

Appendix E
Surface Water Quality

Appendix E1

Surface Water and Sediment Quality Guidelines

Table E1-1: Water Quality Guidelines

Parameter	Units	Guidelines			
		Aquatic Life			Drinking Water
		CCME (2015)	GoA (2018)	ECCC (2017)	Health Canada (2017)
Field Measured					
pH	pH units	6.5 to 9.0	6.5 to 9.0	-	7.0-10.5 ^{d1}
Specific Conductivity	µS/cm	-	-	-	-
Dissolved Oxygen (DO)	mg/L	6.5 or 9.5 ^{a1}	6.5 or 9.5	-	-
Temperature	°C	-	b1	-	≤15 ^{d1}
Conventional Parameters and Major Ions					
pH	pH Units	6.5 to 9.0	6.5 to 9.0	-	7.0-10.5 ^{d1}
Alkalinity	mg/L	-	20 ^{b2}	-	-
Total Dissolved Solids (TDS)	mg/L	-	-	-	≤500 ^{d1}
Total Suspended Solids (TSS)	mg/L	a2	b3	-	-
Sodium	mg/L	-	-	-	≤200 ^{d1}
Chloride	mg/L	120	120	-	≤250 ^{d1}
Sulphate	mg/L	-	b4	-	≤500 ^{d1}
Nutrients and Organics					
Ammonia	mg/L	7.0 - 48.3 ^{a3}	b5	-	-
Nitrate-Nitrogen	mg/L	2.9 ^{a4}	3	-	10 ^{d3}
Nitrite-Nitrogen	mg/L	0.06 ^{a5}	b6	-	1 ^{d3}
Phosphorus, Total	mg/L	a6	b7	-	-
Phenols	mg/L	0.004	0.004	-	-
Hydrocarbons					
Benzene	mg/L	0.37	0.04	-	0.005 ^{d2}
Toluene	mg/L	0.002	0.005	-	0.024 ^{d1}
Ethylbenzene	mg/L	0.09	0.09	-	0.0016 ^{d1}
Total Xylenes	mg/L	-	0.03	-	0.02 ^{d1}
F1 - VPH (C ₆ -C ₁₀)	mg/L	-	0.15	-	-
F2 - EPH (C ₁₀ -C ₁₄)	mg/L	-	0.11	-	-
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	µg/L	5.8	5.8	-	-
Acenaphthylene	µg/L	-	-	-	-
Acridine	µg/L	4.4	4.4	-	-
Anthracene	µg/L	0.012	0.012	-	-
Benz[a]anthracene	µg/L	0.018	0.018	-	-
Benzo[a]pyrene	µg/L	0.015	0.015	-	0.04 ^{d2}
Benzo[ghi]perylene	µg/L	-	-	-	-
Benzo[k]fluoranthene	µg/L	-	-	-	-
Chrysene	µg/L	-	-	-	-
Dibenz[a,h]anthracene	µg/L	-	-	-	-
Fluoranthene	µg/L	0.04	0.04	-	-
Fluorene	µg/L	3	3	-	-
Indeno[1,2,3-cd]pyrene	µg/L	-	-	-	-
Naphthalene	µg/L	1.1	1.0	-	-
Phenanthrene	µg/L	0.4	0.4	-	-
Pyrene	µg/L	0.025	0.025	-	-
Quinoline	µg/L	3.4	3.4	-	-
Total Metals					
Aluminum (Al)	µg/L	5 or 100 ^{a7}	-	-	100 ^{d4}
Antimony (Sb)	µg/L	-	-	-	6 ^{d2}
Arsenic (As)	µg/L	5	5	-	10 ^{d2}
Barium (Ba)	µg/L	-	-	-	1,000 ^{d2}
Beryllium (Be)	µg/L	-	-	-	-
Boron (B)	µg/L	1500	1500	-	5,000 ^{d2}
Cadmium (Cd)	µg/L	a8	b8	-	5 ^{d1}
Chromium (Cr)	µg/L	1 ^{a9}	1 ^{b9}	-	50 ^{d1}
Cobalt (Co)	µg/L	-	b8	c1	-
Copper (Cu)	µg/L	a10	7 ^{b8/b10}	-	≤1,000 ^{d1}
Iron (Fe)	µg/L	300	-	-	≤300 ^{d1}
Lead (Pb)	µg/L	a11	b8	-	10
Manganese (Mn)	µg/L	-	-	-	≤50 ^{d1}
Mercury (Hg)	µg/L	0.026	0.005	-	1 ^{d2}
Molybdenum (Mo)	µg/L	73	73	-	-
Nickel (Ni)	µg/L	a12	b8/b11	-	-
Selenium (Se)	µg/L	1	1	-	5 ^{d2}
Silver (Ag)	µg/L	0.25	0.1	-	-
Thallium (Tl)	µg/L	0.8	0.8	-	-
Uranium (U)	µg/L	15 ^{a13}	15 ^{b12}	-	20 ^{d2}
Vanadium (V)	µg/L	-	-	120	-
Zinc (Zn)	µg/L	30	30	-	≤5,000 ^{d1}
Dissolved Metals					
Aluminum (Al)	µg/L	-	b13	-	-
Iron (Fe)	µg/L	-	300	-	-

