25 October 2018 **BY EMAIL & REGULAR MAIL**

Honourable Rod Phillips
Minister of the Environment
Ministry of the Environment, Conservation and Parks
Ferguson Block
77 Wellesley Street West, 11th Floor
Toronto, ON
M7A 2T5

Dear Minister Phillips:

RE: SETTING A PROVINCIAL WATER QUALITY OBJECTIVE FOR CHLORIDES

We are writing to request that your Ministry undertake action to create a Provincial Water Quality Objective (PWQO) for chlorides.

The use of road salts is by far the greatest source of chlorides entering water bodies across Ontario. Chlorides represent a significant threat to the health of Ontario's aquatic environment causing lethal levels of toxicity to many aquatic fauna, such as freshwater mussels, amphibians, and fish. Not only is our biodiversity at risk, but our economy is also strained by road salt via infrastructure degradation. Data from Environment and Climate Change Canada indicates a 12% increase in road salt applied between 2005 and 2009. In the same timeframe, private companies saw a 157% increase in road salt application. By designating a Provincial Water Quality Objective for chlorides, Ontario can seek to ensure that its lakes, rivers, streams and aquatic environment are protected from increasing chloride levels due to increasing application of road salts. In conjunction with the Provincial (Stream) Water Quality Monitoring Network, a chloride PWQO will help determine whether chloride levels in Ontario's water bodies are safe and can identify areas for remediation or stricter road salt protections.

Attached please find a detailed Briefing Note on this critical freshwater health issue in Ontario, including historical background and a science-based proposal for what should be included in a Provincial Water Quality Objective for chlorides.

We trust that our recommendation to create a Provincial Water Quality Objective for chlorides will be duly considered and acted upon by the Ontario government. We respectfully request your written response to this submission. We would be pleased to

meet with you or staff to further discuss these necessary improvements to protecting Ontario's aquatic environment from the significant threat of road salts.

Yours truly,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Theresa McClenaghan, Executive Director and Counsel

WORLD WILDLIFE FUND - CANADA

Megan Leslie, President & CEO

ENVIRONMENTAL DEFENCE

Tim Gray, Executive Director

Attachment

CC: Dianne Saxe, Environmental Commissioner of Ontario

SETTING A PROVINCIAL WATER QUALITY OBJECTIVE FOR CHLORIDES

Briefing Note

25 October 2018

Road salts represent a significant threat to the health of Ontario's aquatic environment. By designating a Provincial Water Quality Objective (PWQO) for chlorides, Ontario can seek to ensure that its lakes, rivers, streams and aquatic environment is protected from increasing chloride levels due to increasing application of road salts. In conjunction with the Provincial (Stream) Water Quality Monitoring Network, a PWQO for chlorides will help determine whether chloride levels in Ontario's water bodies are safe and can identify areas for remediation or stricter road salt protections.

Under the *Constitution Act, 1867*, protecting fresh water and aquatic environments is shared provincial and federal jurisdiction. As such, this brief describes relevant federal and inter-jurisdictional initiatives that help to shed light on current road salt use and chloride pollution and that highlight the available science that can be drawn upon to develop a PWQO for chloride. Although there is a Canadian Water Quality Guideline for chloride, it is necessary to build on that information to determine a PWQO for Ontario, as the use is higher and the urbanization is denser than elsewhere in the country.

PART I - ROAD SALT USE IN ONTARIO

Determining current road salt use in Ontario is challenging because there are no mandatory reporting requirements (federally[1] or provincially[2]) and the federal voluntary program for road salt management only applies to medium and large municipalities. That said, some general data is available. According to a 2011 Canadian Council of Ministers of the Environment ("CCME") study, 97% of road salt used in Canada is in the form of NaCl, 2.9% is in the form of $CaCl_2$, and 0.1% as $MgCl_2$ and KCl[3]. In a study of the 1997 to 1998 winter, Ontario had the highest chloride use[4] on roadways in Canada, estimated at 1,148,570 tonnes[5]. This represented almost 40% of the total release of chlorides into the environment for all of Canada.[6] Data from Environment and Climate Change Canada indicates a 12% increase in road salt applied between 2005 and 2009. In the same timeframe, private companies saw a 157% increase in road salt application[7]. Not only does road salt use take a toll on the aquatic environment, it's estimated that corrosion and environmental costs of chloride-based products amount up to a minimum $496 per tonne on average[8].

