APPENDIX A – APPENDIX D ARE PROVIDED SEPERATELY

Appendix A: Summary of water quality data for sites sampled on the Hokio Stream upstream and downstream of the Levin Landfill.

[1] Guidelines as per Horizons One Plan (Operative Version December 2014), (Schedule E: Water Management Zone (Lake Papaitonga West_8).

[2] Guidelines as per ANZECC 2000 trigger values at the 95% species protection level.

[3] Individual samples are considered as meeting the trigger value if below detection limit or, when detected, if at or below the trigger value.

HS1: Hokio Stream Upstream

	Ammon-N	Nitrate-N	SIN	DRP	BOD	Faecal col	Chloride	Aluminium
Average	0.157	0.847	0.874	0.113	3.9	1,287	32.6	0.125
Min	0.000	0.005	0.000	0.004	1.0	0	15.2	0.000
5%ile	0.000	0.076	0.012	0.007	1.1	13	22.3	0.010
10%ile	0.000	0.100	0.078	0.012	1.6	44	23.9	0.011
20%ile	0.010	0.130	0.178	0.021	2.0	103	25.5	0.016
25%ile	0.020	0.178	0.270	0.024	2.2	153	26.4	0.019
50%ile (median)	0.060	0.575	0.570	0.070	3.0	330	29.4	0.063
75%ile	0.160	1.233	1.310	0.172	5.0	578	32.8	0.143
90%ile	0.438	1.900	1.880	0.256	7.1	988	35.6	0.315
95%ile	0.728	2.265	2.178	0.343	8.7	2,315	37.0	0.433
Max	1.750	4.500	5.050	0.480	13.4	40,000	300.0	0.655
StDev	0.287	0.862	0.870	0.115	2.6	5,627	29.9	0.161
95% C.I.	0.061	0.199	0.185	0.032	0.7	1,560	6.3	0.042
Guideline	< 0.400 [1]		< 0.167 [1]	< 0.015 [1]	< 2 [1]			< 0.055 [2]
%compliance[3]	89		19	19	24			45
N. of Samples	85	72	85	48	50	50	85	56

HS1: Hokio Stream Upstream (continued)

	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	0.002	0.081	0.000	0.004	0.004	0.643	0.001	0.161	0.002	0.007
Min	0.000	0.002	0.000	0.000	0.000	0.035	0.000	0.005	0.000	0.000
5%ile	0.000	0.030	0.000	0.001	0.001	0.063	0.000	0.010	0.000	0.001
10%ile	0.001	0.049	0.000	0.001	0.001	0.120	0.000	0.015	0.000	0.001
20%ile	0.001	0.050	0.000	0.001	0.001	0.190	0.000	0.024	0.000	0.001
25%ile	0.001	0.050	0.000	0.001	0.001	0.215	0.000	0.028	0.000	0.001
50%ile (median)	0.001	0.061	0.000	0.001	0.001	0.470	0.000	0.069	0.001	0.003
75%ile	0.002	0.072	0.000	0.001	0.002	0.920	0.001	0.218	0.001	0.007
90%ile	0.003	0.100	0.001	0.002	0.003	1.460	0.001	0.382	0.001	0.013
95%ile	0.003	0.120	0.001	0.002	0.010	1.906	0.002	0.518	0.005	0.022
Max	0.006	0.800	0.010	0.140	0.090	2.600	0.025	1.030	0.048	0.080
StDev	0.001	0.100	0.001	0.017	0.013	0.564	0.003	0.211	0.007	0.013
95% C.I.	0.000	0.022	0.000	0.004	0.004	0.128	0.001	0.046	0.002	0.004
Guideline	< 0.024 [2]	< 0.370 [2]	< 0.0002 [2]		< 0.0014 [2]		< 0.0034 [2]	< 1.9 [2]	< 0.011 [2]	< 0.008 [2]
%compliance	100	98	97		63		98	100	97	83
N. of Samples	45	81	48	72	48	75	58	82	58	48

