APPENDIX E.11

2018 GROUNDWATER MONITORING REPORT

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 GROUNDWATER MONITORING PROGRAM REPORT

2019-03-31	0		
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Date	**Rev.**	**Prepared By**	**Reviewed and Approved By**

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SECTION 1.0 - INTRODUCTION

In accordance with Condition 23 of the Project Certificate No. 005 – Amendment No. 2 issued to Baffinland Iron Mines Corporation (Baffinland) by the Nunavut Impact Review Board (NIRB) for the Mary River Project (Project), Baffinland continued to conduct a groundwater monitoring program in 2018. The 2018 Groundwater Monitoring Program (2018 Monitoring Program) used a similar methodology as the 2017 Groundwater Pilot Program (2017 Pilot Program) and involved establishing shallow groundwater wells up-gradient and down-gradient of the Mine Site Non-Hazardous Waste Landfill Facility (Landfill Facility) using drive-point piezometers and collecting water samples near the depth of the active layer (approx. 0.8 to 1.2 metres) during mid-September 2018.

The objective of the 2018 program was to further assess the feasibility and utility of monitoring groundwater quality near Project infrastructure using drive-point piezometers. The following sections discuss the methods and results of the 2018 Monitoring Program conducted at the Landfill Facility and provides recommendations for future groundwater monitoring at the Project.

SECTION 2.0 - METHODS

2.1 INSTALLATION OF MONITORING WELLS

The 2018 Monitoring Program was conducted by establishing groundwater wells up-gradient and down-gradient of the Landfill Facility. Groundwater monitoring locations were established to the depth of the active layer (approx. 0.8 – 1.2 metres) using drive-point piezometers. Drive-point piezometers used in the 2018 Monitoring Program were Solinst Model 615 Drive-Point Piezometers equipped with 5/8" x 1/2" low density polyethylene (LDPE) open tubing. Three (3) wells (MS-LF-GW1-18, MS-LF-GW2-18, and MS-LF-GW3-18) were established down-gradient of the Landfill Facility and two (2) wells (MS-LF-REF1-18, MS-LF-REF2-18) were established up-gradient of the Landfill Facility. Surface topography and drainage paths near the Landfill Facility were used to estimate the groundwater flow direction and determine the appropriate well locations. All down-gradient monitoring locations were established within 30 metres of the limits of the Landfill Facility.

Installation of the wells involved advancing drive-point piezometers by hand into the ground until the depth of refusal was reached. Depth of refusal was inferred to be the top of the permafrost zone (lower limit of the active layer). Upon reaching the depth of refusal, the depth was recorded in a field note book and the location was assigned a well ID.

Figure 1 presents the locations of the wells monitored during the 2017 Pilot Program and 2018 Monitoring Program. As shown in Figure 1, down-gradient wells monitored on the west and north side of the Landfill Facility remained generally in the same locations for the both the 2017 and 2018 programs. To better characterize the water quality of up-gradient inflows near the Landfill Facility, two up-gradient (reference) wells were established in close proximity to the northwest and southwest corners of Landfill Facility.

Table 1 provides the coordinates and depths for the monitoring wells established near the Landfill Facility during the 2018 Monitoring Program.

Similar to the 2017 Pilot Program, the 2018 Monitoring Program was conducted in September; the time at which the permafrost active layer within the Project area should be at its maximum depth during the year.

2.2 WATER LEVEL ELEVATION MEASUREMENTS

Following the installation of each well, water level was measured using a Solinst Model 102 Coaxial Water Level Meter and recorded in a field note book. A ground surface elevation survey was conducted at each 2018 well location to calculate the 2018 well water level elevations. Ground surface and water level elevations for the 2018 wells are presented in Table 1.

2.3 WATER SAMPLE COLLECTION AND ANALYSIS

Following the water level measurement, a minimum of 1 litre (L) was purged from each well to remove standing water from the screened zone of the piezometer. Purging and sample collection was completed using a Grundfos peristaltic pump equipped with 1/2" outside diameter (OD) LDPE open tubing.

Samples were collected in bottle sets provided by ALS Canada Ltd. (ALS). Sample bottle sets collected were labelled with the company name, well ID, date, time and if field filtration or preservatives were applied to the samples. The samples were packed in coolers with ice and shipped off-site for analysis to ALS Environmental located in Waterloo, ON. Sample preservation and storage and holding times were conducted as outlined by ALS lab requirements.