Much of the data is now about 20 years out of date. More recent numbers suggest that a peak of 4.18 million tonnes was used on Canadian roads between 2001 and 2009[9], representing only the data from municipal and provincial road organizations that have voluntarily adopted the federal Code of Practice for the Environmental Management of Road Salts and submitted annual reports. The numbers are likely higher as sale and usage reporting often conflict[10].

Despite the lack of current, comprehensive data on road salt use, chlorides have begun to consistently show up in increasing amounts in Ontario's water bodies. In fact, chloride concentrations above background are a commonly used indicator of increasing urbanization[11]. The CCME study indicated that road salt is the single largest source of chloride entering Lake Ontario from local sources and is also a significant source of chloride loading in Lake Simcoe in Ontario[12]. Very high levels of chlorides can also be found in other Ontario waterways. In February 2011, samples taken from Cooksville Creek, a Lake Ontario tributary in Mississauga, Ontario, reported chloride levels as high as 20,000mg/L[13]in the winter. By comparison, the Ontario Drinking Water Guideline for chlorides is 250mg/L[14], and seawater chloride concentration are approximately 19,230mg/L[15]. In isolating the Provincial Water Quality Monitoring Network raw data for chlorides from October to March from 2009-2014, 415 samples tested above 120mg/L, which is the CCME recommendation for the protection of aquatic life[16], with 79 of those samples testing above 640mg/L[17]. The highest reading was 5,410mg/L. Further, from 1975 to 2009, average chloride concentrations in Ontario's streams dramatically increased from under 30mg/L to over 50mg/L[18]. No longer can we consider this a winter problem, as several live chloride monitoring stations across Mississauga, ON (Cooksville Creek, Sheridan Creek, Credit River) show chloride levels in ranges that are unhealthy and lethal for aquatic species in summer months of July and August[19]. This legacy contamination is a consequence of chloride overloading in the winter, and an inability of our soils and flora to uptake chlorides.

PART II - THE PROVINCIAL WATER QUALITY OBJECTIVES PROCESS

Provincial Water Quality Objectives provide important guidance for making water quality management decisions in Ontario. PWQOs are "numerical and narrative criteria which serve as chemical and physical indicators representing a satisfactory level for surface waters … and, where it discharges to the surface, the ground water of the Province."[20] They are "set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water."[21] PWQOs do not apply to drinking water and, instead, apply to raw water.

The process for setting a PWQO is set out in a 1992 MOEE publication entitled "Ontario's Water Quality Objective Development Process" (*PWQO Process* document). The *PWQO Process* document describes the process for setting both a PWQO and a Provincial Water Quality Guideline (PWQG). A PWQO is a numerical limit "recommended to protect all forms of aquatic life cycles during indefinite exposure and to protect recreational water uses" and are established when a defined minimum information base is available[22]. PWQGs are used when there is some "scientifically sound aquatic toxicological data available with which to assess potential aquatic environmental impacts, but there is not enough information to meet the minimum

requirements for setting a PWQO."[23] PWQGs are intended to become PWQOs when enough data is available.

To prioritize substances for which to set a PWQO, the 1992 *PWQO Process* document describes the Effluent Monitoring Priority Pollutants List (EMPPL), which is used to identify a list of contaminants of greatest concern for Ontario[24]. The EMPPL no longer seems to exist. The document then states that requests for new candidate substances "originate in various pollution control activities of the [Ministry of the Environment, Conservation and Parks] and from other Ministries"[25]. In this regard, the Ontario government has identified chlorides as a contaminant of concern in both the Water Quality in Ontario 2014 Report[26] and Ontario's Great Lakes Strategy 2016 Progress Report. In the 2016 Progress Report, Ontario calls for protection of rivers and streams from salt contamination, recognizes that chloride concentrations have been increasing and that a portion of applied road salt stays in the environment and moves slowly[27]. Because of the pollution control activities related to road salts already underway, Ontario should extend this work and designate a PWQO for chlorides. With the usage of road salts increasing during the winter months, and the scientific data indicating persistent occurrence in the aquatic environment, as well as the harm to environmental and aquatic health, chlorides should be ranked high as a priority for immediate action.