**Part 1. Water Quality Guidelines for the Protection of Aquatic Life
CWQG (CCME 2018)**

a1 = Guideline is based on temperature preferences of biota. In this case, the cold water biota guidelines for both early life and other life stages are shown.

a2 = Guideline assumes clear flow conditions and is based on the following:

Clear flow - Maximum increase of 25 mg/L (TSS) or 8 NTU (turbidity) from background levels for any short-term exposure (e.g., 24-h period).

Maximum average increase of 5 mg/L (TSS) or 2 NTU (turbidity) from background levels for longer term exposures (e.g., > 24-h).

High flow - Maximum increase of 25 mg/L (TSS) or 8 NTU (turbidity) from background levels at any time when background levels are between 25 and 250 mg/L (TSS) or 80 NTU (turbidity). Should not increase more than 10% of background levels when background is >250 mg/L (TSS) or >80 NTU (turbidity).

a3 = Guideline is for ammonia as nitrogen.

Guideline = 0.1 (at pH=9.0 and temperature= 25°C)

Guideline = 40 (at pH= 6.5 and temperature= 5°C)

a4 = Guideline is expressed as nitrate-N.

a5 = Guideline is expressed as nitrite-N.

a6 = The trophic status of lakes is assessed using the total phosphorus concentrations. The Canadian Trigger Ranges are as follows: ultra-oligotrophic - <0.004 mg/L; oligotrophic - 0.004 to 0.01 mg/L; mesotrophic - 0.01 to 0.02 mg/L;

meso-eutrophic - 0.02 to 0.035 mg/L; eutrophic - 0.035 to 0.1 mg/L; and hyper-eutrophic - >0.1 mg/L.

a7 = Guideline = 100 µg/L at pH ≥ 6.5

a8= The chronic benchmark concentration of 0.09µg/L is for waters of 50 mg/L hardness.

When water hardness is >0 to <17 mg/L, guideline is 0.04 µg/L.

At hardness ≥17 mg/L to ≤ 280 mg/L guideline= 10^{0.8545[ln(hardness)]-2.46}

At hardness >280 mg/L the guideline is 0.37 µg/L.

a9 = Guideline is for hexavalent chromium (Cr_{VI}) because its guideline is more stringent than the trivalent chromium (Cr_{III}).

a10 = Copper guideline is dependent on hardness.

At hardness 0 to <82 mg/L, the guideline is 2 µg/L.

At water hardness ≥82 to ≤180 mg/L, guideline = e^{0.8545[ln(hardness)]-1.465*0.2}

At water hardness > 180 mg/L, guideline is 4 µg/L.

a11 = Lead guideline is dependent on hardness. Guideline = e^{1.273[ln(hardness)]-4.705}

At water hardness 0 to ≤60 mg/L, guideline is 1 µg/L.

At water hardness >60 to ≤ 180 mg/L, guideline = e^{-1.273[ln(hardness)]-4.705}

At hardness > 180 mg/L, guideline is 7 µg/L.

a12 = Nickel guideline is dependent on hardness.

At water hardness 0 to ≤60 mg/L, guideline is 25 µg/L.

At water hardness >60 to ≤ 180 mg/L, guideline = e^{0.76[ln(hardness)]+1.06}

At water hardness > 180 mg/L, guideline is 150 µg/L.

a13 = Long-term concentration.

