

26 July 2017

T&T Landfills Ltd.
Happy Valley Road
WELLINGTON

Attention: **Sophie Gray**
 Landfill Manager

Dear Sophie

Quarterly Stream Monitoring Results – June 2017

Stream surface water and groundwater quality monitoring at T&T Landfill is required by conditions 7 and 8 of discharge permit WGN070260 [26124] to be undertaken every three months. The sampling sites are:

- TTW - western gully stream (true right branch) at the northern end of the landfill
- TTE - eastern gully stream (true left branch) at the northern end of the landfill
- TTD - lower stream, 100 m downstream from the toe of the landfill
- TTG - groundwater bore 100 m downstream from the toe of the landfill
- OSU - Owhiro Stream upstream of the landfill tributary
- OSD - Owhiro Stream downstream of the landfill tributary

This report relates to routine quarterly monitoring undertaken in June 2017 (Laboratory report attached) including an additional sample taken as requested by T&T Landfills. It also comments on two additional monitoring rounds which were undertaken in May and June 2017 which were triggered by high ammoniacal nitrogen during the April quarterly sampling.

Surface water monitoring results

Stream conditions were inspected at each of the stream sampling sites and the following observations made:

- Stream flow was moderate at TTD (downstream) site and appeared cloudy. The streambed showed an orange/brown precipitate and foam was present in several locations around the sampling site.
- At the TTW site, west branch of the stream, water was clear and the stream bed was clean. The channel was mostly free of macrophytes. A light cover of periphyton was visible on the bed.
- At the TTE site, east branch of the stream, water was clear and the stream bed was clean. The channel was mostly free of macrophytes. No periphyton was visible on the bed.
- At the OSU site, water in the Owhiro Stream was clear and the streambed was clean. A light cover of periphyton was visible on the bed.
- At the OSD site, water in the Owhiro Stream was slightly cloudy. The streambed showed an orange/brown precipitate and a small amount of foam was present in several locations around the sampling site. Periphyton was visible on the bed.

Condition 8 of the resource consent requires that the contaminant contribution from the landfill (the difference between the contaminant concentrations upstream and downstream of the landfill) be compared against specified tolerance limits. The contaminant contribution for T&T Landfill is calculated by subtracting the mean of TTW and TTE from TTD. Should any tolerance limit be exceeded, *and* where that result also exceeds ANZECC (2000) Guidelines for Ecosystem Protection 90% trigger value, further sampling is required to be undertaken.

During the June 2017 sampling round the upper tolerance limits for alkalinity and total ammoniacal-nitrogen were exceeded (Table 1). Site specific ANZECC (2000) trigger values was exceeded for zinc only (Table 2). As total ammoniacal-nitrogen or zinc did not exceed both the upper tolerance limits and site specific ANZECC (2000) trigger values at TTD, additional sampling rounds will not be required.

Table 1: June 2017 Contaminant Contribution Compared with Upper tolerance limits

Parameter	Quarterly Results TTD				Lower Tolerance Limit (LTL)	Upper Tolerance Limit (UCL)
	29/06/17	10/04/17	15/12/2016	27/09/2016		
pH	-0.25	-0.05	-0.1	-0.45	-0.4	0.4
Electrical Conductivity	67.95	172.05	72.55	138.8		72.4
Alkalinity	267	463	241	398.5		226
Total suspended solids	1.25	31.75	15.5	23.5		31.7
COD	17	69	21	53		21
Total Hardness	348.5	874.5	316.5	731.5		465
Ammoniacal Nitrogen	2.195	6.895	2.795	5.995		0.346
Iron	3.07725	9.2255	6.9895	8.18075		2748
Manganese	1.7179175	4.09335	2.298115	3.1984675		1461
Lead	0.000265	0.0038675	0.000525	0.003145		5.9
Copper	0.000545	0.0036775	-0.00025	0.003535		4.0
Zinc	-0.028075	0.057625	0.009025	0.058625		130
Arsenic	0.00185	0.00405	0.00295	0.00545		13
Chromium	0.001075	0.004535	0.001835	0.0027125		1

