



MEMORANDUM

DATE: December 10, 2020
TO: Bill McDonough and Chris Prucha, Waste Management (WM)
FROM: François Richard and Madeleine Corriveau, BluMetric Environmental Inc.
PROJECT NO: 190222-07
SUBJECT: North Lagoon and Groundwater Sampling Results, Waste Management Richmond Landfill, Town of Greater Napanee

This memorandum provides sampling results related to the North Lagoon Investigation at the Waste Management (WM) Richmond Landfill (the Site) in the Town of Greater Napanee. The sampling included:

- Quarterly groundwater samples from monitoring wells M217 and M218, two shallow groundwater monitoring wells installed immediately downgradient from the North Lagoon; and,
- North Lagoon samples collected from surface and from 0.4 m below surface.

The groundwater samples were collected in compliance with Condition 8.5(c)iv from the Environmental Compliance Approval (no. A371203) for the site, which states that newly installed groundwater monitoring wells shall be tested a minimum of four times on a quarterly basis during the first year after being established. The surface water samples collected from the North Lagoon were collected at the request of the Ministry of the Environment, Conservation and Parks (MECP).

The results are summarized and discussed below.

GROUNDWATER SAMPLING

Groundwater samples were collected from shallow groundwater monitoring wells M217 and M218 on January 23, April 20, July 31 and November 3, 2020. Both wells are poor producers and were purged dry prior to sampling following recovery. The samples were analyzed for the general/inorganic parameters and volatile organic compounds (VOCs) outlined in Tables 3 and 4

from the Environmental Monitoring Plan (EMP) dated April 2016. Results are presented in Table 1 at the end of the text. 1,4-dioxane was not detected in any of the groundwater samples.

With the exception of xylenes at M218 in November, which were detected at just above the detection limit (0.00011 mg/L), no VOCs were measured above the laboratory's reportable detection limit (RDL) in any of the groundwater samples.

NORTH LAGOON SAMPLING

Two samples were collected from the North Lagoon on November 3, 2020: one from surface and one from a depth 0.4 m below the surface, taking care not to disturb the bottom sediments. Results are presented in Table 1 at the end of the text. Water quality results for the North and South Chamber leachate sumps from samples, collected on May 13, 2020 as part of the EMP monitoring program, are also included in the table for comparison purposes.

As expected, the results were very similar for both North Lagoon samples (at surface and 0.4 m depth). 1,4-dioxane was not detected in either of the North Lagoon samples. Leachate indicator parameters were generally lower in the North Lagoon samples compared to previous results (from October 2019).

DISCUSSION

Shallow groundwater quality observed at monitoring wells M217 and M218, immediately downgradient from the North Lagoon, is consistent with background concentrations¹ in the shallow groundwater flow zone. For most leachate indicator parameters (i.e. ammonia, boron, chloride, DOC, potassium and sodium), concentrations were up to an order of magnitude lower in the groundwater monitoring well samples when compared to concentrations in the North Lagoon samples, with the exception of the November 2020 results for M218 which had higher concentrations for some parameters compared to the groundwater samples from previous events (ammonia, chloride, TDS, boron, manganese, sodium). The concentrations observed are still generally low, however the relatively higher mineralization observed is consistent with the low permeability conditions observed locally (slow recovery wells).

¹ Environmental Monitoring Plan, Richmond Landfill, BluMetric Environmental Inc., April 2016.

Of significant note, 1,4-dioxane, the primary leachate indicator for the Site, was not detected in any of the samples collected from the new monitoring wells. Groundwater quality results do not indicate the presence of leachate impacts in the shallow groundwater flow zone downgradient of the North Lagoon.

We trust the above is satisfactory. If you have any questions or need further information please do not hesitate to contact the undersigned.

Respectfully submitted,
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TABLES