Water samples were analyzed for routine chemistry (pH, conductivity), nutrients (ammonia, nitrate), chloride, total and dissolved metals, oil & grease and petroleum hydrocarbon (PHC) fractions F2 to F4. Refer to Table 2 for a complete list of the parameters analyzed.

2.3.1 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Samples collected during 2018 followed the water sampling principles outlined in the Project's *Surface Water Sampling Program - Quality Assurance and Quality Control Plan (BAF-PH1-830-P16-0001; QA/QC Plan)*. One (1) duplicate for MS-LF-GW1-18 was taken during the 2018 Monitoring Program, meeting the 10% QA/QC sampling requirement outlined in the *QA/QC Plan*.

SECTION 3.0 - RESULTS AND DISCUSSION

3.1 PERMAFROST ACTIVE LAYER DEPTHS

Table 1 presents the field measurements and observations documented during the 2018 program, including the estimated depths of the active layer at the monitoring wells established in 2018. As discussed in Section 2.1, drive-point piezometers were advanced into the ground by hand until the depth of refusal was encountered. The depth of refusal was estimated to be the depth (lower limit) of the active layer at each monitoring well location. Depths of the active layer during 2018, observed during mid-September, ranged between 0.84 m, at MS-LF-GW-REF1, to 1.18 m, at MS-LF-GW2. Active layer depths measured during 2018 are generally consistent with the active layer depths observed during the 2017 Pilot Program and historical measurements within the Project area.

3.2 WATER LEVEL ELEVATIONS AND ESTIMATED FLOW DIRECTION

Table 1 presents the calculated water level elevations (masl) at each monitoring well established during the 2018 program.

As shown in Table 1, calculated water level elevations (hydraulic head) at the 2018 monitoring wells indicated that the direction of groundwater flows was consistent with the observed surface water flows near the Landfill Facility and the perceived flow direction estimated using the surrounding topography and ground surface elevations. Water level elevations on the north perimeter suggest that groundwater flows west from up-gradient (reference) monitoring well MS-LF-GW-REF1 towards the down-gradient (exposed) monitoring well MS-LF-GW1. Similarly, on the Landfill Facility's west perimeter, water level elevations suggest that groundwater flows north from up-gradient (reference) monitoring well MS-LF-GW-REF2 towards down-gradient (exposed) monitoring wells MS-LF-GW3 and MS-LF-GW2. Based on the data set and limited characterization of the stratigraphy, local groundwater flows are inferred to be towards the southwest.

3.3 ANALYTICAL WATER QUALITY RESULTS

Water samples were collected at three (3) monitoring wells down-gradient of the Landfill Facility and at two (2) monitoring wells up-gradient of the Landfill Facility. Analytical water quality results for the samples collected at the monitoring wells are provided in Table 2.

Due to very limited water quality data set for groundwater at the Project, Project specific guidelines for groundwater quality, based on baseline data and/or Canadian environmental guidelines, have not been developed for the Project. In comparing the water quality results for the 2018 Monitoring Program with the water quality criteria outlined in *Table 7 – Effluent Quality Discharge Limits for the Landfill Facilities* of the Project's Type A Water Licence (2AM-MRY1325 – Amend. No. 1), no exceedances of criteria were noted.

3.3.1 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Table 3 summarizes the relative percent differences (RPDs) between parameter results for the MS-LF-GW1 sample and its duplicate (MS-LF-GW101). As shown in Table 3, calculated RPDs between the MS-LF-GW1 sample and its duplicate are generally acceptable. All parameters had RPDs less than 30% with exception of total metals: aluminium, chromium, iron, and titanium. Of these total metals, only aluminium, iron and titanium were also above 3 times their respective MDL and were most likely not a result of lab error. Elevated RPDs for these three (3) parameters were most likely a result of the amount of solids collected in the sample and corresponding duplicate. This is evidenced by the fact the RPDs greater than 30% were not observed for their corresponding dissolved metals fractions.

To ensure the continued collection of representative, accurate and reliable water quality data at the Project, Baffinland will continue to require all personnel involved with water quality sampling to be experienced and fully trained in the Project's QA/QC procedures and processes outlined in the Project's *QA/QC Plan*.