HS2: Hokio Stream Beside Landfill

	Ammon-N	Nitrate-N	SIN	DRP	BOD	Faecal col	Chloride	Aluminium
Average	0.162	0.848	0.881	0.107	4.1	1,371	32.8	0.126
Min	0.000	0.005	0.000	0.003	1.0	24	16.0	0.000
5%ile	0.000	0.076	0.016	0.007	1.0	33	22.5	0.010
10%ile	0.000	0.100	0.080	0.011	1.5	58	24.3	0.011
20%ile	0.014	0.162	0.198	0.021	2.0	99	26.0	0.016
25%ile	0.020	0.198	0.230	0.023	2.0	133	27.0	0.025
50%ile (median)	0.070	0.690	0.700	0.073	3.0	280	29.9	0.055
75%ile	0.200	1.185	1.240	0.142	5.0	585	32.0	0.151
90%ile	0.378	1.881	1.974	0.234	8.1	1,322	36.0	0.315
95%ile	0.694	2.280	2.250	0.320	11.4	2,685	37.8	0.527
Max	1.400	4.400	4.790	0.477	14.3	42,000	305.0	0.645
StDev	0.244	0.842	0.856	0.110	3.1	5,923	30.2	0.162
95% C.I.	0.052	0.194	0.182	0.031	0.8	1,642	6.4	0.042
Guideline	< 0.400 [1]		< 0.167 [1]	< 0.015 [1]	< 2 [1]			< 0.055 [2]
%compliance	92		19	17	28			50
N. of Samples	85	72	85	48	50	50	85	56

HS2: Hokio Stream Beside Landfill (continued)

	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	0.001	0.072	0.000	0.007	0.002	0.678	0.001	0.158	0.003	0.008
Min	0.000	0.025	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.000
5%ile	0.001	0.040	0.000	0.001	0.001	0.094	0.000	0.011	0.000	0.001
10%ile	0.001	0.047	0.000	0.001	0.001	0.152	0.000	0.016	0.000	0.001
20%ile	0.001	0.050	0.000	0.001	0.001	0.216	0.000	0.027	0.000	0.001
25%ile	0.001	0.051	0.000	0.001	0.001	0.265	0.000	0.034	0.000	0.001
50%ile (median)	0.001	0.060	0.000	0.001	0.001	0.500	0.000	0.065	0.001	0.003
75%ile	0.002	0.079	0.000	0.001	0.002	0.950	0.001	0.239	0.001	0.009
90%ile	0.003	0.088	0.001	0.002	0.004	1.368	0.001	0.360	0.002	0.013
95%ile	0.003	0.096	0.001	0.003	0.006	1.730	0.002	0.550	0.005	0.027
Max	0.006	0.600	0.010	0.350	0.010	2.400	0.025	1.060	0.130	0.084
StDev	0.001	0.062	0.001	0.041	0.002	0.545	0.003	0.199	0.017	0.014
95% C.I.	0.000	0.014	0.000	0.010	0.001	0.123	0.001	0.043	0.004	0.004
Guideline	< 0.024 [2]	< 0.370 [2]	< 0.0002 [2]		< 0.0014 [2]		< 0.0034 [2]	< 1.9 [2]	< 0.011 [2]	< 0.008 [2]
%compliance	100	99	100		77		98	100	95	71
N. of Samples	45	81	48	72	48	75	58	82	58	48