AEQG (GoA 2018)

b1 = Thermal additions should not alter thermal stratification or turnover dates, exceed maximum weekly average temperatures, nor exceed maximum short term temperatures.

b2 = A minimum values unless natural conditions are less.

b3 = During clear flows or for clear waters: Maximum increase of 25 mg/L from background for any short term exposure (e.g., 24 hours). Maximum average increase of 5 mg/L from background levels for longer term exposure.

During high flow or for turbid waters: Maximum increase of 25 mg/L from background levels at anytime when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is greater than or equal to 250 mg/L.

b4 = Varies with hardness, averaging period is 30 days.

b5 = Varies with pH and temperature; Total NH₃ guideline (as N) N= (0.019/f)*0.8224; f=1/10[(pka-ph)+1], where f=un-ionized ammonia fraction.

b6 = Varies with chloride concentration.

b7 = Narrative; varies by water body type and nitrogen/phosphorus fluctuations in relation to aquatic health.

b8 = Equation, varies with hardness.

b9 = Guideline is for hexavalent chromium (Cr VI) because its guideline is more stringent than trivalent chromium.

b10 = Long term guideline applies only to waters of hardness > 50 mg/L.

b11 = Averaging period is 4 days for long term.

b12 = Long-term concentration.

b13 = At pH ≥ 6.5, long-term guideline is 50 µg/L. At pH <6.5, guideline = e^{(1.6-3.327(pH)+0.402(pH)^2)}X1000

FEQG (ECCC 2017)

c1 = Equation, varies with hardness.

Part 2. Drinking Water Quality Guidelines

GCDWQ (Health Canada 2017)

d1 = Aesthetic objective.

d2 = Maximum allowable concentration (MAC).

d3 = Guideline corresponds to nitrate-N and nitrite-N.

d4 = A health-based guideline for aluminum in drinking water has not been established.

Operational guidance values of less than 100 µg/L total aluminum for conventional treatment plants and less than 200 µg/L total aluminum for other types of treatment systems are recommended.

Table E1-2: Sediment Quality Guidelines

Parameter	Units	CCME 2002		GoA 2018		
		ISQG	PEL	ISQG	PEL	LEL
Polycyclic Aromatic Hydrocarbons						
2-Methylnaphthalene	mg/kg	0.02	0.2	0.02	0.2	-
Acenaphthene	mg/kg	0.0067	0.089	0.0067	0.089	-
Acenaphthylene	mg/kg	0.0059	0.13	0.0059	0.13	-
Anthracene	mg/kg	0.047	0.25	0.047	0.25	-
Benz[a]anthracene	mg/kg	0.032	0.39	0.032	0.39	-
Benzo[a]pyrene	mg/kg	0.032	0.78	0.032	0.78	-
Chrysene	mg/kg	0.057	0.86	0.057	0.86	-
Dibenz[a,h]anthracene	mg/kg	0.0062	0.135	-	-	-
Fluoranthene	mg/kg	0.11	2.36	0.11	2.36	-
Fluorene	mg/kg	0.021	0.14	0.021	0.14	-
Naphthalene	mg/kg	0.035	0.39	-	-	-
Phenanthrene	mg/kg	0.042	0.52	0.042	0.52	-
Pyrene	mg/kg	0.053	0.88	0.053	0.88	-
Total Metals						
Arsenic (As)	mg/kg	5.9	17	5.9	17	-
Cadmium (Cd)	mg/kg	0.6	3.5	-	-	-
Chromium (Cr)	mg/kg	37.3	90	37.3	90	-
Copper (Cu)	mg/kg	35.7	197	35.7	197	-
Lead (Pb)	mg/kg	35	91.3	35	91.3	-
Manganese (Mn)	mg/kg	-	-	-	-	460
Mercury (Hg)	mg/kg	0.17	0.49	0.17	0.49	-
Nickel (Ni)	mg/kg	-	-	-	-	16
Selenium (Se)	mg/kg	-	-	2	-	-
Zinc (Zn)	mg/kg	123	315	123	315	-

Notes: ISQG = Interim sediment quality guidelines.
PEL = Probable effects limit.
LEL = Lowest effects limit.