As listed in the *PWQO Process* document, there are several minimum data requirements to set a PWQO[28]. There are different data requirements for toxicity and mutagenicity, and different requirements for fish, invertebrates, and algae/aquatic plants. The PWQO must be derived from literature conforming to the following rules for minimum data[29]:

For fish:

- Toxicological data from at least three different species including at least one cold-water fish species (e.g. Rainbow trout) and one warm-water fish species (e.g. Fathead minnow) must be present.
- At least one fish species must be resident in Ontario.
- Marine or brackish water species must not be used.
- The data must include two different chronic whole organism responses (e.g. mortality, growth, reproduction), and at least one of these must involve an early life stage.
- Acute lethal responses are generally not used to meet minimum data requirements for an Objective except where a convincing case can be made that they are indicative of chronic lethality.

For invertebrates:

- At least two different orders of invertebrates must be represented, one of which must be from the class Crustacea.
- Marine or brackish water species must not be used.
- Data from no more than one tropical invertebrate species may be used.

- Data must include two different responses and at least one of these must involve an early life stage.
- Acute lethality data are generally not used except when a convincing case can be made that acute lethal responses are indicative of chronic lethality.

Algae/Aquatic Plants

- At least one algae or aquatic plant species must be represented.
- Algae/plants must be freshwater species resident in temperate North America.

Data on bioaccumulation is also required for a PWQO. This includes the bioconcentration factor and information on the potential effects in predators and/or human consumers of contaminated biota[30].

There are additional requirements to set a PWQO for mutagenicity:

- Data must be derived from freshwater aquatic organisms.
- Data must be from tests which expose organisms for a period of time permitting adequate cell division or DNA replication.
- Data must be available for at least three primary studies demonstrating mutagenic events or mutagenicity related diseases in aquatic bacteria, plant, invertebrate or vertebrate species.
- Minimal data set must include results from at least one vertebrate study and must not include results from more than one plant or bacterial study.

As demonstrated below, the CCME data set requirements for Canadian Water Quality Guidelines meets the minimum data set requirements to set a PWQO.
Chlorides represent a significant threat to the health of Ontario's aquatic environment causing lethal levels of toxicity to many aquatic fauna, such as freshwater mussels[31], amphibians[32], and fish[33].

PART III - CHLORIDES AS A PWQO

The Ontario government should immediately begin the above process to designate chlorides as a PWQO. Ontario needs to ensure that chloride usage is monitored and decreased to protect the health of our aquatic environment.

In 2001, Environment Canada and Health Canada released its Priority Substances List Assessment Report for Road Salts. The report concluded that "road salts that contain inorganic chloride salts with or without ferrocyanide salts should be considered 'toxic' under [*Canadian Environmental Protection Act*] 1999 because of tangible threats of serious or irreversible environmental damage."[34] Despite this finding, road salts have never been added to Schedule 1 of *CEPA*. Instead, the Government of Canada published the voluntary Code of Practice for the Environmental Management of Road Salts (Code of Practice) in 2004. In 2012, the five-year review of the Code of Practice was released.

In its conclusion, the report recognized that the environmental impacts of road salts had been widely documented, and that the result of numerous studies indicated that "the concentration of chlorides in the environment are approaching or surpassing levels that are harmful to aquatic organisms and remains an issue both in the short term and long term." In a follow-up report for 2013-2014, Environment and Climate Change Canada reported that 196 road organizations reported under the Code of Practice, well below their target of 220 organizations[35]. Another review of this code is scheduled for 2019. Federal initiatives alone will not be sufficient to address the particular concerns about road salts use in Ontario.

The data to support a PWQO for chlorides is numerous and is discussed in the CCME study. To set a Canadian Water Quality Guideline for freshwater long and short-term exposure to chlorides, CCME used CCME protocol with the statistical (Type A) approach. The data requirements for the long-term exposure guideline for freshwater environments are as follows:

Fish

- Three species, including at least one salmonid and one non-salmonid.