Table 2: June 2017 Quarterly Monitoring Results and ANZECC (2000) trigger values

Parameter	Unit	ANZECC guidelines*	TTD	TTE	TTW	OSU	OSD
pH	pH	NA (6-9)	7.3	7.5	7.6	7.6	7.8
Conductivity	µS/m	NA	96.7	31	26.5	35.1	84.1
Alkalinity	g/m ³ CaCO ₃	NA	310	47	39	47	250
Total suspended solids	g/m ³	NA	10	16	1.5	1.5	9
COD	g/m ³	NA	20	3	3	3	14
Total Hardness	g/m ³ CaCO ₃	NA	400	55	48	64	330
Ammoniacal Nitrogen	g/m ³	1.430 (2.34)	2.2	0.005	0.005	0.005	1.46
Total Iron	g/m ³	NA	3.1	0.035	0.0105	0.046	1.92
Total Manganese	g/m ³	2.500	1.72	0.0039	0.000265	0.0028	1.35
Total Lead	g/m ³	0.0056 (0.011)	0.00065	0.00072	0.00005	0.00025	0.00073
Total Copper	g/m ³	0.0018 (0.0028)	0.00081	0.000265	0.000265	0.00167	0.0011
Total Zinc	g/m ³	0.015 (0.027)	0.0142	0.084	0.00055	0.022	0.0157
Total Arsenic	g/m ³	0.042	0.0024	0.00055	0.00055	0.00055	0.0017
Total Chromium	g/m ³	0.006	0.00134	0.000265	0.000265	0.000265	0.0011

* ANZECC (2000) Guidelines for Ecosystem Protection 90% default trigger value (Table 3.4.1); values in brackets are guidelines adjusted to site specific factors (ie. pH = 7.6 and hardness = 50 g/m³ CaCO₃.)

Additional Sample

An additional sample was taken as requested by T&T Landfill, labelled Mitchell's. The storm water pipe and sample location indicated brown sediment on the stream bed and murky orange water. The results indicate this water is similar to the TTE, TTW and OSU with high levels of iron but low levels of ammoniacal nitrogen.

Groundwater monitoring results

Groundwater monitoring bore results were similar to those recorded over the last three quarters (Table 3).

Table 3: Groundwater monitoring results

Parameter	Unit	TTG Results			
		29/06/17	10/04/17	15/12/2016	27/09/2016
pH	pH	6.7	6.7	6.7	6.7
Chloride	g/m ³	90	85	91	86
Conductivity	µS/m	47.9	51.5	57.5	46.6
Nitrate Nitrogen	g/m ³	1.93	1.52	1.81	1.63
Ammoniacal Nitrogen	g/m ³	0.005	0.005	0.005	0.005
Total Lead	g/m ³	0.0119	0.038	0.05	0.035
Total Zinc	g/m ³	0.022	0.094	0.149	0.115
Total Iron	g/m ³	5.9	21	18.6	21
Total Manganese	g/m ³	0.77	4.5	1.49	1.5
Total Copper	g/m ³	0.0054	0.017	0.036	0.0177

Additional monitoring (May and June 2017)

During the last quarterly monitoring round on the 10 April 2017, ammoniacal-nitrogen exceeded both the upper tolerance limit and ANZECC (2000) trigger values at TTD. Consequently, as required by condition 8 of the discharge permit, additional sampling rounds were undertaken in May and June. The results of all three monitoring rounds are summarised in Table 4.