Appendix E2

***Surface Water Quality Data from the
Aquatic Local Study Area***

Table E2-1: Baseline Water Quality Results for the Sandy River

Parameter	Units	SR1				SR2				SR3				SR4	SR5				n	Number below detection	Median	Min	Max								
		Fall	Spring	Summer	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring						Summer	Fall	Winter					
		22-Oct-10	#####	10-Aug-11	10-Mar-11	4-May-10	17-Aug-10	19-Oct-10	8-Mar-11	26-May-16	10-Aug-16	27-Oct-16	8-Mar-17	4-May-10	18-Aug-10	20-Oct-10	10-Mar-11	4-May-10	29-May-12	12-Aug-12	17-Oct-12	10-Mar-13	26-May-16	10-Aug-16	26-Oct-16	8-Mar-17					
Field Measured																															
Temperature	°C	3.1	9.1	-	-	6.3	15.3	3.2	0.0	10.6	18.0	2.2	-	5.8	15.7	1.5	0.0	4.0	12.5	17.0	4.0	0.0	9.3	17.2	2.1	-	21	0	5.8	0.0	18.0
pH	pH units	7.6	7.1	7.5	-	8.8	7.1	8.4	8.0	7.1	8.5	-	-	8.2	7.9	7.7	7.4	8.0	7.9	8.1	8.2	7.2	7.6	7.5	8.6	-	22	0	7.8	7.1	8.8
Specific Conductivity	µS/cm	197	136	181	-	140	143	241	99	126	239	140	-	145	157	204	289	150	152	194	234	322	137	239	146	-	22	0	151	2	322
Dissolved Oxygen (DO)	mg/L	9.3	9.4	7.3	-	8.9	7.7	8.7	2.2	9.4	8.9	8.8	-	11.8	7.0	9.0	6.9	11.9	8.8	7.7	11.0	8.2	8.6	7.4	12.6	-	22	0	8.8	2.2	12.6
Conventional Parameters and Major Ions																															
pH	pH Units	8.3	7.9	7.9	-	7.9	8.1	8.2	8.3	7.8	8.1	7.8	7.4	8.0	8.2	8.3	8.2	8.0	8.2	8.0	7.9	7.8	7.8	8.0	7.8	7.5	24	0	8.0	7.4	8.3
Specific Conductivity	µS/cm	203	102	181	-	125	178	191	373	133	220	153	348	132	191	208	339	136	163	189	232	317	146	222	170	354	24	0	190	102	373
Total Dissolved Solids (TDS)	mg/L	164	52	-	-	96	104	136	202	64	113	90	199	96	124	116	224	112	108	120	168	168	71	114	99	206	23	0	114	52	224
Total Suspended Solids (TSS)	mg/L	23	21	< 2	-	42	7.0	2.0	4.0	23	<3.0	<3.0	-	26	3.0	<2	4.0	31	3	7	4	3	35	<3.0	5.5	-	22	0	4	1	42
Turbidity	NTU	10	9.4	2.5	-	18	5.0	3.0	8.2	5.4	1.7	-	-	15	3.7	4.2	6.9	18	3	7	4	6.5	7.3	4.0	-	20	0	6	2	18	
Hardness	mg/L	95	48	94	-	63	97	93	177	67	111	79	162	67	100	100	174	70	69	107	123	174	71	114	88	176	24	0	96	48	177
Alkalinity	mg/L	108	53	91	-	67	94	103	204	62	116	81	185	71	101	109	193	70	84	103	128	172	69	117	91	190	24	0	102	53	204
Calcium	mg/L	24	12	25	-	16	25	26	47	17	30	20	43	17	26	27	47	18	18	29	32	46.2	19	30	23	48	24	0	25	12	48
Magnesium	mg/L	8.2	4.5	7.8	-	5.6	8.4	7.0	14	5.8	8.9	7.0	13	5.9	8.4	8.1	14	6.2	6.0	8.7	10.2	14.3	5.6	9.2	7.4	14	24	0	8	5	14
Potassium	mg/L	< 0.5	0.9	< 0.5	-	1.2	< 0.5	< 0.5	1.1	0.6	0.2	0.3	0.9	0.9	< 0.5	< 0.5	1.2	1.0	0.7	< 0.5	0.5	1.3	0.6	0.2	0.4	0.9	24	7	0.5	<0.5	1.3
Sodium	mg/L	4.0	1.6	2.9	-	2.5	3.0	3.5	9.2	3.0	4.1	3.0	8.5	2.7	3.3	3.7	7.8	2.6	3.7	3.6	6.0	8.9	3.1	4.3	3.2	8.4	24	0	3.6	1.6	9.2
Bicarbonate	mg/L	131	65	111	-	81	115	125	247	76	141	99	225	86	123	132	236	85	103	126	156	210	84	143	111	232	24	0	124	65	247
Carbonate	mg/L	< 1	< 1	< 1	-	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	24	24	-	< 1	< 1
Chloride	mg/L	0.5	0.5	0.4	-	0.4	0.3	0.4	0.5	<0.5	<0.5	<0.5	1.9	0.4	0.3	0.3	0.6	0.4	0.7	0.5	0.8	0.6	<0.5	<0.5	<0.5	0.5	24	0	0.4	0	2