Table 1: North Lagoon and Groundwater Chemistry

Reading Name	Units	Leachate		North Lagoon			Groundwater Monitoring Wells							
		North Chamber 2020-05-13	South Chamber 2020-05-13	North Lagoon 2019-10-03	North Lagoon 2020-11-03	North Lagoon 0.4 m 2020-11-03	M217 2020-01-23	M217 2020-04-20	M217 2020-07-31	M217 2020-11-03	M218 2020-01-23	M218 2020-04-20	M218 2020-07-31	M218 2020-11-03
General/Inorganic														
Alkalinity	mg/L	1600	2000	460	250	260	340	350	380	360	360	350	400	410
Ammonia	mg/L	181	261	10.7	0.42	0.41	< 0.15	< 0.15	0.16	< 0.15	< 0.15	< 0.15	0.2	0.39
Biochemical Oxygen Demand	mg/L	13	18		< 2	< 2								
Chemical Oxygen Demand	mg/L	210	280		43	41								
Chloride	mg/L	340	720	140	120	120	< 1	1.4	2.6	2	1.1	< 1	5.1	69
Conductivity	µS/cm	3900	5700	1300	830	860	620	650	700	740	660	660	700	970
Dissolved Organic Carbon	mg/L	77	94	28	16	17	1.8	2.2	3.5	2	1.5	1.4	1.5	2.1
Hardness	mg/L	700	590		180	180								
Naphthalene	mg/L	0.0087	0.000098		< 0.00005	< 0.00005								
Nitrate	mg/L	< 0.1	< 0.2	< 0.1	0.17	0.16	0.56	0.52	0.21	0.11	0.19	0.19	0.17	< 0.1
Nitrite	mg/L	< 0.01	< 0.02	< 0.01	0.024	0.022	< 0.01	< 0.01	0.04	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
N-nitrosodimethylamine	ng/L	< 8	< 10.6		< 2.13	< 2.15								
pH (Lab)	unitless	7.42	7.87		8.13	8.13								
Phenols	mg/L	< 0.008	0.0063		< 0.004	< 0.004								
Phosphorus (total)	mg/L	0.68	0.75		< 0.03	0.034								
Sulphate	mg/L	< 1	< 1	< 1	1.3	< 1	6.7	6.2	22	54	25	20	28	46
Total Dissolved Solids	mg/L	1520	2170	745	390	425	320	330	355	410	360	345	365	535
Total Kjeldahl Nitrogen	mg/L	150	260		1.3	1.3								
Metals														
Boron	mg/L	1.5	2.9	0.53	0.32	0.32	< 0.02	0.036	0.11	0.11	0.065	0.06	0.076	0.38
Cadmium	mg/L	< 0.0001	< 0.0001		< 0.0001	< 0.0001								
Calcium	mg/L			68			43	48	55	73	59	62	66	67
Chromium (Total)	mg/L	0.009	0.015		< 0.005	< 0.005								
Cobalt	mg/L	0.0056	0.01		< 0.0005	< 0.0005								
Copper	mg/L	< 0.002	0.002		< 0.002	< 0.002								
Iron	mg/L	13	5.5	< 0.1	0.36	0.69	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lead	mg/L	< 0.0005	< 0.0005		< 0.0005	< 0.0005								
Magnesium	mg/L			37			49	51	48	47	45	45	48	49
Manganese	mg/L	0.74	0.4	0.052	0.009	0.033	0.007	0.013	0.037	0.059	0.014	0.007	0.012	0.099
Nickel	mg/L	0.024	0.062		0.005	0.006								
Potassium	mg/L	89	150	35	20	20	0.53	1.1	3	2.9	3.1	3.2	3	8.6
Sodium	mg/L	320	570	130	99	100	16	19	28	25	19	19	18	82
Zinc	mg/L	0.014	0.28		< 0.01	< 0.01								
Volatile Organic Compounds (VOCs)														
1,1,1,2-Tetrachloroethane	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1,1-Trichloroethane	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,1,2,2-Tetrachloroethane	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1,2-Trichloroethane	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1-Dichloroethane	mg/L	0.00059	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,1-Dichloroethylene	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,2-Dichlorobenzene (o)	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,2-Dichloroethane	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,3,5-Trimethylbenzene	mg/L	0.0026	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,3-Dichlorobenzene (m)	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,4-Dichlorobenzene (p)	mg/L	0.0067	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,4-Dioxane	mg/L	0.051	0.03	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Benzene	mg/L	0.0058	0.00065	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chlorobenzene	mg/L	0.0054	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chloroethane	mg/L	0.0023	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chloromethane	mg/L	< 0.0025	< 0.0025	< 0.0025	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Cis-1,2-Dichloroethylene	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Dichloromethane	mg/L	< 0.0025	0.035	< 0.0025	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	0.013	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
m+p-Xylene	mg/L	0.036	0.00086	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00011
o-Xylene	mg/L	0.0098	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Styrene	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Tetrachloroethylene	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Toluene	mg/L	0.0032	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Total Xylenes	mg/L	0.045	0.00086	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00011
Trans-1,2-dichloroethylene	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Trichloroethylene	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Vinyl Chloride	mg/L	< 0.001	< 0.001	< 0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002