

Sturgeon River Watershed Alliance

Road Salt and Snow Management in the Sturgeon River Watershed

Introduction / Context

Salinity refers to the amount of dissolved salt in water. Salt is naturally present in the environment and some salinity is needed for aquatic life. However, too much salinity in a waterbody can be toxic to fish and plants and can affect the overall health of aquatic ecosystems. Salts such as chloride, sodium and potassium, can enter a waterbody by direct precipitation, leaching through soils, overland run-off, and stormwater and wastewater discharge. In particular, chloride can be of concern because it is toxic to aquatic life at low concentrations, it is highly soluble and not susceptible to degradation.

In 2017, the Sturgeon River Watershed Alliance commissioned CPP Environmental to conduct the [Sturgeon River Aquatic Health Assessment](#) (2019). This report identified salinity and in particular, chloride concentrations, as an issue in some parts of the Sturgeon River. For example, salinity and chloride concentrations in Carrot Creek exceeded Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life. Some salinity may be a result of a connection with groundwater. As per the CPP report...

“...salinity (as represented by specific conductivity) during the open water period is relatively similar across stations sampled along the Sturgeon River. During winter, when the influence of groundwater is relatively greater, salinity increases gradually downstream in the Sturgeon River, going from about 400 to 1400 $\mu\text{S}/\text{cm}$. This is somewhat expected since, as it moves east, the Sturgeon River decreases in elevation and thus intercepts a greater proportion of groundwater, which tends to be more saline than precipitation and surface runoff. Indeed, salt concentrations in buried valleys in the area are high (TDS = 2,730 mg/L in the Onoway Channel at Big Lake outlet; MacDonald 2018).” (CPP 2019)

Increasing salinity can also be a result of land use activities as follows:

“In addition, chloride concentrations during ice cover were 4 to 5 times higher downstream of Big Lake as compared to all upstream sites. These sampling sites are downstream of areas that drain high road densities; thus, road salt application appears to be increasing chloride values at these sites.” (CPP 2019)

Patrick Laceby, Alberta Environment and Parks (AEP), has been working on the issue of salinity in the North Saskatchewan River for the last couple of years. Some key findings of his [research](#) are that chloride increases more than five times downstream of Edmonton (at Pakan) compared to sites upstream. Sources include road de-icers (54%), agriculture including potash from fertilizer and urine from livestock (20%), along with waste water treatment plant and industrial effluent (15%).¹

Looking at the impact of de-icers in more detail, the Minnesota Department of Transportation [Study of De-icing Salt Accumulation and Transport Through a Watershed](#) looked at the residence time of chloride in small, urban watersheds which varied from 14 to 26 days, depending on winter weather conditions, with 37 to 63% of chloride applied as de-icers exported in snowmelt and rainfall surface runoff. In contrast, a monitored highway ditch exported less than 5% of chloride applied to the adjacent road.²

Climate can also play a role in increasing salt concentrations as water temperatures rise and evaporation increases. Wabamun Lake in the Modeste watershed is an example of a waterbody showing a trend of increasing salinity. In the Sturgeon River watershed, further analysis may be needed to identify the sources of increasing salinity and to separate out land use practices from other contributors like ground water or climate variability. However, in the meantime, we can ensure where we are using salts, that we are using the best practices possible, to ensure we are not making a poor situation worse.

Current Road Salt and Snow Management Practices in Alberta

Looking at chloride loading, and the use of de-icers in particular, many communities use sand and salts such as Calcium Chloride and Sodium Chloride on sidewalks, recreational trails, city streets, country roads and highways to achieve public safety during the winter months. Sand-salt mixtures might be varied according to ambient temperature and weather conditions. Different minerals and concentrations might also be adjusted for various temperatures. For example, plow trucks may sand and salt the roads to a temperature of -10°C. If it is colder than -10°, sand may be used and in extreme cold, a sand and calcium mixture may be used.

Sand and salt are generally purchased and stockpiled before the winter season. Communities that plow and remove snow from roadways also need to store this material until spring melt. Both salt and snow storage yards have the potential to increase run-off of road salt and other contaminants into local water bodies.

To avoid contributing to increasing salinity of our waterbodies, municipalities can ensure they are using best practices to protect their local watersheds. Many jurisdictions across Canada, such as the [Great](#)

¹ Laceby, J. & Kerr, Jason & Zhu, Dongnan & Chung, Cecilia & Situ, Q. & Abbasi, S. & Orwin, John. (2019). Chloride inputs to the North Saskatchewan River watershed: the role of road salts as a potential driver of salinization downstream of North America's northern most major city (Edmonton, Canada). *Science of The Total Environment*. 688. 10.1016/j.scitotenv.2019.06.208.

² Herb, William, Ben Janke and Heinz Stefan. 2017. Study of De-icing Salt Accumulation and Transport Through a Watershed. Prepared for Minnesota Department of Transportation. MN/RC 2017-50

[Lakes Area](#) or the Region of Waterloo ([Salt Management website](#)) are looking more closely at road salt management. Closer to home, the [Camrose Source Water Protection Plan](#) identifies contamination from road salt application and snow storage as high risks and includes a number of actions to mitigate this risk.