HS3: Hokio Stream Downstream

	Ammon-N	Nitrate-N	SIN	DRP	BOD	Faecal col	Chloride	Aluminium
Average	0.152	0.853	0.874	0.107	4.1	1,133	33.2	0.428
Min	0.000	0.005	0.000	0.004	0.8	8	8.5	0.007
5%ile	0.000	0.096	0.010	0.008	1.0	39	23.0	0.008
10%ile	0.000	0.101	0.074	0.015	1.3	57	24.6	0.011
20%ile	0.021	0.146	0.164	0.023	2.0	78	26.1	0.016
25%ile	0.030	0.193	0.240	0.025	2.5	114	26.6	0.018
50%ile (median)	0.070	0.700	0.700	0.080	3.0	319	30.0	0.058
75%ile	0.170	1.200	1.210	0.130	5.1	1,025	33.0	0.225
90%ile	0.338	1.795	1.870	0.238	7.7	1,998	36.0	0.475
95%ile	0.538	2.259	2.428	0.327	10.7	5,022	38.0	0.644
Max	1.400	3.700	4.090	0.473	14.6	17,000	305.0	15.800
StDev	0.239	0.801	0.827	0.110	2.9	2,625	30.2	2.102
95% C.I.	0.051	0.185	0.176	0.031	0.8	728	6.4	0.551
Guideline	< 0.400 [1]		< 0.167 [1]	< 0.015 [1]	< 2 [1]			< 0.055 [2]
%compliance	92		20	10	22			50
N. of Samples	85	72	85	48	50	50	85	56

HS3: Hokio Stream Downstream (continued)

	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	0.002	0.068	0.000	0.002	0.003	1.541	0.002	0.241	0.001	0.009
Min	0.000	0.025	0.000	0.000	0.000	0.038	0.000	0.001	0.000	0.000
5%ile	0.001	0.040	0.000	0.000	0.001	0.064	0.000	0.015	0.000	0.001
10%ile	0.001	0.041	0.000	0.001	0.001	0.137	0.000	0.018	0.000	0.001
20%ile	0.001	0.050	0.000	0.001	0.001	0.249	0.000	0.026	0.000	0.001
25%ile	0.001	0.050	0.000	0.001	0.001	0.278	0.000	0.032	0.000	0.001
50%ile (median)	0.001	0.060	0.000	0.001	0.001	0.500	0.000	0.076	0.001	0.003
75%ile	0.002	0.070	0.000	0.001	0.002	1.150	0.001	0.250	0.001	0.008
90%ile	0.003	0.081	0.001	0.003	0.004	1.820	0.002	0.392	0.002	0.014
95%ile	0.003	0.090	0.001	0.007	0.008	2.464	0.004	0.608	0.003	0.021
Max	0.011	0.500	0.010	0.040	0.031	43.200	0.025	4.340	0.015	0.141
StDev	0.002	0.051	0.001	0.006	0.005	5.291	0.005	0.602	0.003	0.023
95% C.I.	0.001	0.011	0.000	0.001	0.001	1.197	0.001	0.130	0.001	0.006
Guideline	< 0.024 [2]	< 0.370 [2]	< 0.0002 [2]		< 0.0014 [2]		< 0.0034 [2]	< 1.9 [2]	< 0.011 [2]	< 0.008 [2]
%compliance	100	99	100		60		95	98	97	77
N. of Samples	45	81	48	72	42	75	58	82	58	48

Appendix B: Summary of Wilcoxon test results for sites sampled on the Hokio Stream upstream (HS1) and downstream (HS3) of the Levin Landfill. Significant differences are indicated in red.

Wilcoxon test results for Hokio Stream HS1 (Upstream) vs HS3 (Downstream)

	Ammon-N	Nitrate-N	SIN	DRP	BOD	Faecal col	Chloride	Aluminium
Wilcoxon	1.75	**2.07**	1.87	0.68	0.13	0.96	**4.20**	0.52
P value	0.081	**0.038**	0.062	0.495	0.893	0.337	**0.000**	0.602

Wilcoxon test results for Hokio Stream HS1 (Upstream) vs HS3 (Downstream) (continued)

	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Wilcoxon	0.71	**2.29**	0.37	1.22	0.56	**3.49**	1.53	1.18	0.35	0.57
P value	0.476	**0.022**	0.715	0.221	0.574	**0.001**	0.126	0.239	0.724	0.572

Appendix C: Summary of water quality data for Monitoring Bores downgradient of the Levin Landfill.