Table 4: Results of additional monitoring at TTD post April 2017 Quarterly monitoring

Determinand	ANZECC (2000) 90% TV	10/04/17	16/05/17 (A1)	9/06/17 (A2)	Mean of A1 and A2	Adaptive Management action required?
pH	n.s.	7.3	7.5	7.4	7.45	no
Electrical conductivity	n.s.	199.8	87.8	83.3	85.55	no
Alkalinity	n.s.	500	280	270	275	no
Total suspended solids	n.s.	34	12	8	10	no
COD	n.s.	72	20	15	17.5	no
Total Hardness	n.s.	920	340	340	340	no
Total ammoniacal N	1.430 (2.34)	6.9	1.8	1.6	1.7	no
Iron	n.s.	9.3	0.08	0.05	0.065	no
Manganese	2.5	4.1	1.98	1.76	1.87	no
Lead	0.0056 (0.011)	0.004	0.00005	0.00005	0.00005	no
Copper	0.0018 (0.0028)	0.0042	0.000025	0.0005	0.0002625	no
Zinc	0.015 (0.027)	0.06	0.0032	0.0059	0.00455	no
Arsenic	0.006	0.0046	0.0015	0.0005	0.001	no
Chromium	0.042	0.0048	0.0008	0.0007	0.00075	no

* ANZECC (2000) Guidelines for Ecosystem Protection 90% default trigger value (Table 3.4.1); values in brackets are guidelines adjusted to site specific factors (ie. pH = 7.6 and hardness = 50 g/m³ CaCO₃).

Both of the additional samples from TTD exceeded the default ammonia trigger value, indicating that adaptive management action may be required to reduce the risk of ammonia toxicity. However, when the ammonia guideline is adjusted for the site specific factors in accordance with Table 3.4.1 of ANZECC (2000), the trigger value for site TTD increases to 2.34 g/m³ due to a generally lower pH and consequently lower toxicity of ammonia at this site (maximum pH at TTD of 7.6).

Nevertheless, adaptive management actions had previously been triggered in December 2016 and are currently underway with the construction of a wetland treatment systems and initiation of programme to divert stormwater around the landfill.

Conclusion

The water quality monitoring results for the second quarter of 2017 indicate that contaminant levels in the tributary below the landfill were within an acceptable range.

The next round of routine quarterly testing is due by the end of September 2017.

Yours sincerely,



David Cameron
Senior Environmental Scientist
MWH New Zealand Limited

Encl.: Lab Report

Copy to: Ian Leary (Spencer Holmes)



ANALYSIS REPORT

Client:	Stantec New Zealand Limited	Lab No:	1800821	SPv1
Contact:	Mr D Cameron C/- Stantec New Zealand Limited PO Box 13052 Armagh Christchurch 8141	Date Received:	30-Jun-2017	
		Date Reported:	10-Jul-2017	
		Quote No:	37978	
		Order No:		
		Client Reference:	T&T Landfill Monitoring	
		Submitted By:	A Fountain	

Sample Type: Aqueous

Sample Name:	TTG	TTE	TTW	TTD	OSU	
Lab Number:	1800821.1	1800821.2	1800821.3	1800821.4	1800821.5	
pH	pH Units	6.7	7.5	7.6	7.3	7.6
Total Alkalinity	g/m ³ as CaCO ₃	-	47	39	310	47
Total Hardness	g/m ³ as CaCO ₃	-	55	48	400	64
Electrical Conductivity (EC)	mS/m	47.9	31.0	26.5	96.7	35.1
Total Suspended Solids	g/m ³	-	16	< 3	10	< 3
Total Arsenic	g/m ³	0.0038	< 0.0011	< 0.0011	0.0024	< 0.0011
Dissolved Calcium	g/m ³	-	12.3	10.5	131	14.4
Total Chromium	g/m ³	0.0042	< 0.00053	< 0.00053	0.00134	< 0.00053
Total Copper	g/m ³	0.0054	< 0.00053	< 0.00053	0.00081	0.00167
Total Iron	g/m ³	5.9	0.035	< 0.021	3.1	0.046
Total Lead	g/m ³	0.0119	0.00072	< 0.00011	0.00065	0.00025
Dissolved Magnesium	g/m ³	-	5.9	5.2	18.8	6.8
Total Manganese	g/m ³	0.77	0.0039	< 0.00053	1.72	0.0028
Total Zinc	g/m ³	0.022	0.084	< 0.0011	0.0142	0.022
Chloride	g/m ³	90	-	-	-	-
Total Ammoniacal-N	g/m ³	< 0.010	< 0.010	< 0.010	2.2	< 0.010
Nitrite-N	g/m ³	< 0.002	-	-	-	-
Nitrate-N	g/m ³	1.93	-	-	-	-
Nitrate-N + Nitrite-N	g/m ³	1.93	-	-	-	-
Chemical Oxygen Demand (COD)	g O ₂ /m ³	-	< 6	< 6	20	< 6