Sulphate	mg/L	2.3	1.8	0.9	-	0.9	1.4	0.9	4	0.5	<0.3	0.6	1.7	1.0	1.0	2.1	3.0	0.9	1	< 0.5	2	2.2	0.7	<0.3	0.7	1.5	24	1	1.0	<0.5	4
Nutrients and Organics																															
Ammonia-Nitrogen	mg/L	< 0.02	< 0.02	< 0.02	-	0.04	< 0.02	0.02	0.2	<0.05	0.08	0.06	0.2	0.02	< 0.02	< 0.02	0.05	0.04	< 0.02	< 0.02	< 0.02	< 0.02	<0.05	<0.05	<0.05	0.09	24	14	0.06	<0.02	0.2
Nitrate-Nitrogen	mg/L	< 0.05	< 0.05	< 0.05	-	< 0.050	< 0.05	< 0.05	0.17	<0.02	<0.02	<0.02	0.2	< 0.050	< 0.05	< 0.05	0.24	< 0.050	< 0.05	< 0.05	< 0.05	0.22	<0.02	<0.02	<0.02	0.3	24	19	-	<0.05	0.3
Nitrite-Nitrogen	mg/L	< 0.05	< 0.05	< 0.05	-	< 0.050	< 0.05	< 0.05	< 0.05	<0.01	<0.01	<0.01	<0.01	< 0.050	< 0.05	< 0.05	< 0.05	< 0.050	< 0.03	< 0.03	< 0.03	< 0.03	<0.01	<0.01	<0.01	<0.1	24	24	-	<0.01	<0.05
Total Kjeldahl Nitrogen	mg/L	0.6	0.4	0.3	-	0.6	1.1	0.4	1.0	0.4	0.9	0.2	0.5	0.3	0.1	2.0	0.2	0.4	0.3	0.4	0.33	0.6	0.7	<0.2	0.4	0.4	24	0	0.4	0.1	2
Phosphorus, Total	mg/L	0.02	0.04	0.03	-	0.1	0.04	0.02	0.04	-	-	0.02	0.04	0.07	0.03	< 0.02	0.04	0.07	0.03	0.04	0.03	0.05	-	-	0.03	0.04	20	1	0.04	<0.02	0.1
Biochemical Oxygen Demand	mg/L	< 2	< 2	< 2	-	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	23	22	-	< 2	< 3.0
Carbon (Total Organic)	mg/L	15	14	17	-	13	17	15	12	16	45	14	14	13	16	14	12	13	13	20	27	11.5	16	45	15	14	24	0	14	12	45
Phenol (Total)	mg/L	0.005	0.004	< 0.002	-	< 0.002	< 0.002	< 0.002	0.002	0.002	<0.001	0.002	0.001	< 0.002	-	0.004	< 0.002	< 0.002	< 0.002	0.005	< 0.002	< 0.002	0.002	<0.001	0.002	0.001	23	12	0.002	<0.002	0.005
Naphthenic Acids	mg/L	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	-	-	0.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.81	0.35	-	-	-	-	< 0.1	17	14	-	< 0.1	< 1.0
Hydrocarbons																															
Benzene	mg/L	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	23	23	-	<0.0005	< 0.001
Toluene	mg/L	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	23	23	-	<0.0005	< 0.001
Ethylbenzene	mg/L	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	23	23	-	<0.0005	< 0.001
Total Xylenes	mg/L	< 0.002	< 0.003	< 0.003	-	< 0.002	< 0.002	< 0.002	< 0.002	<0.00071	<0.00071	<0.00071	<0.00071	< 0.002	-	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	23	23	-	<0.00071	< 0.003
VH (C6-C10)	mg/L	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	< 0.050	< 0.050	<0.10	<0.10	<0.10	<0.10	< 0.050	-	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	23	23	-	< 0.050	<0.10
F2 - EPH (C10-C16)	mg/L	< 0.030	< 0.030	< 0.030	-	< 0.030	< 0.030	< 0.030	< 0.030	<0.10	<0.10	<0.10	<0.10	< 0.030	-	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	23	23	-	< 0.030	<0.10
F1 - VPH (C6-C10)	mg/L	< 0.050	< 0.050	< 0.050	-	< 0.050	< 0.050	< 0.050	< 0.050	<0.10	<0.10	<0.10	<0.10	< 0.050	-	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	23	23	-	< 0.050	<0.10
Polycyclic Aromatic																															
Acenaphthene	µg/L	< 0.01	< 0.01	< 0.01	-	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	< 0.01	-	< 0.01	< 0.01														