B1 (Monitoring Bore)

	Aluminium	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	0.627	0.003	1.435	0.001	0.008	0.022	1.823	0.067	11.020	0.009	0.036
Min	0.000	0.000	0.583	0.000	0.000	0.005	0.022	0.000	0.541	0.002	0.000
5%ile	0.005	0.001	0.777	0.000	0.001	0.005	0.078	0.000	1.440	0.004	0.000
10%ile	0.007	0.001	0.887	0.000	0.001	0.006	0.128	0.000	2.920	0.004	0.003
20%ile	0.015	0.001	1.100	0.000	0.001	0.008	0.506	0.001	6.625	0.005	0.006
25%ile	0.049	0.002	1.360	0.000	0.002	0.018	0.700	0.008	10.650	0.008	0.020
50%ile (median)	0.180	0.003	1.700	0.001	0.005	0.024	0.970	0.096	15.350	0.010	0.055
75%ile	1.000	0.004	2.136	0.001	0.015	0.047	2.000	0.196	17.890	0.013	0.086
90%ile	1.260	0.005	2.229	0.003	0.018	0.057	5.040	0.263	20.760	0.017	0.121
95%ile	14.700	0.024	2.910	0.010	0.180	0.091	45.800	0.639	26.000	0.070	0.181
Max	2.324	0.004	0.468	0.002	0.023	0.020	5.737	0.129	5.917	0.009	0.043
StDev	0.603	0.001	0.101	0.001	0.006	0.006	1.354	0.033	1.281	0.002	0.013
95% C.I.	0.627	0.003	1.435	0.001	0.008	0.022	1.823	0.067	11.020	0.009	0.036
N. of Samples	57	38	82	41	65	41	69	59	82	59	41

B2 (Monitoring Bore)

	Aluminium	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	1.086	0.008	2.745	0.001	0.011	0.009	2.150	0.002	10.415	0.012	0.018
Min	0.009	0.001	0.560	0.000	0.001	0.002	0.050	0.000	0.100	0.003	0.000
5%ile	0.018	0.002	1.323	0.000	0.002	0.002	0.126	0.000	1.593	0.004	0.000
10%ile	0.023	0.003	1.820	0.000	0.002	0.002	0.200	0.000	2.503	0.005	0.002
20%ile	0.042	0.004	2.225	0.000	0.003	0.004	0.400	0.000	4.990	0.007	0.004
25%ile	0.197	0.006	2.700	0.000	0.005	0.006	0.900	0.001	7.425	0.010	0.013
50%ile (median)	1.033	0.008	3.265	0.001	0.008	0.011	3.250	0.003	9.650	0.014	0.024
75%ile	3.807	0.011	3.750	0.001	0.014	0.014	4.310	0.004	12.730	0.018	0.036
90%ile	5.150	0.014	4.198	0.001	0.017	0.015	5.355	0.006	16.000	0.022	0.039
95%ile	8.860	0.086	4.630	0.010	0.230	0.087	18.100	0.025	252.000	0.085	0.095
Max	1.940	0.013	0.828	0.002	0.031	0.013	2.758	0.004	27.007	0.011	0.021
StDev	0.499	0.004	0.178	0.000	0.007	0.004	0.646	0.001	5.775	0.003	0.006
95% C.I.	1.086	0.008	2.745	0.001	0.011	0.009	2.150	0.002	10.415	0.012	0.018
N. of Samples	58	39	83	42	66	42	70	60	84	60	42

B3 (Monitoring Bore)