Aquatic Invertebrates

- Three aquatic or semi-aquatic invertebrates, at least one of which must be planktonic crustacean. For semi-aquatic invertebrates, the life stages tested must be aquatic.
- It is desirable, but not necessary, that one of the aquatic invertebrate species be either a mayfly, caddisfly, or stonefly.

Aquatic Plants

- At least one study on a freshwater vascular plant or freshwater algal species.
- If a toxicity study indicates that a plant or algal species is among the most sensitive species in the data set, then this substance is considered to be phyto-toxic and three studies on nontarget freshwater plant or algal species are required.

Data quality requirements for CCME indicate that primary and secondary no-effects and low-effects level data are acceptable to meet the minimum data set requirement[36].

The data requirements for the short-term exposure guidelines for freshwater environments are as follows:

Fish

- Three species, including at least one salmonid and one non-salmonid.

Aquatic Invertebrates

- Three aquatic or semi-aquatic invertebrates, at least one of which must be a planktonic crustacean. For semi-aquatic invertebrates, the life stages tested must be aquatic.
- It is desirable, but not necessary, that one of the aquatic invertebrate species be either a mayfly, caddisfly, or stonefly.

Plants

- Toxicity data for aquatic plants or algae are highly desirable, but not necessary.
- If a toxicity study indicates that a plant or algal species is among the most sensitive species in the data set, then this substance is considered to be phyto-toxic and two studies on nontarget freshwater plant or algal species are required.

Data quality requirements for CCME indicate that primary and secondary no-effects and low-effects level data are acceptable to meet the minimum data set requirement[37].

The data needed to create a CCME water quality guideline is similar to the data required to create a PWQO. CCME created a 120mg/L for long-term exposure to chlorides for the protection of aquatic life and a 640mg/L for short-term exposure to chlorides for the protection of aquatic life. This means that CCME had the necessary studies to create those guidelines, meaning that the necessary studies to create a PWQO exist. The studies CCME relied on are referenced at the end of their report.

Further, it is important to build upon the available research and consider the specific context in Ontario, which (as mentioned earlier) has higher road salt use than other regions of Canada. As well, some of the studies used by the CCME include sensitivities of species that are not native to Ontario which could have higher chloride tolerances. Field studies done by staff from the Toronto Region Conservation Authority have found that species native to Ontario are more sensitive than those used by the CCME; specifically that native benthic invertebrate species are sensitive to concentrations considerably lower than 120 mg/L[38].

PART IV - CONCLUSIONS

For the foregoing reasons, it is concluded that while Ontario has made progress on dealing with the significant threat of road salts to Ontario's aquatic environment, Ontario could still do more by creating a PWQO for chlorides.

In particular, it is recommended that Ontario explore and build on the science used by CCME to set short and long-term freshwater chloride guidelines for the protection of the aquatic environment. Ontario can use the CCME data requirements to set a PWQO for chlorides.