To assist municipalities, Environment Canada has published a [Code of Practice for the Environmental Management of Road Salts](#). (Also, see their road salt [webpage](#)). The code recommends municipalities develop road salt management plans. The Transportation Association of Canada has developed a [Salt Management Guide](#) to assist with plan development. A plan should take into consideration all activities that might result in the release of road salts to the environment, such as storage, application of salts on roads and the disposal of snow containing salts. It should also include information about operator training for proper procedures, record keeping, equipment needs, and alternative de-icing material and practices. Benefits for municipalities that have a plan can include better trained and equipped employees to effectively and efficiently carry out salt operations, costs savings from reduced salt use, a decrease in the amount of chloride released into the environment, and increased awareness of environmental preservation and stewardship.

Provincially, salt use/contamination falls under the *Environmental Protection and Enhancement Act* (EPEA) in Alberta. AEP provides [Snow Disposal Guidelines](#) as well as [Salt Contamination Assessment and Remediation Guidelines](#). Municipal Snow Melt facilities are expected to have a Water Quality Based Effluent Limit (WQBEL) for chloride and any effluent that they release.³ Alberta currently has no formal policy/regulation on load management, though it has been undertaken through some subregional water frameworks (e.g., Industrial Heartland and the Bow River Phosphorus Plan) and may be realized in the North Saskatchewan Regional Plan and Water Quality Management Frameworks, once they are completed.

Salt and Snow Management in the Sturgeon River Watershed

To get an understanding of the scope of the issue, it is worthwhile looking at road density within the Sturgeon River Watershed. In total, the watershed has about 6,170 kilometres (km) of roads, in an area of about 3,312 km² (a density of 1.86 km / km²). However, amounts vary around the watershed, with areas of residential development, including summer villages and cities, showing the highest density. The type of road is also important, with paved roads (particularly in urban areas and primary highways) often receiving more treatment than gravel roads (which are often plowed but not salted) in rural less populated areas.

³ For guidance, see AEP's [Water Quality Based Effluent Limits Procedures Manual](#).

Table 1. Road Density within the Sturgeon River Watershed, by jurisdiction.			
Summary Unit	Area in WS (km²)	Length of Road (km)	Road Density (km/km²)
County of Barrhead No. 11	17.36	15.73	0.91
Lac Ste. Anne County	960.99	1,501.47	1.56
Parkland County	796.66	1,952.73	2.45
Sturgeon County	1,406.51	2,177.96	1.55
Westlock County	58.76	65.67	1.12
Edmonton	25.67	107.26	4.18
Spruce Grove	31.61	166.89	5.28
St. Albert	46.04	348.82	7.58
Bon Accord	4.01	13.46	3.36
Gibbons	9.59	29.57	3.09
Morinville	11.32	58.16	5.14
Onaway	3.46	13.81	3.99
Stony Plain	36.86	126.45	3.43
Alberta Beach	2.72	17.58	6.47
Spring Lake	2.83	8.56	3.03
Castle Island	0.06	0.97	17.53
Ross Haven	0.69	4.30	6.18
Sandy Beach	2.31	8.17	3.53
Silver Sands	2.35	10.14	4.31
South View	0.25	3.56	14.49
Sunrise Beach	1.69	8.18	4.84
Sunset Point	1.06	4.96	4.71
Val Quentin	0.28	3.94	13.93
West Cove	1.08	5.87	5.45
Yellowstone	0.26	3.21	12.20
Sturgeon River Watershed	3,311.99	6,169.64	1.86

While road salt and snow management may look slightly different in each municipality for different reasons, there is value in comparing notes to see if there are any learnings that can be shared between jurisdictions in the Sturgeon River watershed and elsewhere. Appendix 1 is a start to this work to identify current policies, plans or best practices in use by SRWA members. From this initial comparison, a number of recommendations have been developed for SRWA member municipalities as follows:

Initial Recommendations

1. If they haven't already, that all SRWA member municipalities document their commitment to following Environment Canada's [Code of Practice for the Environmental Management of Road Salts](#). This can be stated in a municipal Salt and Snow Management Policy. For example, see Parkland County's [Salt Management Policy](#) (C-PW26) which includes the following standard: "Manage road salts in accordance

with Environment Canada's Code of Practice for the Environmental Management of Road Salts, and all other applicable federal and provincial laws.”

2. If they haven't already and using the Transportation Association of Canada's [Salt Management Guide](#), that all SRWA member municipalities develop Road Salt Management Plans. For an example, contact Sturgeon County and ask for a copy of their *SC Winter Maintenance (Sand and Salt)* document. Or go online to see City of Toronto's [Salt Management Plan](#).
3. That SRWA member municipalities with snow and salt storage yards ensure such sites meet all environmental regulations such as EPEA and incorporate best practices such as the [Snow Disposal Guidelines for The Province of Alberta](#) produced by Alberta Environment.
4. Using the [Environment Canada Road Salt Performance Indicators](#), that the SRWA encourage all of its member municipalities to provide data on annual salt usage and the achievement of these indicators, and for the SRWA to include this information in its state of the watershed reporting. Note that City of St. Albert already collects this data and contributed to the national report [Environmental management of road salts: summary of data 2014 to 2018](#).
5. Where resources allow, that the SRWA continue to include salt (chloride) in its Sturgeon River watershed water quality monitoring and assessment program.

