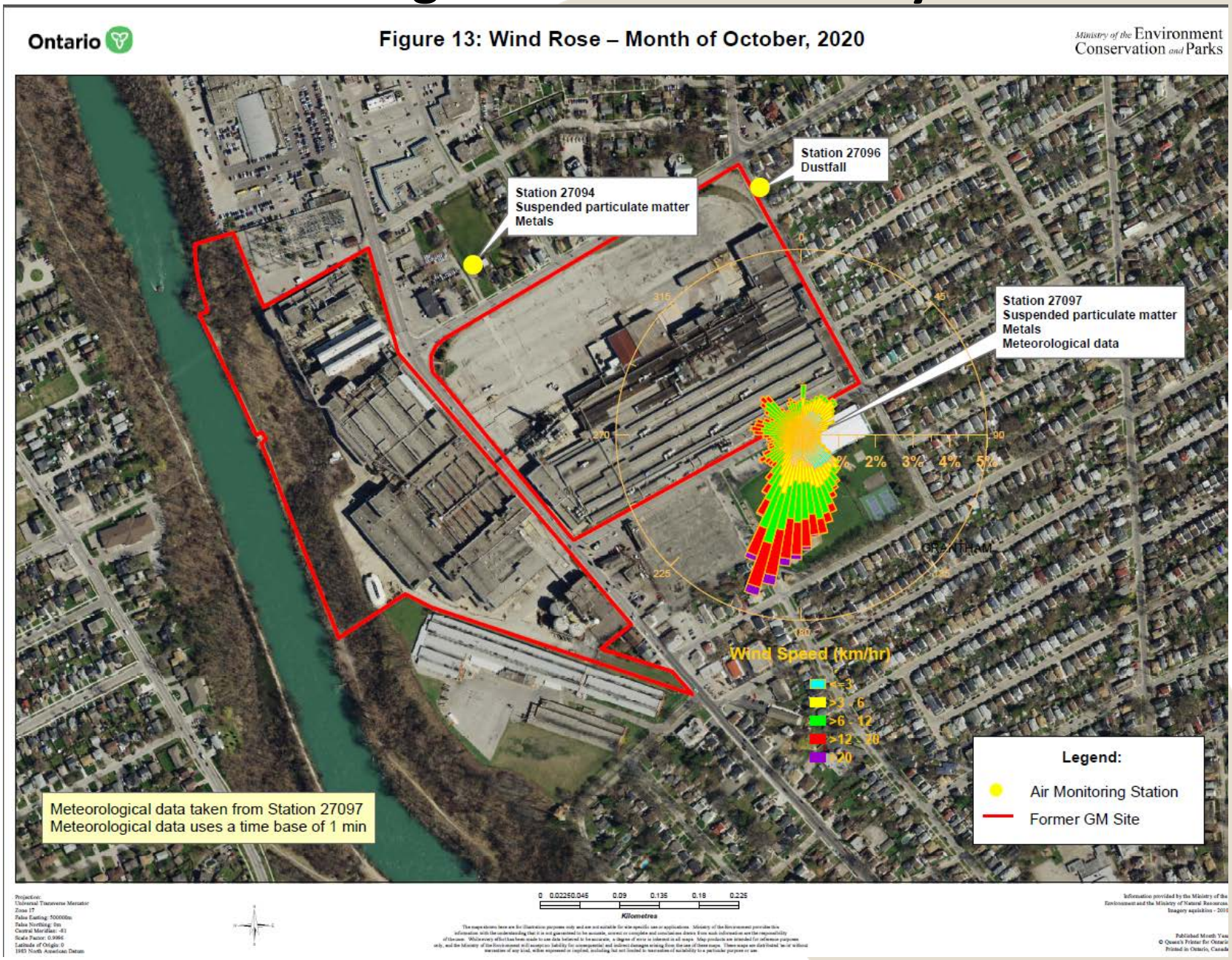
Sampling Events / predominant wind	Parameters tested
July 30, 2020 / North West wind August 4, 2020 / North West wind August 8, 2020 / South & North West wind August 13, 2020 / North East wind August 18, 2020 / North West wind August 25, 2020 / North West & South West wind August 29, 2020 / West & South West wind October 7, 2020 / North West wind October 16, 2020 / North West, South West, South East October 24, 2020 / North West wind	Suspended particulate Metals 30-day dustfall (depositional particulate) Microscopic particle identification Asbestos

- Analysis results were compared to:
    1. Ontario Regulation 419/05 Air Pollution – Local Air Quality
    2. Ambient Air Quality Criteria (AAQC)
    3. Samples with microscopic synthetic fibers were tested for asbestos (3rd party lab accredited for asbestos analysis)

MECP Air Monitoring Locations – Single Day Wind Rose



MECP Air Monitoring Locations – Monthly Wind Rose



MECP Air Hi-Vol Monitoring Results

All results are below air standards and Ambient Air Quality Criteria.