Sample Name:	OSD	Mitchells St.		
Lab Number:	1800821.6	1800821.7		
pH	pH Units	7.8	6.7	-
Total Alkalinity	g/m ³ as CaCO ₃	250	80	-
Total Hardness	g/m ³ as CaCO ₃	330	69	-
Electrical Conductivity (EC)	mS/m	84.1	38.1	-
Total Suspended Solids	g/m ³	9	137	-
Total Arsenic	g/m ³	0.0017	0.0033	-
Dissolved Calcium	g/m ³	106	11.6	-
Total Chromium	g/m ³	0.00110	0.00138	-
Total Copper	g/m ³	0.00110	0.00113	-
Total Iron	g/m ³	1.92	5.9	-
Total Lead	g/m ³	0.00073	0.0022	-
Dissolved Magnesium	g/m ³	16.5	9.8	-
Total Manganese	g/m ³	1.35	1.93	-
Total Zinc	g/m ³	0.0157	0.0125	-
Total Ammoniacal-N	g/m ³	1.46	0.139	-
Chemical Oxygen Demand (COD)	g O ₂ /m ³	14	34	-



SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-7
Total Digestion	Nitric acid digestion. APHA 3030 E 22 nd ed. 2012 (modified).	-	1-7
pH	pH meter. APHA 4500-H+ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-7
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	2-7
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	2-7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1-7
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 22 nd ed. 2012.	3 g/m ³	2-7
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	2-7
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-7
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.05 g/m ³	2-7
Total Chromium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-7
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-7
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.021 g/m ³	1-7
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00011 g/m ³	1-7
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	2-7
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.00053 g/m ³	1-7
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012 / US EPA 200.8.	0.0011 g/m ³	1-7
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl ⁻ E (modified from continuous flow analysis) 22 nd ed. 2012.	0.5 g/m ³	1
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 22 nd ed. 2012.	0.010 g/m ³	1-7
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22 nd ed. 2012.	6 g O ₂ /m ³	2-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



ANALYSIS REPORT

Client:	Stantec New Zealand Limited	Lab No:	1790246	SPV1
Contact:	A Fountain C/- Stantec New Zealand Limited PO Box 13052 Armagh Christchurch 8141	Date Received:	10-Jun-2017	
		Date Reported:	19-Jun-2017	
		Quote No:	79221	
		Order No:		
		Client Reference:	T&T Landfill Monitoring	
		Add. Client Ref:	Additional testing	
		Submitted By:	Mr D Cameron	

Sample Type: Aqueous

	Sample Name:	TTD 09-Jun-2017 9:20 am	OSU 09-Jun-2017 9:05 am	OSD 09-Jun-2017 9:10 am	TTW 09-Jun-2017 9:40 am	
	Lab Number:	1790246.1	1790246.2	1790246.3	1790246.4	
pH	pH Units	7.4	7.7	7.8	7.7	-
Total Alkalinity	g/m ³ as CaCO ₃	270	49	220	40	-
Total Hardness	g/m ³ as CaCO ₃	340	64	280	46	-
Electrical Conductivity (EC)	mS/m	83.3	34.7	71.6	25.8	-
Total Suspended Solids	g/m ³	8	< 3	7	< 3	-
Dissolved Arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Dissolved Calcium	g/m ³	106	14.4	85	10.1	-
Dissolved Chromium	g/m ³	0.0007	< 0.0005	0.0005	< 0.0005	-
Dissolved Copper	g/m ³	0.0005	0.0016	0.0008	< 0.0005	-
Dissolved Iron	g/m ³	0.05	0.03	0.09	< 0.02	-
Dissolved Lead	g/m ³	< 0.00010	0.00011	< 0.00010	< 0.00010	-
Dissolved Magnesium	g/m ³	17.3	6.9	15.0	5.0	-
Dissolved Manganese	g/m ³	1.76	0.0022	1.27	< 0.0005	-
Dissolved Zinc	g/m ³	0.0059	0.0173	0.0063	< 0.0010	-
Total Ammoniacal-N	g/m ³	1.6	< 0.010	1.06	< 0.010	-
Chemical Oxygen Demand (COD)	g O ₂ /m ³	15	< 6	10	< 6	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
pH	pH meter. APHA 4500-H+ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1-4
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 22 nd ed. 2012.	3 g/m ³	1-4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-4
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-4
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.05 g/m ³	1-4



