Re: February 21, 2020 MW19-01 and MW19-02 Sampling Results

On February 21, 2020, ministry staff sampled the two new shallow groundwater wells MW19-01 and MW19-02. The samples were submitted to ALS Environmental and analytical results were reported on February 24, 2020. A summary of the results is as follows:

- MW19-01:
  - Due to high turbidity of the water sample (>2,000 NTU), analysis of metals (dissolved or total), major ions and other inorganic parameter were not assessed because high turbidity can cause either positive or negative bias.
  - The high sample turbidity was due to the inability to collect the sample using a low flow sampling method, because MW19-01 well casing was recently extended more than five meters above original grade in preparation for the soil wedge construction. Future monitoring of MW19-01 will require a submersible pump or other sampling method capable to handle both the required lift while still achieving low sample turbidity.
  - A hydrocarbon sheen was apparent on the surface of water that was purged from MW19-01. Hence, water samples were collected and analysed for Extractable Petroleum Hydrocarbons (EPH), Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH), and Polycyclic Aromatic Hydrocarbons (PAH). Unlike the inorganic parameters noted above, high sample turbidity is expected to have negligible effect on the organic parameters, unless the sediment itself is contaminated with organic constituents.
  - The analytical results reported heavy hydrocarbons as well as four PAHs at concentrations above the laboratory detection limits. However, all results were below applicable water quality standards. All hydrocarbon results are presented in the attached laboratory Certificate of Analysis (COA).
  - Results have been shared with the Named Parties for follow up.

- MW19-02:
  - The analytical results of inorganic and organic parameters were compared to the applicable *Contaminated Sites Regulation* (CSR) generic numerical water standards for protection of drinking water and aquatic life. No exceedances were identified.
  - Major ions were plotted on a Piper Diagram (Figure 1). The diagram indicates that the sampled water is similar to the previous sample collected in January and its ion ratios are representative of typical shallow, fresh groundwater.
  - Table 1 compares the groundwater analytical results to the CSR standards.

Based on these sampling results, there are no immediate concerns and the ministry will continue to review water monitoring results and closure activities that are being undertaken by the Named Parties as part of the Spill Prevention Order.

Attachment(s): Table 1: Leachate indicator parameters as measured at water monitoring sites.

Figure 1: Piper diagram.

Certificate of Analysis for MW19-01

Certificate of Analysis for MW19-02

Table 1: Leachate indicator parameters as measured at groundwater monitoring sites (compared to water quality standards) showing how the most recent receiving environment sampling results for leachate indicator parameters compare to applicable standards (CSR standards).

	Groundwater Monitoring Sites[1]					
		Groundwater				
		MW19-01		MW19-02		
Parameter	**CSR Standards[3]**	**2019-12-19**	**2020-01-21**	**2019-12-19**	**2020-01-21**	**2020-02-21**
General Parameters						
Alkalinity, Total as $CaCO_3$ (mg/L)	N/A	83.3	154	161	109	113
pH	N/A	7.63	7.96	7.74	7.69	NI
Total Dissolved Solids (mg/L)	N/A	162	274	593	286	218
Anions						
Chloride (mg/L)	250[AO]	4.57	9.97	25.5	5.68	7.42
Nitrite (as N) (mg/L)	0.6 - 2 [Cl]	<0.010	<0.010	<0.010	<0.010	<0.0010
Sulphate (mg/L)	500	38.9	53.8	263	109	80.8
Total Hardness as $CaCO_3$ (mg/L)	N/A	54.7	70.7	321	189	181
Dissolved Metals						
Calcium, dissolved (mg/L)	N/A	18.2	23.1	108	63.7	61.1
Chromium, dissolved (mg/L)	0.010	<0.00050	<0.00050	<0.00050	<0.00050	0.00013
Copper, dissolved (mg/L)	0.030 - 0.090 [H]	<0.00040	0.00061	0.00067	0.00063	0.00048
Lead, dissolved (mg/L)	0.010	<0.00020	<0.00020	<0.00020	<0.00020	<0.000050
Magnesium, dissolved (mg/L)	N/A	2.26	3.15	12.8	7.31	6.92
Manganese, dissolved (mg/L)	1.5	0.0337	0.0121	0.274	0.0297	0.00968
Potassium, dissolved (mg/L)	N/A	0.82	1.58	1.52	0.72	0.821
Sodium, dissolved (mg/L)	200	31.8	60.2	54.9	10.6	11.9