Table 1: Summary of Monitoring Results at Station 27094 (Pumping Station)

Sample Date	Predominant Wind Direction	Concentration (µg/m³)									
		Suspended Particulate Matter	Copper	Nickel	Cadmium	Chromium	Lead	Iron	Manganese	Vanadium	Zinc
O. Reg. 419/05 24-hr Standard and Ambient Air Quality Criteria		**120**	**50**	**0.2**	**0.025**	**0.5**	**0.5**	**4.0**	**0.4**	**2**	**120**
30-Jul-20	NW	19	0.081	0.001	0.005	0.002	0.005	0.36	0.013	0.002	0.001
04-Aug-20	NW	6	0.054	0.001	0.005	0.002	0.005	0.1	0.005	0.002	0.001
08-Aug-20	S,NW	14	0.055	0.001	0.005	0.002	0.005	0.24	0.01	0.002	0.001
13-Aug-20	NE	60	0.34	0.001	0.005	0.0054	0.0053	0.95	0.032	0.003	0.001
18-Aug-20	NW	13	0.069	0.001	0.005	0.002	0.005	0.22	0.009	0.002	0.001
25-Aug-20	NW, SW	29	0.075	0.001	0.005	0.002	0.005	0.39	0.013	0.019	0.37
29-Aug-20	W, SW	4	0.041	0.001	0.005	0.002	0.005	0.13	0.007	0.022	0.36
07-Oct-20	NW	12	0.052	0.001	0.005	0.002	0.005	0.19	0.007	0.002	0.001
16-Oct-20	NW,SW,SE	21	0.06	0.001	0.005	0.002	0.005	0.27	0.01	0.002	0.001
24-Oct-20	NW	4	0.051	0.001	0.005	0.002	0.005	0.11	0.005	0.019	0.39

Table 2: Summary of Monitoring Results at Station 27097 (Arena)

Sample Date	Predominant Wind Direction	Concentration (µg/m³)									
		Suspended Particulate Matter	Copper	Nickel	Cadmium	Chromium	Lead	Iron	Manganese	Vanadium	Zinc
O. Reg. 419/05 24-hr Standard and Ambient Air Quality Criteria		**120**	**50**	**0.2**	**0.025**	**0.5**	**0.5**	**4.0**	**0.4**	**2**	**120**
30-Jul-20	NW	19	0.045	0.001	0.005	0.0029	0.005	0.37	0.014	0.002	0.001
04-Aug-20	NW	8	0.052	0.001	0.005	0.002	0.005	0.11	0.009	0.002	0.001
08-Aug-20	S,NW	21	0.052	0.001	0.005	0.002	0.005	0.31	0.01	0.002	0.001
13-Aug-20	NE	40	0.051	0.001	0.005	0.0031	0.0065	0.69	0.027	0.002	0.001
18-Aug-20	NW	16	0.038	0.001	0.005	0.002	0.005	0.3	0.015	0.002	0.001
25-Aug-20	NW, SW	27	0.042	0.001	0.005	0.002	0.005	0.41	0.013	0.002	0.001
29-Aug-20	W, SW	12	0.037	0.001	0.005	0.002	0.005	0.14	0.003	0.018	0.35
07-Oct-20	NW	12	0.03	0.001	0.005	0.0022	0.005	0.21	0.008	0.002	0.001
16-Oct-20	NW,SW,SE	17	0.048	0.001	0.005	0.002	0.005	0.26	0.013	0.002	0.001
24-Oct-20	NW	5	0.029	0.001	0.005	0.002	0.005	0.098	0.003	0.02	0.37

MECP Air Hi-Vol Monitoring Results

- All measurements were all significantly below their respective O. Reg. 419/05 24-hour standards and AAQC for suspended particulate matter and metals.

- Maximum measured 24-hour concentration of suspended particulate matter was 60 ug/m^3 and 40 ug/m^3 from the pumping station (27094) and arena (27097) respectively, well below Reg 419/05 standard of 120 ug/m^3 .

- On three dates (July 30, Oct 7 and Oct 24) the winds were from the northwest direction resulting in the pumping station being directly upwind and the arena being directly downwind of the GM property. Both stations measured approximately the same concentration of suspended particulate matter indicating that off site suspended particulate emissions from the GM property to the downwind area were not observed.

- Results of microscopic analysis determined that the hi-vol samples contained mainly road dust particles (minerals), biological materials, trace synthetic fibers, tire wear particles and trace metal fragments.

- Seven Hi-vol samples found with trace synthetic fibers were sent for asbestos analysis – **no asbestos** was detected in any the samples submitted.

MECP Air Dustfall Monitoring Results

Sample Period	Total insoluble content (g/m2/30D)	Biological Material (vol%)	Minerals (vol%)
AAQC	**7 g/m^2 per 30 days**		
August 2020	2	65%	35%
September 2020	2.4	80%	20%
October 2020	3	70%	30%

Ontario

Water and Air Surveys Results Summary

- **Surface Water Survey Outcomes**
  - No impacts to Twelve Mile Creek water quality were observed.
  - Stormwater entering Twelve Mile Creek is typical of urban stormwater quality.
  - No ongoing dry weather discharges are occurring from the former GM property to the creek.
  - Oil/grit separators on the former GM property will be updated as part of development activities.
  - Sanitary sewage discharge via municipal storm sewer identified and subsequently stopped by the City.
- **Air Monitoring Survey Outcomes**
  - Samples mainly contained normal road dust.
  - High volume air samples were below ministry standards and Ambient Air Quality Criteria.
  - No asbestos was found in the air samples.
  - Monthly dustfall was below Ambient Air Quality Criteria.
  - Suspended particulate matter was similar in the samples upwind and downwind of the property suggesting no fugitive dust emissions from the property.

Regional Public Health Review Comments

- Public Health has not detected any unusual health outcomes in the vicinity of the GM plant.
- Based on the thorough sampling and analysis conducted by MECP, the water in the vicinity of the GM Plant appears to be better in terms of harmful contaminants than is typically seen in urban areas. Likewise, the air quality shows contaminants well below standards meant to protect health.
- Based on this evidence, Public Health believes there is no increased risk of adverse health to persons living in the vicinity of the former GM plant.
- Public Health is also supportive of mitigation measures recommended by MECP (i.e., updating on-site oil grit separators) to further protect local residents from environmental contaminants.

Questions?