SECTION 4.0 - CONCLUSIONS AND RECOMMENDATIONS

The objective of the 2018 Monitoring Program was to further assess the feasibility and utility of monitoring groundwater near Project infrastructure using drive-point piezometers. While challenges to implementing a groundwater monitoring program in shallow soils do exist, the results of the 2018 Monitoring Program demonstrate that groundwater monitoring may be feasible using drive-point piezometers at the Project. Due to the limited data set, further groundwater monitoring and assessment of the stratigraphy is required to gain a better understanding of natural groundwater chemistry and hydrogeology at the Project. As additional monitoring is conducted in future years, Baffinland will be able to better characterize groundwater chemistry at Project locations and identify any trends, including potential impacts from Project activities or infrastructure. Consideration will be given to the development of site-specific groundwater quality parameters based on background (reference) conditions (if available) and potentially utilizing groundwater quality guidelines from other jurisdictions, as appropriate.

Baffinland plans to continue the groundwater monitoring program in 2019 using a consistent methodology to the previous groundwater programs at the Project and implementing any lessons learned.

During 2019, Baffinland will consider completing the following initiatives regarding groundwater monitoring at the Project:

- Finalization of the Standard Operating Procedure (SOP) outlining the procedure for monitoring groundwater at the Project using drive-point piezometers;
- Updating the Project's *QA/QC Plan* to outline additional QA/QC protocols for groundwater sampling at the Project; and,
- Utilize a flow cell to monitor changes in solids concentrations (TSS, turbidity) during groundwater sampling events to reduce potential water quality variability in duplicates and improve the reproducibility of analytical results.

Following the 2019 year, Baffinland will provide further recommendations to relevant parties regarding Baffinland's proposed path forward.

FIGURES

Monitoring Well ID	MS-LF-GW-REF1-18	MS-LF-GW1-18	MS-LF-GW-REF2-18	MS-LF-GW3-18	MS-LF-GW2-18
Coordinates (UTM; NAD83)	17W 7912638.5 560840.1	17W 7912598.4 560816.9	17W 7912405.5 560874.8	17W 7912460.9 560822.4	17 W 7912487.2 560811.5
Active Layer Depth (mbgs)	0.84	1.12	1.08	1	1.18
Ground Surface Elevation (masl)	179.85	179.12	179.05	177.99	178.07
Water Level Elevation (masl)	179.62	179.09	177.97	177.66	177.25

LEGEND:

- UP-GRADIENT (REFERENCE) 2018 WELL LOCATION
- DOWN-GRADIENT (EXPOSED) 2018 WELL LOCATION
- UP-GRADIENT (REFERENCE) 2017 WELL LOCATION
- DOWN-GRADIENT (EXPOSED) 2017 WELL LOCATION

NOTES:

1. ORTHO-IMAGERY PROVIDED BY BAFFINLAND IRON MINES CORPORATION, DATED OCTOBER 2018.
2. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2.5m.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	25MAR'19	ISSUED WITH TRANSMITTAL	AV	AS	AV

Baffinland

MARY RIVER PROJECT

2018 GROUNDWATER MONITORING PROGRAM

Knight Piésold CONSULTING

P/A NO. NB102-181/54

REF NO. NB19-00246

FIGURE 1

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TABLES

TABLE 1 – FIELD MEASUREMENTS AND ELEVATIONS – 2018 GROUNDWATER MONITORING PROGRAM

Monitoring Well ID	MS-LF-GW-REF1-18	MS-LF-GW-REF2-18	MS-LF-GW1-18	MS-LF-GW2-18	MS-LF-GW3-18
Well Type	**Up-gradient (Reference)**	**Up-gradient (Reference)**	**Down-gradient (Exposed)**	**Down-gradient (Exposed)**	**Down-gradient (Exposed)**
Coordinates (UTM; NAD83)	17W 7912638.5 560840.1	17W 7912405.5 560874.8	17W 7912598.4 560816.9	17 W 7912487.2 560811.5	17W 7912460.9 560822.4
Active Layer Depth (mbgs)[1]	0.84	1.08	1.12	1.18	1.00
Ground Surface Elevation (masl)	179.85	179.05	179.12	178.07	177.99
Water Level Elevation (masl)	179.62	177.97	179.09	177.25	177.66

Notes:

[1]Metres below ground surface (mbgs) – determined by depth of refusal during drive-point piezometer installation.

