Reducing Chloride Impacts on Waterways from Municipal Salt Storage Facilities

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Forward thinking initiative from the **City of Vaughan- Infrastructure Development**

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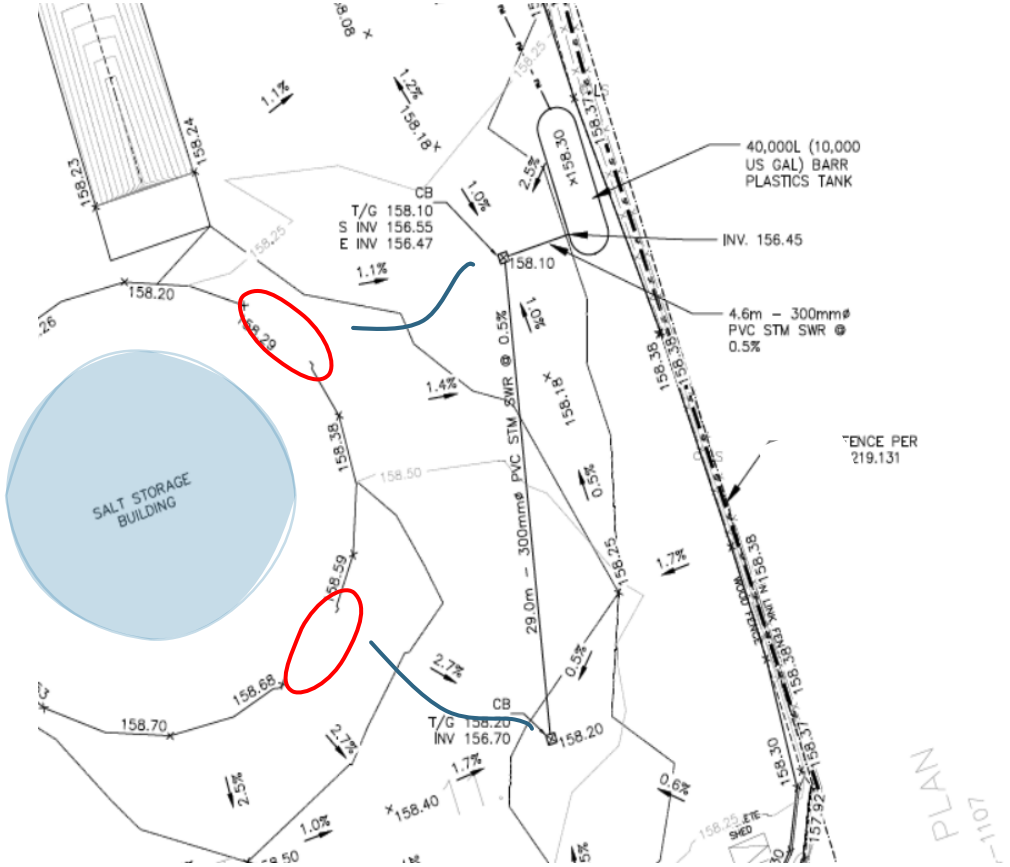
1.0 Introduction
Urban Watershed Group Ltd. (UWGL)

- **Jim Hartman, P. Eng** is a Director at Urban Watershed Group Limited.
- **Eric Persichini, CET** is the Field Services Manager at Urban Watershed Group Limited.
- Specializes in creative and innovative urban land development and civil engineering solutions for planners, developers and public sector clients.
- The Greenland Group of Companies **(GREENLAND®)** is an award-winning engineering and technologies enterprise. It includes private consulting firms, other businesses and internationally renowned research teams that collaborate on civil; environmental; alternative energy; and software engineering projects.
- City of Vaughan - Infrastructure Development Project lead by the **Facility Management** department (John-Paul Zentana, Architectural Technologist).

2.0 Scope and Goal of the Project

- The City of Vaughan (City) is adopting forward thinking approach to reduce the chloride impacts from road salt on the nearby waterways at their **West Yard Public Work Site.**
- **The goal** is to capture salt contaminated runoff and contain it within an underground storage tank.
- Measure chloride content and determine disposal location.
- Added benefit of improving overall site drainage.