ENDNOTES

[1] Despite chloride being identified as toxic in sufficient quantities by the Federal Government, Canada does not currently track chlorides under the National Pollutant Release Inventory.
[2] Ontario tracks chloride releases from a small number of sectors, such as electric power generation and metal mining, but not from other industries. See Canadian Council of Ministers of the Environment (CCME). 2011. Canadian water quality guidelines for the protection of aquatic life: Chloride (online: http://ceqg-rcqe.ccme.ca/download/en/337?redir=1535032589). In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg at 2.
[3] CCME, *supra* note 2 at 2.
[4] Including both road salt and dust suppressant applications.
[5] CCME, *supra* note 2 at 2.
[6] *Ibid.*
[7] Environment Canada: Five-year review of progress: code of practice for the environmental management of road salts (online: http://publications.gc.ca/site/eng/9.695258/publication.html).
[8] Shi, X., Veneziano, D., Xie, N. and Gon, J. 2013. Use of chloride-based ice control products for sustainable winter maintenance: A balanced perspective. Cold Regions Science and Technology 86, 104-112.
[9] Environment and Climate Change Canada. 2012. Five-year Review of Progress: Code of Practice for the Environmental Management of Road Salts (online: http://publications.gc.ca/collections/collection_2012/ec/En14-54-2012-eng.pdf) at 20.
[10] *Ibid* at 20-22.
[11] CCME, *supra* note 2 at 2.
[12] *Ibid.*
[13] *Ibid* at 2-3.
[14] Ontario Ministry of the Environment. 2003. Technical support document for Ontario drinking water standards, objectives and guidelines (online: http://www.ontla.on.ca/library/repository/mon/6000/10313601.pdf). This is an aesthetic guideline (eg, the point at which it can be tasted in the water).
[15] CCME, *supra* note 2 at 2.
[16] 120mg/L is the long-term exposure Canadian Water Quality Guideline for the Chloride ion for the protection of aquatic life, which is intended to protect against negative effects to aquatic ecosystem structure and function during indefinite exposures.
[17] 640mg/L is the short-term exposure Canadian Water Quality Guideline for the Chloride ion for the protection of aquatic life, which is intended to protect most species against lethality during severe but transient events, but not intended to protect all components of aquatic ecosystem structure and function.
[18] Ontario Ministry of the Environment. 2011. Water Quality in Ontario 2010 Report (online: http://www.ontla.on.ca/library/repository/mon/26004/316712.pdf) at 59.
[19] Credit Valley Conservation Authority: Real-Time Monitoring (online: https://cvc.ca/watershed-science/watershed-monitoring/real-time-monitoring/).
[20] Ontario Ministry of Environment and Energy. 1994. Water management: policies, guidelines, provincial water quality objective (online: https://www.ontario.ca/page/water-management-policies-guidelines-provincial-water-quality-objectives).
[21] *Ibid.*
[22] Ontario Ministry of the Environment. 1992. Ontario's water quality objective development process (online: http://agrienvarchive.ca/download/ON_watqual_obj_dev_1992.pdf) at 4.
[23] *Ibid.*
[24] *Ibid* at 5.
[25] *Ibid* at 6.
[26] Ontario Ministry of the Environment and Climate Change. 2016. Water Quality in Ontario 2014 Report (online: https://www.ontario.ca/page/water-quality-ontario-2014-report).

[27] Ontario Ministry of the Environment and Climate Change. 2016. Ontario's Great Lakes strategy 2016 progress report (online: https://www.ontario.ca/page/ontarios-great-lakes-strategy-2016-progress-report).
[28] See generally, *PWQO Process* document, *supra* note 24.
[29] *PWQO Process* document, *supra* note 24 at 11.
[30] *Ibid* at 13.
[31] Gillis PL, 2011. Assessing the Toxicity of Sodium Chloride to the Glochidia of Freshwater Mussels: Implications for Salinization of Surface Waters. Environmental Pollution. 159: 1702-1708.
[32] Sanzo, D., and Hecnar, S.J. 2006. Effect of road de-icing salt (NaCl) on larval wood frogs (Rana sylvatica). Environmental Pollution 140: 247-256.
[33] Elphick J.R.F., K.D. Bergh and H.C. Bailey. 2011. Chronic toxicity of chloride to freshwater species: effects of hardness and implications for water quality guidelines. Environmental Toxicology and Chemistry. 30: 239-246.
[34] Environment Canada and Health Canada. 2001. Priority substances list assessment report for road salts (online: https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/psl2-lsp2/road_salt_sels_voirie/road_salt_sels_voirie-eng.pdf).
[35] Environment and Climate Change Canada. 2016. Code of practice for the environmental management of road salts: overview of 2013-2014 reported data in the context of national targets, overview road salts report 2013-2014 (online: http://publications.gc.ca/collections/collection_2016/eccc/En11-13-2014-eng.pdf) at 1. These organizations included 8 provinces, 178 municipalities, 3 private roadways organizations and 7 national parks.
[36] Canadian Council of Ministers of the Environment. 2007. A protocol for the derivation of water quality guidelines for the protection of aquatic life 2007 (online: https://www.ccme.ca/files/Resources/supporting_scientific_documents/protocol_aql_2007e.pdf). In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, 1999.
[37] *Ibid*.
[38] A.M. Wallace and R.G. Biastoch. 2016. Detecting changes in the benthic invertebrate community in response to increasing chloride in streams in Toronto, Canada. Freshwater Science. 35(1):353–363.

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