Parameter	Units	SR1				SR2				SR3				SR4	SR5				n	Number below detection	Median	Min	Max								
		Fall	Spring	Summer	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring						Summer	Fall	Winter					
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	20	20	-	<0.05	<0.05	
Uranium (U)	µg/L	0.05	< 0.05	< 0.05	-	0.05	< 0.05	< 0.05	0.16	0.04	0.07	0.02	0.1	< 0.05	< 0.05	< 0.05	0.12	0.05	< 0.05	< 0.05	0.1	0.09	0.06	0.08	0.03	0.1	24	9	0.1	0	0.2
Vanadium (V)	µg/L	0.1	0.9	< 0.1	-	2	< 0.1	< 0.1	< 0.1	-	-	-	-	1.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	-	16	10	1	0.1	2.0
Zinc (Zn)	µg/L	< 1	1.4	< 0.5	-	2.0	3.0	< 1	2.0	<3	<3.0	<3.0	11	2.0	< 1	< 1	2.0	-	< 0.5	1.4	< 0.5	4.0	-	<3.0	4.8	5.4	24	12	2.0	1	11
Dissolved Metals	µg/L																														
Aluminum (Al)	µg/L	5	5	7	-	4	5	3	4	6	9	5	6	4	18	3	3	5	38	4	5	4	6	5	7	6	24	0	5.0	3.0	38
Antimony (Sb)	µg/L	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0.1	<0.1	<0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0.1	<0.1	<0.1	24	24	-	<0.05	<0.1	
Arsenic (As)	µg/L	0.3	0.3	0.7	-	0.4	0.7	0.3	0.1	0.5	0.9	0.4	0.5	0.4	0.7	0.3	0.3	0.4	0.4	1	0.6	0.4	0.5	0.8	0.4	0.5	24	0	0.4	0.1	1.0
Barium (Ba)	µg/L	14	12	18	-	17	21	18	35	18	23	14	32	18	22	19	32	34	20	22	20	26.5	22	23	16	33	24	0	21	12	35
Beryllium (Be)	µg/L	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	20	20	-	<0.1	<0.1	
Boron (B)	µg/L	6.0	3.0	10	-	9.0	9.0	17	26	10	18	<10	24	9.0	10	7.0	20	9.0	13.0	15.0	12.0	17	19	22	<10	24	24	0	11	3	26
Cadmium (Cd)	µg/L	< 0.015	< 0.015	< 0.015	-	< 0.015	< 0.015	< 0.015	< 0.015	0.009	0.008	<0.005	0.006	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.02	<0.005	<0.005	0.02	24	19	-	<0.015	0.02	
Chromium (Cr)	µg/L	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	0.1	<0.1	<0.1	<0.1	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	0.8	0.5	0.1	<0.1	<0.1	<0.1	24	20	-	<0.1	0.8	
Cobalt (Co)	µg/L	0.09	0.07	0.06	-	0.09	0.06	0.08	0.17	-	-	-	-	0.07	0.06	0.06	0.1	0.08	0.08	0.08	0.07	0.12	-	-	-	20	0	0.08	0.06	0.17	
Copper (Cu)	µg/L	0.1	0.1	0.2	-	< 0.1	0.2	0.1	0.4	0.5	0.4	0.2	0.9	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4	0.7	0.3	<0.2	0.5	24	3	0.2	0.1	0.9	
Iron (Fe)	µg/L	500	160	380	-	390	420	460	400	235	393	317	674	350	430	460	490	380	450	438	636	564	305	181	320	549	24	0	410	160	674
Lead (Pb)	µg/L	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	0.07	24	23	-	<0.05	0.07	
Manganese (Mn)	µg/L	< 0.05	0.03	0.01	-	100	< 50	< 50	230	86	20	24	174	100	< 50	< 50	100	60	60	31.5	38	133	168	2.5	34	94	24	0	36	2	230
Mercury (Hg)	µg/L	< 0.008	< 0.008	< 0.008	-	< 0.008	< 0.008	< 0.008	< 0.008	0.006	<0.005	<0.005	<0.005	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.005	< 0.005	< 0.005	< 0.005	0.008	<0.005	<0.005	<0.005	24	22	-	<0.005	0
Molybdenum (Mo)	µg/L	0.07	0.07	0.1	-	0.1	< 0.05	0.2	0.4	-	-	-	-	0.1	< 0.05	0.1	0.3	0.1	0.1	0.2	0.2	0.26	-	-	-	16	0	0.1	0	0.4	
Nickel (Ni)	µg/L	0.3	0.3	0.4	-	0.3	0.4	0.2	0.5	<0.5	0.6	<0.5	<0.5	0.3	0.7	0.3	0.5	0.3	0.4	0.5	0.3	0.42	0.5	0.7	<0.5	<0.5	24	0	0.3	0	0.7
Selenium (Se)	µg/L	< 0.6	< 0.6	< 0.6	-	< 0.6	< 0.6	< 0.6	< 0.6	<0.05	<0.05	<0.05	<0.05	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	<0.05	<0.05	<0.05	<0.05	24	24	-	<0.05	<0.6	
Silver (Ag)	µg/L	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	<0.01	<0.01	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	<0.01	<0.01	<0.01	24	24	-	<0.01	<0.05	
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	20	20	-	<0.05	<0.05	
Uranium (U)	µg/L	< 0.05	< 0.05	0.1	-	< 0.05	< 0.05	< 0.05	0.15	0.03	0.07	0.02	0.1	< 0.05	< 0.05	< 0.05	0.12	< 0.05	< 0.05	< 0.05	0.06	0.09	0.05	0.08	0.02	0.1	24	11	0.07	<0.05	0.22
Vanadium (V)	µg/L	< 0.05	< 0.05	0.09	-	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	< 0.05	0.06	< 0.05	< 0.05	< 0.05	0.06	0.22	< 0.05	< 0.05	-	-	-	16	12	-	<0.05	0.22	
Zinc (Zn)	µg/L	1.4	2.2	1.6	-	1.6	1.1	1.6	6.5	4.6	1.0	2.5	2.7	1.8	5.3	1.4	3.8	1.4	< 0.5	1.9	0.8	2.4	5.4	<1.0	2.6	8.5	24	1	1.9	<0.5	8.5