TABLE 2 - ANALYTICAL WATER QUALITY RESULTS - 2018 GROUNDWATER MONITORING PROGRAM

ANALYTE	Monitoring Well ID			MS-LF-GW-REF1-18	MS-LF-GW-REF2-18	MS-LF-GW1-18	MS-LF-GW1-18
	Sample Date (MM/DD/YYYY)			9/15/2018	9/15/2018	9/16/2018	9/16/2018
	Sample Time			15:00 HRS	17:30 HRS	11:45 HRS	12:00 HRS
	ALS Laboratory ID			L2167895-1	L2167895-2	L2167895-3	L2167895-4
	Sample Type			Up-gradient (Reference)	Up-gradient (Reference)	Down-gradient (Exposed)	Down-gradient (Exposed); Duplicate
General Parameters	**Unit**	**MDL**	**WL Criteria[1]**				
Conductivity	uS/cm	3	-	258	313	1940	1940
pH	pH	0.1	6.0 – 9.5	8.25	8.25	8.03	8.04
Chloride	mg/L	0.5	-	1.74	4.81	420	419
Total Ammonia (as N)	mg/L	0.02	-	<0.020	<0.020	0.062	0.062
Total Nitrate (as N)	mg/L	0.02	-	0.276	0.115	<0.020	<0.020
Total Metals							
Aluminium (Al)	mg/L	0.01	-	1.67	0.15	1.05	1.46
Antimony (Sb)	mg/L	0.0001	-	<0.00010	<0.00010	<0.0010	<0.0010
Arsenic (As)	mg/L	0.0001	0.5	0.00062	0.00035	<0.0010	0.0011
Barium (Ba)	mg/L	0.0002	-	0.0222	0.0251	0.243	0.210
Cadmium (Cd)	mg/L	0.00001	-	0.000017	<0.000010	0.000164	0.000131
Chromium (Cr)	mg/L	0.0005	-	0.00604	0.00174	0.0098	0.0137
Cobalt (Co)	mg/L	0.0001	-	0.00151	0.00018	0.0131	0.0122
Copper (Cu)	mg/L	0.001	0.3	0.0068	0.0045	0.015	0.014
Iron (Fe)	mg/L	0.05	-	2.32	0.178	1.86	2.79
Lead (Pb)	mg/L	0.0001	0.2	0.00322	0.00028	0.00249	0.00296
Lithium (Li)	mg/L	0.001	-	0.0041	0.0015	0.827	0.736
Manganese (Mn)	mg/L	0.0005	-	0.0736	0.00613	0.629	0.556
Molybdenum (Mo)	mg/L	0.00005	-	0.000353	0.000252	0.00184	0.00168
Nickel (Ni)	mg/L	0.0005	0.5	0.00704	0.00688	0.113	0.107
Selenium (Se)	mg/L	0.00005	-	0.000053	<0.000050	<0.00050	<0.00050
Strontium (Sr)	mg/L	0.001	-	0.0196	0.0163	0.286	0.244
Thallium (Tl)	mg/L	0.00001	-	0.000064	0.000022	0.00015	0.00013
Tin (Sn)	mg/L	0.0001	-	0.00026	0.00016	<0.0010	<0.0010
Titanium (Ti)	mg/L	0.0003	-	0.0913	0.00684	0.0719	0.104