	Aluminium	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	0.355	0.059	0.968	0.001	0.008	0.061	7.069	0.002	6.788	0.008	0.021
Min	0.004	0.003	0.220	0.000	0.001	0.001	0.054	0.000	0.340	0.003	0.000
5%ile	0.004	0.007	0.445	0.000	0.002	0.015	0.278	0.000	2.030	0.004	0.000
10%ile	0.005	0.009	0.530	0.000	0.004	0.017	0.369	0.000	3.282	0.005	0.002
20%ile	0.010	0.014	0.660	0.000	0.005	0.024	0.728	0.000	4.438	0.006	0.004
25%ile	0.042	0.034	0.880	0.000	0.006	0.052	3.450	0.001	6.155	0.008	0.012
50%ile (median)	0.348	0.067	1.210	0.001	0.010	0.071	10.300	0.002	8.285	0.009	0.023
75%ile	1.066	0.124	1.546	0.001	0.013	0.137	19.200	0.004	12.000	0.013	0.028
90%ile	1.648	0.194	1.700	0.001	0.015	0.160	24.550	0.007	14.275	0.016	0.090
95%ile	4.250	0.407	2.110	0.010	0.040	0.194	46.800	0.025	18.000	0.024	0.192
Max	0.712	0.076	0.404	0.002	0.006	0.047	9.126	0.004	3.659	0.004	0.035
StDev	0.183	0.024	0.087	0.001	0.001	0.014	2.138	0.001	0.783	0.001	0.011
95% C.I.	0.355	0.059	0.968	0.001	0.008	0.061	7.069	0.002	6.788	0.008	0.021
N. of Samples	58	39	83	42	66	42	70	60	84	60	42

C2 (Monitoring Bore)

	Aluminium	Arsenic	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Average	1.794	0.004	0.727	0.000	0.031	0.014	17.144	0.006	0.703	0.016	0.023
Min	0.001	0.000	0.070	0.000	0.000	0.001	0.090	0.000	0.106	0.000	0.000
5%ile	0.004	0.001	0.132	0.000	0.001	0.002	0.390	0.000	0.190	0.001	0.000
10%ile	0.009	0.001	0.274	0.000	0.002	0.002	0.465	0.000	0.280	0.001	0.002
20%ile	0.013	0.002	0.446	0.000	0.002	0.003	9.750	0.000	0.407	0.003	0.008
25%ile	0.060	0.003	0.580	0.000	0.003	0.007	15.700	0.001	0.527	0.005	0.014
50%ile (median)	1.273	0.007	1.110	0.000	0.008	0.017	22.825	0.006	0.791	0.007	0.030
75%ile	6.755	0.010	1.314	0.001	0.012	0.038	37.770	0.016	1.070	0.011	0.049
90%ile	9.805	0.012	1.397	0.001	0.015	0.045	39.685	0.025	1.487	0.013	0.055
95%ile	23.700	0.015	1.760	0.010	1.700	0.095	45.400	0.046	4.940	0.620	0.154
Max	4.014	0.004	0.421	0.002	0.209	0.019	12.496	0.009	0.734	0.079	0.027
StDev	1.033	0.001	0.091	0.000	0.050	0.006	2.927	0.002	0.157	0.020	0.008
95% C.I.	1.794	0.004	0.727	0.000	0.031	0.014	17.144	0.006	0.703	0.016	0.023
N. of Samples	58	39	83	42	66	42	70	60	84	60	42

Appendix D:

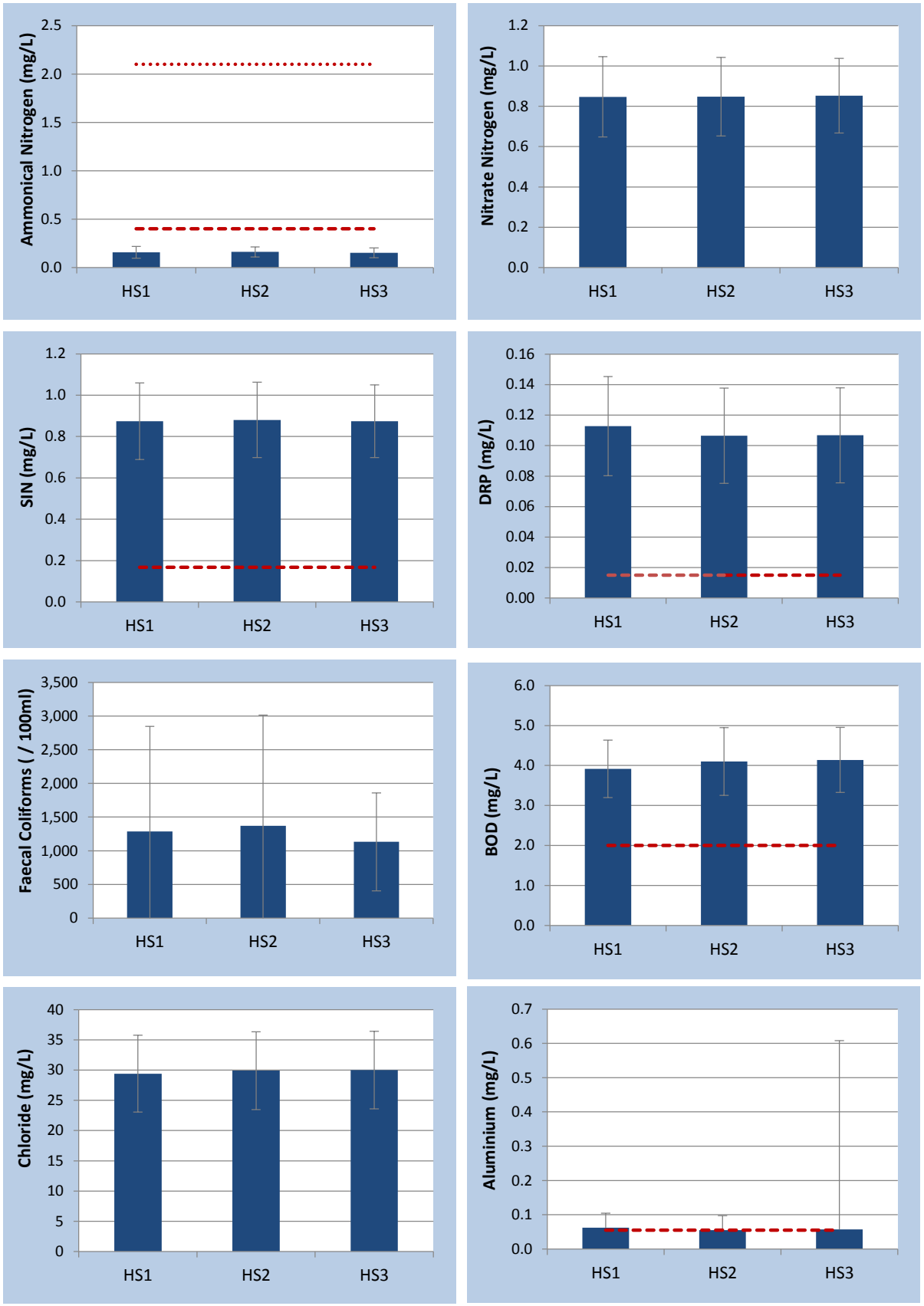
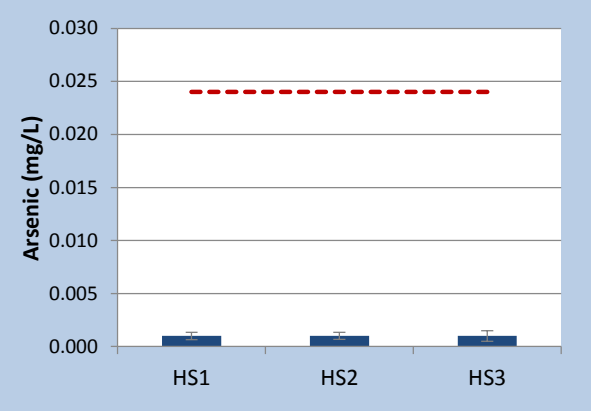
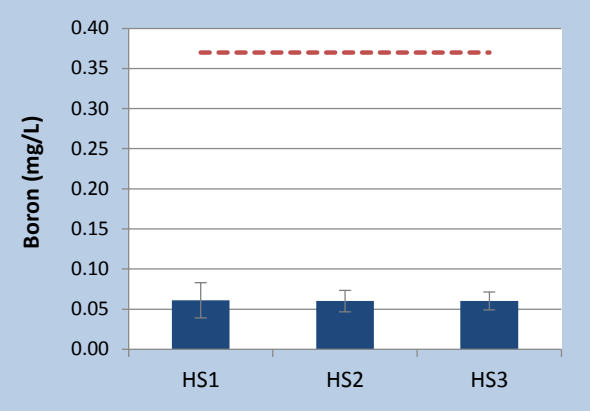