Notes:

Analytical results in excess of Water Quality Guideline

Analytical result meets Water Quality Guideline

No Water Quality Guideline or guideline not applicable

AO: Aesthetic Objective; standard to protect against taste and odour concerns

CAL: Calculated; standard was calculated using the most stringent data available

Cl: Chloride dependent guideline

H: Hardness dependent guideline.

S: Sensitivity to acid input dependent (4 to 8 is for moderately sensitive)

N/A: Not Applicable

NI: Not Indicated/Not Sampled

1: Sampling results as reported in the Islander Engineering Field Review Report, January 15, 2020 and January 29, 2020 (re-sampling report) by Mike Achtem, P.Eng. Sites MW19-01 and MW19-02 are shallow wells located on the property close to the landfill. February 21 results from ministry staff sampling,

Standards for Groundwater Monitoring Sites: Contaminated Sites Regulation, Generic Numerical Water Standards for Aquatic Life and Drinking Water

Table 1: Continued.

Parameter	Groundwater Monitoring Sites[1]					
		Groundwater				
	CSR Standards[3]	MW19-01		MW19-02		
		2019-12-19	2020-01-21	2019-12-19	2020-01-21	2020-02-21
Total Metals						
Calcium, total (mg/L)	N/A	29.6	NI	112	NI	59.3
Chromium, total (mg/L)	N/A	0.0116	NI	0.00716	NI	0.00048
Copper, total (mg/L)	N/A	0.0155	NI	0.00269	NI	0.00072
Iron, total (mg/L)	N/A	8.19	NI	1.45	NI	0.120
Lead, total (mg/L)	N/A	0.00759	NI	0.00075	NI	0.000082
Magnesium, total (mg/L)	N/A	6.54	NI	14.6	NI	6.98
Manganese, total (mg/L)	N/A	0.232	NI	0.309	NI	0.0119
Phosphorus. total (mg/L)	N/A	0.325	NI	0.074	NI	<0.030
Potassium, total (mg/L)	N/A	<0.00050	NI	0.00088	NI	0.826
Sodium, total (mg/L)	N/A	0.162	NI	0.436	NI	10.9
Additional, non-leachate related parameters						
Aluminum, total (mg/L)	N/A	9.16	NI	1.7	NI	0.222
Arsenic, total (mg/L)	N/A	0.00222	NI	0.00059	NI	0.00018
Boron, total (mg/L)	N/A	0.000051	NI	0.000052	NI	0.013
Cobalt, total (mg/L)	N/A	0.00471	NI	0.00172	NI	0.00014
Mercury, total (mg/L)	N/A	NI	NI	NI	NI	NI
Molybdenum, total (mg/L)	N/A	0.00521	NI	0.00408	NI	0.00128
Nickel, total (mg/L)	N/A	0.00843	NI	0.00332	NI	<0.00050
Selenium, total (mg/L)	N/A	<0.00050	NI	0.00088	NI	0.000315
Silver, total (mg/L)	N/A	<0.000050	NI	<0.000050	NI	0.000012
Zinc, total (mg/L)	N/A	0.0237	NI	0.0055	NI	<0.0030

Notes:

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No Water Quality Guideline or guideline not applicable

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Standards for Groundwater Monitoring Sites: Contaminated Sites Regulation, Generic Numerical Water Standards for Aquatic Life and Drinking Water

Figure 1: Piper diagram below shows that the groundwater sampled in February is comparable to previous sampling events. Furthermore, water type of the February sample is typical of shallow, fresh groundwater.