Uranium (U)	mg/L	0.00001	-	0.000953	0.000367	0.0138	0.0122
Vanadium (V)	mg/L	0.0005	-	0.00449	0.00054	<0.0050	<0.0050
Zinc (Zn)	mg/L	0.003	0.5	0.0083	<0.0030	<0.030	<0.030
Dissolved Metals							
Aluminium (Al)	mg/L	0.005	-	0.0072	<0.0050	<0.050	<0.050
Antimony (Sb)	mg/L	0.0001	-	<0.00010	<0.00010	<0.0010	<0.0010
Arsenic (As)	mg/L	0.0001	-	<0.00010	0.00029	<0.0010	<0.0010
Barium (Ba)	mg/L	0.0001	-	0.0107	0.0255	0.211	0.207
Cadmium (Cd)	mg/L	0.00001	-	<0.000010	<0.000010	0.000174	0.000148
Chromium (Cr)	mg/L	0.0005	-	<0.00050	0.00104	<0.0050	<0.0050
Cobalt (Co)	mg/L	0.0001	-	<0.00010	<0.00010	0.0103	0.0102
Copper (Cu)	mg/L	0.0002	-	0.00175	0.004	0.0074	0.0073
Iron (Fe)	mg/L	0.01	-	<0.010	<0.010	<0.10	<0.10
Lead (Pb)	mg/L	0.00005	-	<0.000050	<0.000050	<0.00050	<0.00050
Lithium (Li)	mg/L	0.001	-	0.0012	0.0012	0.672	0.707
Manganese (Mn)	mg/L	0.0005	-	0.00091	0.0011	0.517	0.513
Mercury (Hg)	mg/L	0.00001	-	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.00005	-	0.000375	0.000234	0.00152	0.00160
Nickel (Ni)	mg/L	0.0005	-	0.00083	0.00603	0.0850	0.0833
Selenium (Se)	mg/L	0.00005	-	0.000051	0.000056	<0.00050	<0.00050
Strontium (Sr)	mg/L	0.001	-	0.0152	0.016	0.224	0.227
Thallium (Tl)	mg/L	0.00001	-	<0.000010	0.000015	0.00013	0.00012
Tin (Sn)	mg/L	0.0001	-	<0.00010	<0.00010	<0.0010	<0.0010
Titanium (Ti)	mg/L	0.0003	-	0.00038	<0.00030	<0.0030	<0.0030
Uranium (U)	mg/L	0.00001	-	0.000753	0.000349	0.0123	0.0119
Vanadium (V)	mg/L	0.0005	-	<0.00050	<0.00050	<0.0050	<0.0050
Zinc (Zn)	mg/L	0.001	-	<0.0010	<0.0010	<0.010	0.011
Organics							
Oil & Grease	mg/L	2	-	<2.0	<2.0	<2.0	2.4
Oil & Grease	-	-	No visible sheen	No visible sheen	No visible sheen	No visible sheen	No visible sheen
F2 (C10-C16)	ug/L	100	-	<100	<100	<100	<100
F3 (C16-C34)	ug/L	250	-	<250	<250	<250	<250
F4 (C34-C50)	ug/L	250	-	<250	<250	<250	<250