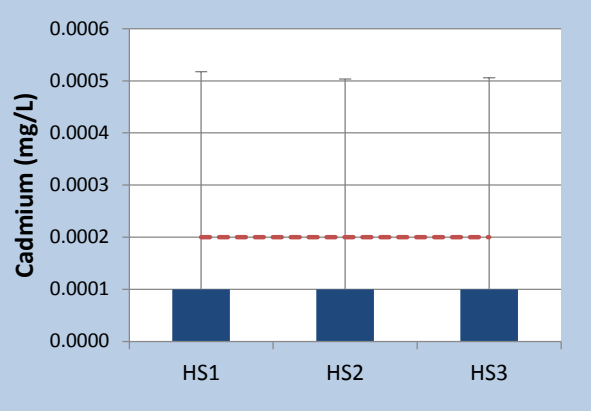
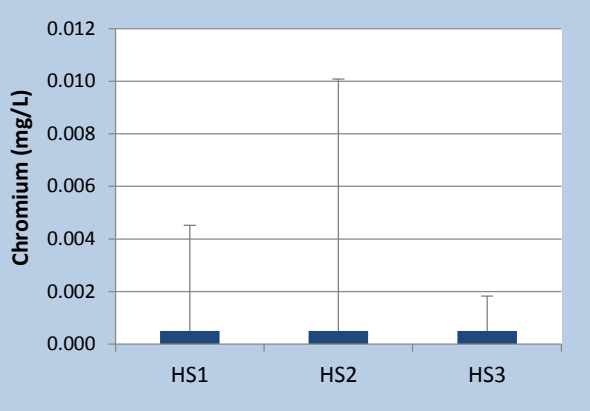