3.0 Design Methodology



- New storm sewer system designed to capture contaminated runoff and direct to UST (sized based on historical precipitation data).
- Runoff stored in UST with instrumentation to measure salinity (chloride) and water level.
- Tanks were then oversized to accommodate for large precipitation (rain and snowmelt) runoff events.
- Logic system implemented to regulate discharge and provide alarms for high chloride concentrations and UST water levels.

3.1 Calculating Capture Volume

- Defined Yard catchment area (Parking lots, driveway, buildings).
- Quantify the number of Storm Events.
- Calculate the average size of Storm Events.
- Determine 80% capture of runoff during road salting period.

24-hr Storm Events from 2002 to 2021				
Storm Event	Precipitation (mm)	Count of Winter Storms Events		
		Per Year	Per Month	Per Week
>0mm	0	97	8	2
25mm	25	2	0.2	0.04
2-yr	57	0.053	0.004	0.001
5-yr	76	0	0	0
10-yr	88	0	0	0
20-yr	103	0	0	0
50-yr	114	0	0	0
100-yr	125	0	0	0
	Total	99	8	2

North Catchment			
	Max 80% Precipitation Events (mm)	Area (Ha)	Total Runoff Volume (m^3)
Daily	8	0.29	23
Weekly	16	0.29	48
Biweekly	33	0.29	95
Monthly	71	0.29	206

South Catchment			
	Max 80% Precipitation Events (mm)	Area (Ha)	Total Runoff Volume (m^3)
Daily	8	0.22	18
Weekly	16	0.22	36
Biweekly	33	0.22	72
Monthly	71	0.22	157

Average Total Precipitation and Snowmelt	Per Day (mm)	Per Week (mm)	Per Month (mm)
Monthly			
January	2.42	17.14	74.88
February	3.15	21.59	89.04
March	2.43	17.26	75.35
April	2.84	20.13	85.30
May	2.74	18.89	84.89
June	3.23	22.54	96.97
July	2.86	19.84	88.55
August	2.50	18.80	77.55
September	2.49	16.44	74.62
October	2.40	16.59	74.33
November	2.48	16.93	74.46
December	2.80	20.47	86.89
Yearly			
Average	2.69	18.89	81.90
Maximum	3.23	22.54	96.97
High 80%	2.85	20.40	88.22
Low 20%	2.44	16.97	74.67
Minimum	2.40	16.44	74.33
Winter Months (October - April)			
Average	2.65	18.59	80.04
Maximum	3.15	21.59	89.04
High 80%	2.84	20.40	86.57
Low 20%	2.44	17.17	74.97
Minimum	2.40	16.59	74.33

4.0 Potential Waterway Chloride Loading Reduction

- Disposal of collected runoff (if required) to be sent to proper water treatment and recovery facility:
  - Approx. cost $0.30/Liter at a licensed facility.
- Collected runoff water quality meeting environmental criteria will be discharged to the nearby watercourse/storm sewer.
- Improve water quality in the nearby watercourse.

4.1 Potential Waterway Chloride Loading Reduction

- West Yard bordered by the Humber River which is regulated by the Toronto and Region Conservation Authority (TRCA).
- Runoff from the site is currently not controlled and the chloride concentration contributing to the Humber River is unknown.
- Criteria for the chloride impacts on the River were derived from the **Canadian Council of Ministers of the Environment (CCME)** guidelines for short and long term release.

Canadian Water Quality Guideline for the chloride ion[a] for the protection of aquatic life