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-4
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-4
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-4
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-4
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-4
Total Ammoniacal-N	Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ F (modified from manual analysis) 22 nd ed. 2012.	0.010 g/m ³	1-4
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22 nd ed. 2012.	6 g O ₂ /m ³	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Kim Harrison MSc
Client Services Manager - Environmental



ANALYSIS REPORT

Client:	Stantec New Zealand Limited	Lab No:	1776452	SPV1
Contact:	A Fountain C/- Stantec New Zealand Limited PO Box 13052 Armagh Christchurch 8141	Date Received:	17-May-2017	
		Date Reported:	25-May-2017	
		Quote No:	79221	
		Order No:		
		Client Reference:	T&T Landfill Monitoring	
		Add. Client Ref:	Additional testing	
		Submitted By:	Mr D Cameron	

Sample Type: Aqueous

Sample Name:		TTE 16-May-2017 9:50 am	TTD 16-May-2017 10:20 am	OSU 16-May-2017 10:45 am	OSD 16-May-2017 10:35 am	TTW 16-May-2017 9:30 am
Lab Number:		1776452.1	1776452.2	1776452.3	1776452.4	1776452.5
pH	pH Units	7.4	7.5	7.6	7.9	8.4
Total Alkalinity	g/m ³ as CaCO ₃	50	280	51	210	46
Total Hardness	g/m ³ as CaCO ₃	59	340	63	260	55
Electrical Conductivity (EC)	mS/m	32.8	87.8	34.9	72.8	30.4
Total Suspended Solids	g/m ³	< 3	12	< 3	10	< 3
Dissolved Arsenic	g/m ³	< 0.0010	0.0015	< 0.0010	< 0.0010	< 0.0010
Dissolved Calcium	g/m ³	13.2	105	14.2	78	12.2
Dissolved Chromium	g/m ³	< 0.0005	0.0008	< 0.0005	0.0005	< 0.0005
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	0.0011	0.0006	< 0.0005
Dissolved Iron	g/m ³	< 0.02	0.08	< 0.02	0.06	< 0.02
Dissolved Lead	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m ³	6.4	18.7	6.7	15.3	6.0
Dissolved Manganese	g/m ³	0.0033	1.98	0.0017	1.36	< 0.0005
Dissolved Zinc	g/m ³	0.0024	0.0032	0.0127	0.0037	< 0.0010
Total Ammoniacal-N	g/m ³	< 0.010	1.8	< 0.010	1.01	< 0.010
Chemical Oxygen Demand (COD)	g O ₂ /m ³	< 6	20	< 6	14	< 6

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
pH	pH meter. APHA 4500-H+ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-5
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-5
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-5
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1-5
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 22 nd ed. 2012.	3 g/m ³	1-5
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-5
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-5



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.05 g/m ³	1-5
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-5
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-5
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-5
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-5
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-5
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-5
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-5
Total Ammoniacal-N	Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ F (modified from manual analysis) 22 nd ed. 2012.	0.010 g/m ³	1-5
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22 nd ed. 2012.	6 g O ₂ /m ³	1-5

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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