Notes:
 Shaded and Bolded cells indicates an aquatic life guideline exceedance.
 Shaded and Italicized cells indicates a drinking water guideline exceedance.
 * = The watercourse was frozen to the bottom

Table E2-2: Baseline Water Quality Results for Unnamed Tributaries of the Sandy River

Parameter	Units	TSR1				TSR2				TSR3				TSR4				TSR5							
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
		11-May-11	10-Aug-11	22-Oct-10	10-Mar-11	4-May-10	17-Aug-10	19-Oct-10	8-Mar-11	4-May-10	17-Aug-10	19-Oct-10	8-Mar-11	4-May-10	18-Aug-10	20-Oct-10	10-Mar-11	26-May-12	10-Aug-12	17-Oct-12	10-Mar-13	26-May-16	9-Aug-16	27-Oct-16	8-Mar-17
Field Measured																									
Temperature	°C	9.6	14.8	9.5	0.0	5.8	17.4	4.7	0.0	1.3	12.0	4.3	*	5.9	14.4	-	*	11	16.6	3.8	0.0	8.2	15.5	1.4	-
pH	pH units	7.1	7.2	8.4	8.1	8.4	7.1	8.4	8.3	8.0	7.4	7.8	*	8.1	7.6	8.2	*	7.6	8.1	8.2	7.23	7.0	7.4	8.0	-
Specific Conductivity	µS/cm	106	159	161	409	126	139	178	183	152	137	180	*	129	159	181	*	172	340	289	242	182	349	167	-
Dissolved Oxygen (DO)	mg/L	11.0	7.3	9.6	5.9	8.6	5.7	8.2	2.2	10.6	6.2	8.0	*	12.2	7.0	7.4	*	9.3	8.9	10.8	8.01	8.2	7.5	10.3	-
Conventional Parameters and Major Ions																									
pH	pH Units	7.9	7.8	8.2	8.2	7.8	8.0	8.2	8.1	7.7	8.1	8.3	*	7.9	8.1	8.2	*	8.2	8.3	8.0	7.7	7.9	8.1	7.9	7.7
Specific Conductivity	µS/cm	102	159	169	416	115	162	157	249	134	176	187	*	121	159	171	*	170	327	303	234	194	324	189	360
Total Dissolved Solids (TDS)	mg/L	56	80	128	280	100	88	112	188	128	156	124	*	96	112	124	*	109	244	200	152	93	160	109	211
Total Suspended Solids (TSS)	mg/L	9	3	< 2	6	11	16	< 2	4	< 2	2	3	*	2	3	3	*	< 2	< 2	3	6	< 3.0	< 3.0	< 3.0	-
Turbidity	NTU	4	1.5	2	17	4	7	1	1.8	3	7	8	*	3	4	3	*	3.0	6.0	5	5	1.7	6.1	-	-
Hardness	mg/L	49	83	82	199	54	83	77	123	69	94	88	*	60	82	84	*	80	194	164	136	96	171	97	192
Alkalinity	mg/L	54	80	90	237	59	83	83	133	71	91	96	*	62	81	90	*	91	189	165	128	94	160	103	204