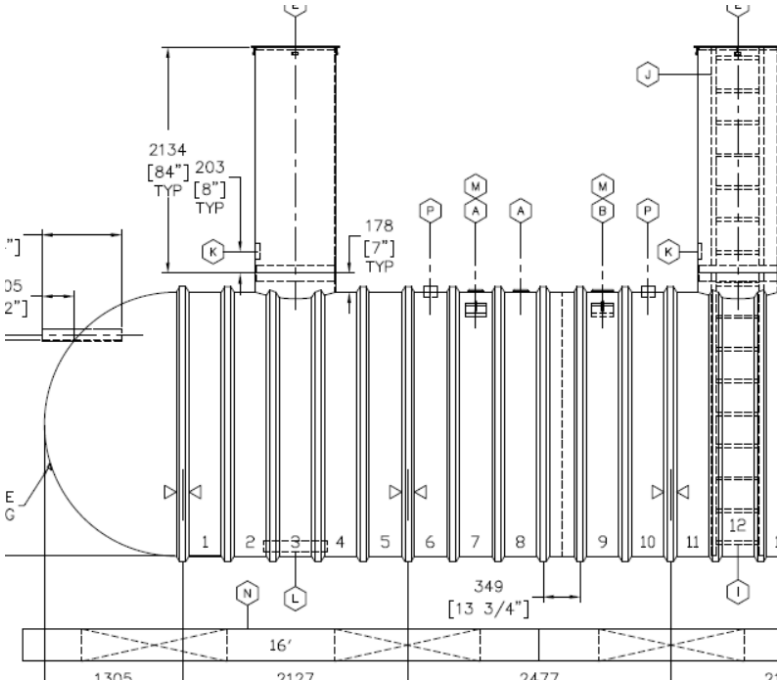
	Long-Term Exposure [b] ($mg\ Cl^-/L$)	Short-Term Exposure [c] ($mg\ Cl^-/L$)
Freshwater	120[d]	640