Notes:

[1]Type 'A' Water Licence – 2Am-MRY1325 – Amendment No. 1 – Table 7 - Effluent Quality Discharge Limits for the Landfill Facilities

TABLE 2 - ANALYTICAL WATER QUALITY RESULTS - 2018 GROUNDWATER MONITORING PROGRAM cont'd

ANALYTE	Monitoring Well ID			MS-LF-GW2-18	MS-LF-GW3-18
	Sample Date (MM/DD/YYYY)			9/16/2018	9/16/2018
	Sample Time			14:40 HRS	16:00 HRS
	ALS Laboratory ID			L2167895-5	L2167895-6
	Sample Type			Down-gradient (Exposed)	Down-gradient (Exposed)
General Parameters	**Unit**	**MDL**	**WL Criteria**		
Conductivity	uS/cm	3	-	1390	375
pH	pH	0.1	6.0 – 9.5	8.05	8.21
Chloride	mg/L	0.5	-	290	15.3
Total Ammonia (as N)	mg/L	0.02	-	0.102	0.147
Total Nitrate (as N)	mg/L	0.02	-	3.09	0.148
Total Metals					
Aluminium (Al)	mg/L	0.01	-	0.337	7.36
Antimony (Sb)	mg/L	0.0001	-	<0.0010	0.00017
Arsenic (As)	mg/L	0.0001	0.5	0.0010	0.00451
Barium (Ba)	mg/L	0.0002	-	0.0993	0.0722
Cadmium (Cd)	mg/L	0.00001	-	0.000092	0.000113
Chromium (Cr)	mg/L	0.0005	-	<0.0050	0.0734
Cobalt (Co)	mg/L	0.0001	-	0.0013	0.0127
Copper (Cu)	mg/L	0.001	0.3	<0.010	0.0276
Iron (Fe)	mg/L	0.05	-	0.87	20.4
Lead (Pb)	mg/L	0.0001	0.2	0.00158	0.0235
Lithium (Li)	mg/L	0.001	-	0.016	0.0138
Manganese (Mn)	mg/L	0.0005	-	0.0247	0.337
Molybdenum (Mo)	mg/L	0.00005	-	0.00083	0.000514
Nickel (Ni)	mg/L	0.0005	0.5	0.0318	0.132
Selenium (Se)	mg/L	0.00005	-	<0.00050	0.000096
Strontium (Sr)	mg/L	0.001	-	0.080	0.0237
Thallium (Tl)	mg/L	0.00001	-	0.00012	0.000256
Tin (Sn)	mg/L	0.0001	-	<0.0010	0.00044
Titanium (Ti)	mg/L	0.0003	-	0.0213	0.455
Uranium (U)	mg/L	0.00001	-	0.0138	0.00115
Vanadium (V)	mg/L	0.0005	-	<0.0050	0.0276
Zinc (Zn)	mg/L	0.003	0.5	<0.030	0.0266
Dissolved Metals					
Aluminium (Al)	mg/L	0.005	-	<0.050	0.0056
Antimony (Sb)	mg/L	0.0001	-	<0.0010	<0.00010
Arsenic (As)	mg/L	0.0001	-	<0.0010	0.00016
Barium (Ba)	mg/L	0.0001	-	0.0892	0.0229
Cadmium (Cd)	mg/L	0.00001	-	0.000079	<0.000010
Chromium (Cr)	mg/L	0.0005	-	<0.0050	0.00064
Cobalt (Co)	mg/L	0.0001	-	<0.0010	<0.00010
Copper (Cu)	mg/L	0.0002	-	0.0054	0.00192
Iron (Fe)	mg/L	0.01	-	<0.10	0.014
Lead (Pb)	mg/L	0.00005	-	<0.00050	<0.000050
Lithium (Li)	mg/L	0.001	-	<0.010	0.0013
Manganese (Mn)	mg/L	0.0005	-	<0.0050	0.00145
Mercury (Hg)	mg/L	0.00001	-	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.00005	-	0.00074	0.00068
Nickel (Ni)	mg/L	0.0005	-	0.0230	0.0122
Selenium (Se)	mg/L	0.00005	-	<0.00050	<0.000050
Strontium (Sr)	mg/L	0.001	-	0.067	0.0169
Thallium (Tl)	mg/L	0.00001	-	<0.00010	0.000021
Tin (Sn)	mg/L	0.0001	-	<0.0010	<0.00010
Titanium (Ti)	mg/L	0.0003	-	<0.0030	0.00045
Uranium (U)	mg/L	0.00001	-	0.0122	0.000614
Vanadium (V)	mg/L	0.0005	-	<0.0050	<0.00050
Zinc (Zn)	mg/L	0.001	-	<0.010	<0.0010
Organics					
Oil & Grease	mg/L	2	-	2.3	6.5
Oil & Grease	-	-	No visible sheen	No visible sheen	No visible sheen
F2 (C10-C16)	ug/L	100	-	<100	<100
F3 (C16-C34)	ug/L	250	-	<250	<250
F4 (C34-C50)	ug/L	250	-	<250	<250

Notes:

[1]Type 'A' Water Licence – 2Am-MRY1325 – Amendment No. 1 – Table 7 - Effluent Quality Discharge Limits for the Landfill Facilities