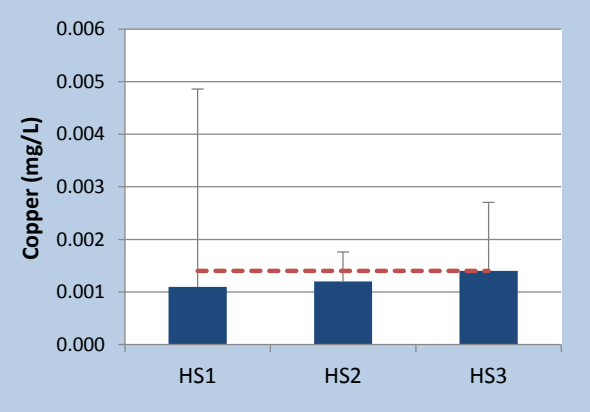
Figure 1: Mean concentrations (and 95 percent confidence intervals) for sites sampled on the Hokio Stream, upstream (HS1), beside (HS2) and downstream (HS3) of the Levin Landfill. Red lines indicate applicable One Plan targets.

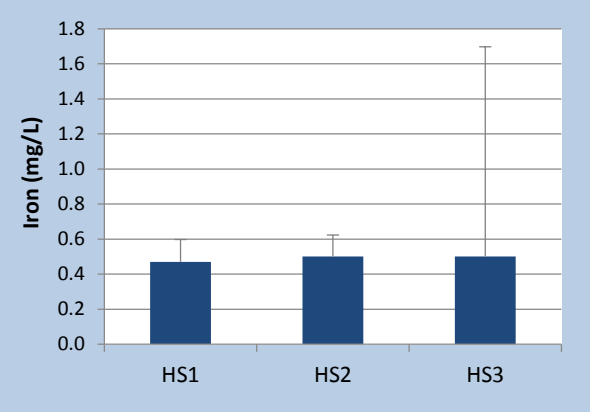

Arsenic (mg/L)
0.030
0.025
0.020
0.015
0.010
0.005
0.000
HS1
HS2
HS3

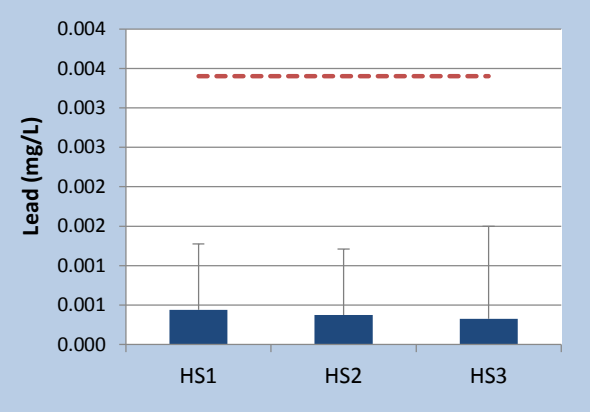

Boron (mg/L)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
HS1
HS2
HS3

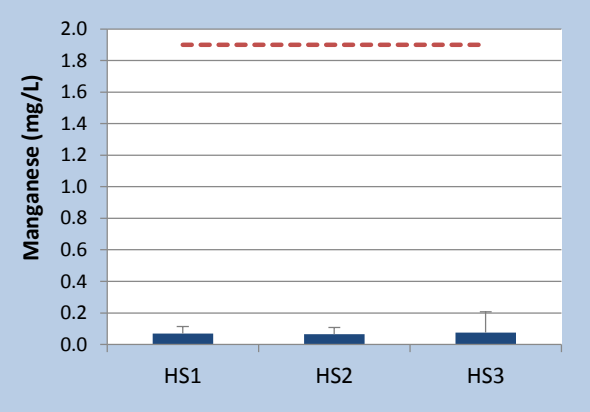

Cadmium (mg/L)
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
HS1
HS2
HS3


Chromium (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
HS1
HS2
HS3


Copper (mg/L)
0.006
0.005
0.004
0.003
0.002
0.001
0.000
HS1
HS2
HS3


Iron (mg/L)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
HS1
HS2
HS3


Lead (mg/L)
0.004
0.004
0.003
0.003
0.002
0.002
0.001
0.001
0.000
HS1
HS2
HS3


Manganese (mg/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
HS1
HS2
HS3

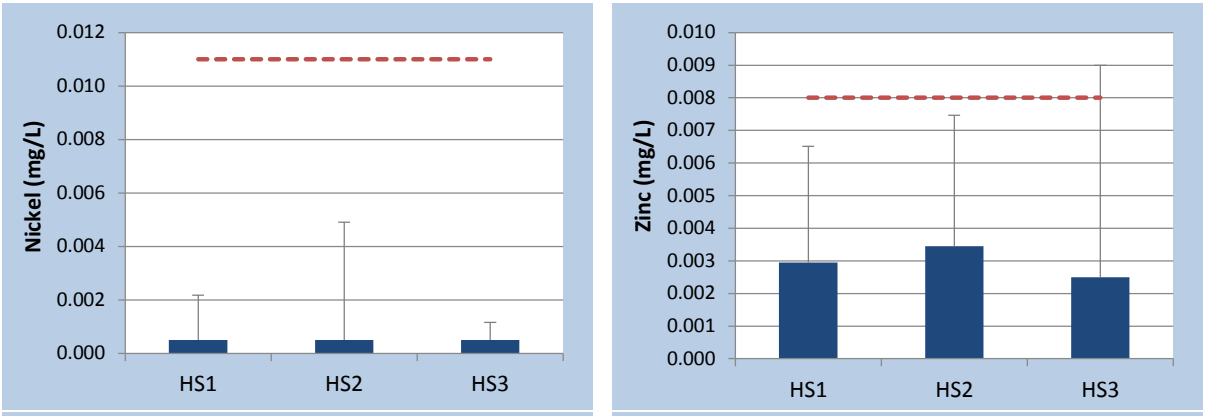


Figure 2: Median metal concentrations (and 95 percent confidence intervals) for sites sampled on the Hokio Stream, upstream (HS1), beside (HS2), and downstream (HS3) of the Levin Landfill. Red lines indicate applicable ANZECC 2000 trigger values at the 95th species protection level.