4.2 Potential Waterway Chloride Loading areas of concern

South-west corner parking lot area

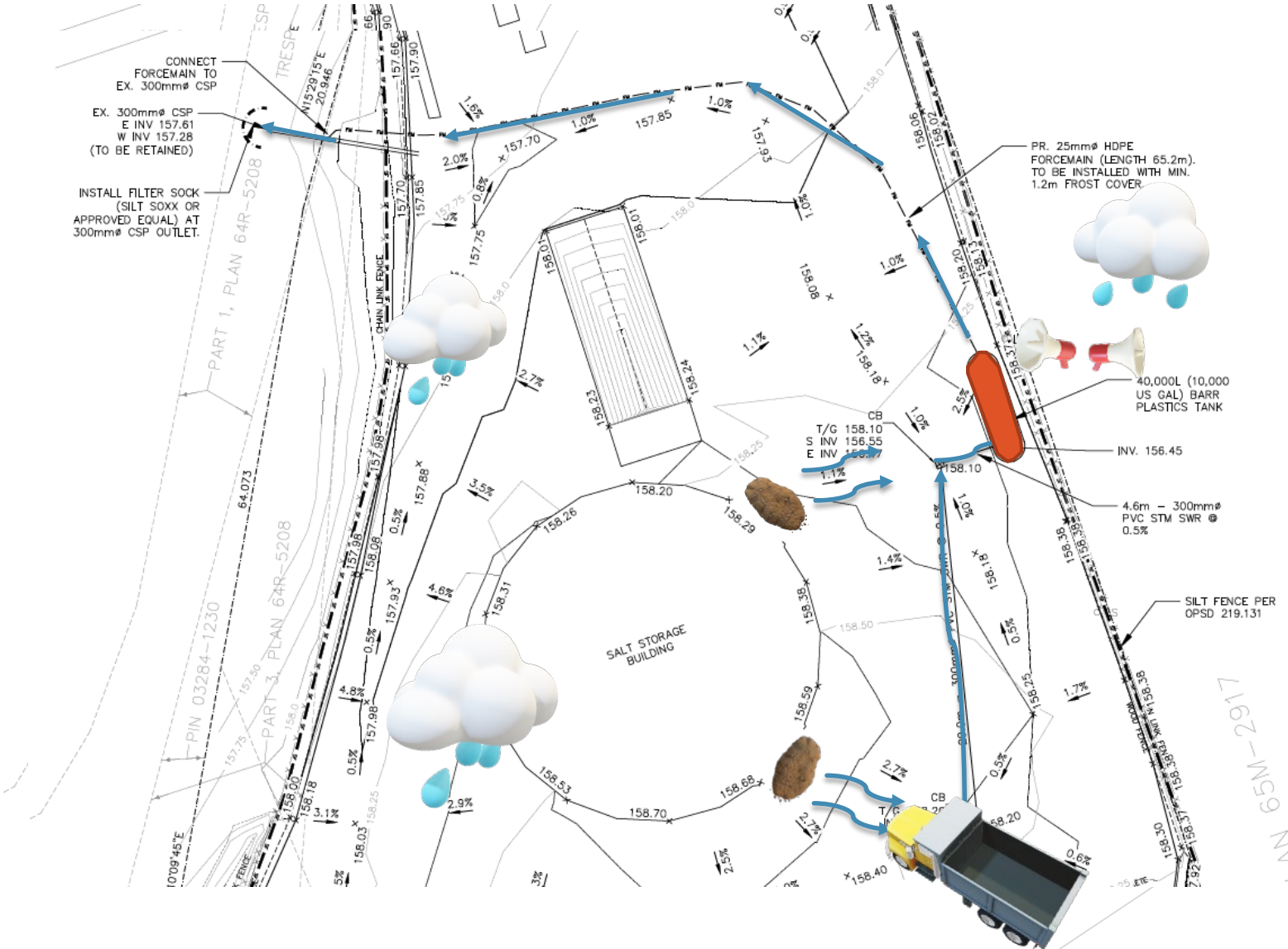
Northerly section of the side

5.0 Logic Control System



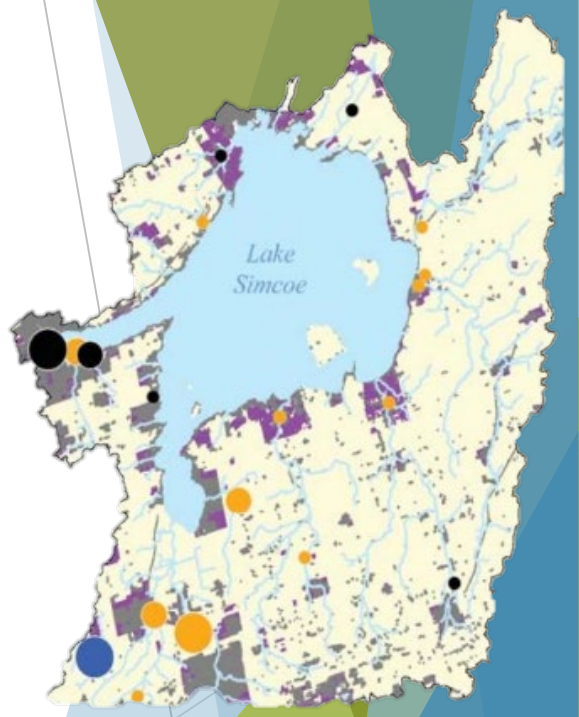
- Continuous monitoring of the chloride concentration in the collection UST by measuring the conductivity and temperature.
- Measurements to be displayed at the tank control panel as well as in the nearby office.
- Automated operation of the system:
  1. Maintain a minimum level in the tank for the submersible pump.
  2. Notification of high chloride concentration above the allowable tolerance (>640 mg/L).
  3. If the concentration is less than 640 mg/L the pump is activated to discharge to the nearby outlet to the Humber River.
  4. Alarm notification is sent to the City to have the tank pumped out if the concentration remains above discharge criteria and/or reaches volumetric capacity.

5.0 Logic Control System Example for West Yard



6.0 Future Opportunities for Municipalities

- System can be **adapted** for existing infrastructure and the City is implementing this for all City salt dome facilities.
- Potential for **re-use** of the chloride contaminated runoff as brine solution.
- **Future monitoring programs** to measure the benefit to watercourses.
- Introduction of alternative salting operation methods and **new environmental initiatives** for the Municipality.
- Pro-active approach to **Environmental Social Governance (ESG)** measures.
- Solution to benefit aquatic habitats. See the example below of initiatives being developed:
  - **EXAMPLE**: The Municipalities in the Lake Simcoe Watershed have developed 'Salt Management Plans" to help navigate the balance between environmental protection and public safety….identifying areas where there is greatest impacts to aquatic habitats'.



7. Closing Remarks

- Overall the expected results of the project will significantly reduce the chloride loading on the Humber River and existing storm sewer infrastructure on all three (3) project sites.
- Innovating the operation of salt storage facilities and improve drainage.
- Installation of UST's can also be used a salt brine storage or application tanks in future applications.
- A solution Municipalities should consider to assist in the overall impact of chlorides in our waterways.
- Facilitating ESG measures for private and public sectors.

7.1 Questions?

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