TABLE 3 - QA/QC ANALYSIS – MS-LF-GW1 DUPLICATE - 2018 GROUNDWATER MONITORING PROGRAM

ANALYTE	Monitoring Well ID			MS-LF-GW1-18	MS-LF-GW1-18	Relative Percent Difference (%)[2]
	Sample Date (MM/DD/YYYY)			9/16/2018	9/16/2018	
	Sample Time			11:45 HRS	12:00 HRS	
	ALS Laboratory ID			L2167895-3	L2167895-4	
	Sample Type			Down-gradient (Exposed)	Down-gradient (Exposed); Duplicate	
General Parameters	**Unit**	**MDL**	**WL Criteria[1]**			
Conductivity	uS/cm	3	-	1940	1940	0.0
pH	pH	0.1	6.0 – 9.5	8.03	8.04	0.1
Chloride	mg/L	0.5	-	420	419	0.2
Total Ammonia (as N)	mg/L	0.02	-	0.062	0.062	0
Total Nitrate (as N)	mg/L	0.02	-	<0.020	<0.020	0
Total Metals						
Aluminium (Al)	mg/L	0.01	-	1.05	1.46	**39.1**
Antimony (Sb)	mg/L	0.0001	-	<0.0010	<0.0010	0.0
Arsenic (As)	mg/L	0.0001	0.5	<0.0010	0.0011	10.0
Barium (Ba)	mg/L	0.0002	-	0.243	0.210	13.6
Cadmium (Cd)	mg/L	0.00001	-	0.000164	0.000131	20.1
Chromium (Cr)	mg/L	0.0005	-	0.0098	0.0137	39.8
Cobalt (Co)	mg/L	0.0001	-	0.0131	0.0122	6.9
Copper (Cu)	mg/L	0.001	0.3	0.015	0.014	6.7
Iron (Fe)	mg/L	0.05	-	1.86	2.79	**50.0**
Lead (Pb)	mg/L	0.0001	0.2	0.00249	0.00296	18.9
Lithium (Li)	mg/L	0.001	-	0.827	0.736	11.0
Manganese (Mn)	mg/L	0.0005	-	0.629	0.556	11.6
Molybdenum (Mo)	mg/L	0.00005	-	0.00184	0.00168	8.7
Nickel (Ni)	mg/L	0.0005	0.5	0.113	0.107	5.3
Selenium (Se)	mg/L	0.00005	-	<0.00050	<0.00050	0.0
Strontium (Sr)	mg/L	0.001	-	0.286	0.244	14.7
Thallium (Tl)	mg/L	0.00001	-	0.00015	0.00013	13.3
Tin (Sn)	mg/L	0.0001	-	<0.0010	<0.0010	0.0
Titanium (Ti)	mg/L	0.0003	-	0.0719	0.104	**44.7**
Uranium (U)	mg/L	0.00001	-	0.0138	0.0122	11.6
Vanadium (V)	mg/L	0.0005	-	<0.0050	<0.0050	0.0
Zinc (Zn)	mg/L	0.003	0.5	<0.030	<0.030	0.0
Aluminium (Al)	mg/L	0.005	-	<0.050	<0.050	0.0
Antimony (Sb)	mg/L	0.0001	-	<0.0010	<0.0010	0.0
Arsenic (As)	mg/L	0.0001	-	<0.0010	<0.0010	0.0
Barium (Ba)	mg/L	0.0001	-	0.211	0.207	1.90
Cadmium (Cd)	mg/L	0.00001	-	0.000174	0.000148	14.9
Chromium (Cr)	mg/L	0.0005	-	<0.0050	<0.0050	0.00
Cobalt (Co)	mg/L	0.0001	-	0.0103	0.0102	1.0
Copper (Cu)	mg/L	0.0002	-	0.0074	0.0073	1.4
Iron (Fe)	mg/L	0.01	-	<0.10	<0.10	0.00
Lead (Pb)	mg/L	0.00005	-	<0.00050	<0.00050	0.00
Lithium (Li)	mg/L	0.001	-	0.672	0.707	5.2
Manganese (Mn)	mg/L	0.0005	-	0.517	0.513	0.8
Mercury (Hg)	mg/L	0.00001	-	<0.000010	<0.000010	0.00
Molybdenum (Mo)	mg/L	0.00005	-	0.00152	0.00160	5.3
Nickel (Ni)	mg/L	0.0005	-	0.0850	0.0833	2.0
Selenium (Se)	mg/L	0.00005	-	<0.00050	<0.00050	0.0
Strontium (Sr)	mg/L	0.001	-	0.224	0.227	1.34
Thallium (Tl)	mg/L	0.00001	-	0.00013	0.00012	7.7
Tin (Sn)	mg/L	0.0001	-	<0.0010	<0.0010	0.00
Titanium (Ti)	mg/L	0.0003	-	<0.0030	<0.0030	0.00
Uranium (U)	mg/L	0.00001	-	0.0123	0.0119	3.3
Vanadium (V)	mg/L	0.0005	-	<0.0050	<0.0050	0.00
Zinc (Zn)	mg/L	0.001	-	<0.010	0.011	10.0
Organics						
Oil & Grease	mg/L	2	-	<2.0	2.4	20.0
Oil & Grease	-	-	No visible sheen	No visible sheen	No visible sheen	-
F2 (C10-C16)	ug/L	100	-	<100	<100	0
F3 (C16-C34)	ug/L	250	-	<250	<250	0
F4 (C34-C50)	ug/L	250	-	<250	<250	0

Notes:

[1]Type 'A' Water Licence – 2Am-MRY1325 – Amendment No. 1 – Table 7 - Effluent Quality Discharge Limits for the Landfill Facilities

[2]Relative Percent Difference (RPD) for a parameter is calculated by dividing the absolute difference between the sample and its duplicate by the analytical result of the sample, and multiplying by 100. **Bold RPD values** indicate parameters in which the RPD was greater than 30% and both analytical results were greater than 3 times the MDL.