Conclusion

While much more can be written about the impacts of road salt and snow storage in the Sturgeon River watershed, this initial paper provides a starting point for discussion. Additionally, it identifies five initial recommendations that can be enacted relatively quickly that will lead to a better awareness and understanding of the scope of this issue in this watershed. In particular, the collection of data will lead to further analysis and perhaps, rationale for additional actions, if required at a later date. In particular, future work should focus on quantifying chloride concentrations in the Sturgeon River watershed; identifying and mitigating sources; and raising awareness of this issue and its potential solution.

Additional Resources

[Alberta Municipal Benchmarking Initiative – Snow & Ice Control Salt Management in Alberta Highway Maintenance Yards](#)

Appendix 1 – Comparison of Road Salt Application and Snow Storage practices by municipalities in the Sturgeon River watershed.

Authority	Responsibility	References EC COP for the Environmental Management of Road Salts?	Have developed their own salt and snow management policies?	Salt Management Plan?	Covered Salt and Snow Storage Sites?	Amounts Used Annually	Special considerations for sensitive areas?
Alberta Transportation / GOA Contract Maintenance Areas 509, 510 Emcon Services Inc. 780-963-5711	Maintenance, construction, and snow removal on Highways 16, 16A, 22, 43, 44, 60, 624, 627, 628, 633, 757, 759, 765, 770 and 779.		AEP Snow Disposal Guidelines				
Parkland County Public Works and Engineering Services departments	Develop and maintain Range Roads and Township Roads in Parkland County (1,250 km of graveled local roads and 800 km of asphalt surface roads) including snow removal .	Yes, as per policy, adheres to Environment Canada's Code of Practice for the Environmental Management of Road Salts	County follows C-PW26 Road Salt policy which provides for the management and use of road salts in a manner that protects the environment without compromising road safety. Mainly for paved roads.				
Lac Ste. Anne County Public Works Department	Maintenance of county owned roads (township and range roads; no highways)						
Sturgeon County Transportation Services	Provides maintenance on subdivision roads, municipal roads and roadside allowances	The County makes its best effort to follow Environment Canada's COP for the	Snow and Ice Control Policy TRA-SNO-1 (intra-net access only)	See SC Winter Maintenance Sand and Salt document		4561 Tonnes of sand pickled with 18 Litres per tonne of Calcium	

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	including 185 km of secondary roads and 1,776 km of local roads.	Environmental Management of Road Salts. (see Brochure)		(intra-net access only)		Chloride = 82,098 litres total 2082 Tonnes Vanscoy Standard road salt (potash style road salt) from NSC	
City of Spruce Grove		“Snow disposal sites will be maintained to minimize the impact of pollutants on the environment and in accordance with the Salt Management Guidelines established by Environment Canada.”	See CP-1002-17 Snow and Ice Control Policy mostly deals with snow clearing priorities.				
City of St. Albert	Roads within city boundaries. Snow and salt management is one of the City’s programs as part of its ISO 14001 EMS program.	St. Albert has a well-managed road salt application program. In response to the federal government’s draft code, we	Policy C-IS-01 Snow and Ice Control Policy .	Salt Management Plan is a detailed manual, with procedures and analytics on	Snow storage stie north of Villeneuve Road (secondary highway 633) closing October 2020.		Bridges and other environmentally sensitive areas have special procedures, e.g., slowing speeds to reduce spray into waterbodies

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		prepared a revised Road Salt Management Application program.		the amount of snow, sand and salt handled each year. Also track the speed and use of sand/salt of individual trucks using their GPS functions.			and limited and careful sand/salt use. Sampling water quality at the Ray Gibbon Drive bridge to assess chloride after we found them increasing in the stormwater ponds for the highway.
City of Edmonton		Meet Codes of Practice established by Transportation Association of Canada and adopted by Environment Canada.	Snow and Ice Control Policy . Report to both Alberta Environment and Environment Canada annually on road salt usage and road salt management. outlined in the Salt Management Plan.		4 snow storage sites with lined snowmelt ponds		Conducted a number of studies
Town of Stony Plain				Committed to developing a road salt plan in their 2007 Environmental Stewardship Strategy .			

Authority	Responsibility	References EC COP for the Environmental Management of Road Salts?	Have developed their own salt and snow management policies?	Salt Management Plan?	Covered Salt and Snow Storage Sites?	Amounts Used Annually	Special considerations for sensitive areas?
Town of Morinville			Snow and Ice Control Policy establishes snow removal priorities.		Salt shed demolished?		
Town of Gibbons			Snow Removal / Ice Control for Roads and Sidewalks Policy				
Town of Onoway							
Town of Bon Accord							
Village of Alberta Beach	Public Works Department at 780-924-3322						
Spring Lake							
Castle Island							
Ross Haven							
Sandy Beach							
Silver Sands							
South View							
Sunrise Beach							
Sunset Point							
Val Quentin							
West Cove							
Yellowstone							