Calcium	mg/L	12	22	22	53	14	22	20.6	33.7	17	24	24	*	15	21	22	*	22	55	44	37	26	48	26	53
Magnesium	mg/L	5	7	7	16	5	7	6	9	6	8	7	*	5	7	7	*	6.1	14	13.5	11	7.9	12	7.6	15
Potassium	mg/L	1.1	< 0.5	< 0.5	1.1	0.6	< 0.5	< 0.5	0.7	1.2	< 0.5	< 0.5	*	0.9	< 0.5	< 0.5	*	< 0.5	0.6	0.9	1.7	0.6	0.6	0.5	0.9
Sodium	mg/L	1.5	2	3	17	1.5	2	2	3	2	2	2	*	2	2	2	*	2.7	3.1	4.1	2.4	2.5	2.4	2.0	3.3
Bicarbonate	mg/L	66	97	109	289	72	101	101	163	86	111	117	*	76	99	109	*	111	230	201	156	115	196	126	249
Carbonate	mg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	< 1	*	< 1	< 1	< 1	< 1	< 5.0	< 5.0	< 5.0	< 5.0
Chloride	mg/L	0.5	0.3	0.5	0.7	0.3	0.4	< 1	0.3	0.4	0.4	0.3	*	0.3	0.3	0.4	*	1.1	0.7	4.3	0.8	< 0.5	< 0.5	< 0.5	< 0.5
Sulphate	mg/L	0.8	0.8	1.6	5	1	2	0.7	0.9	< 0.5	< 0.5	0.7	*	0.9	0.9	2	*	0.6	< 0.5	4.6	1.4	< 0.3	0.4	0.4	1.3
Nutrients and Organics																									
Ammonia-Nitrogen	mg/L	< 0.02	< 0.02	< 0.02	0.4	0.06	0.03	< 0.02	0.2	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	0.2
Nitrate-Nitrogen	mg/L	< 0.05	< 0.05	< 0.05	0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.02	0.1
Nitrite-Nitrogen	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.03	< 0.03	< 0.03	< 0.03	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/L	0.6	0.4	0.2	0.7	0.9	0.6	0.6	0.6	0.3	0.3	0.3	*	0.3	0.2	0.6	*	0.2	0.3	0.3	0.3	0.3	0.6	0.3	0.4
Phosphorus, Total	mg/L	0.03	0.02	< 0.02	0.09	0.04	0.01	< 0.01	< 0.01	0.03	0.04	0.04	*	< 0.02	< 0.02	< 0.02	*	< 0.02	0.03	0.03	0.04	-	-	< 0.02	0.04
Biochemical Oxygen Demand	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	3	< 2	< 2	< 2	*	< 2	< 2	< 2	*	< 2	2	< 2	-	< 3.0	< 2.0	< 2.0	< 2.0
Carbon (Total Organic)	mg/L	13	17	15	12	9	15	14	19	14	17	14	*	11	14	12	*	10	14	24	13	12	14	10	10
Phenol (Total)	mg/L	< 0.002	< 0.002	0.004	< 0.002	< 0.002	< 0.002	< 0.002	0.002	< 0.002	-	0.002	*	< 0.002	-	0.003	*	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.001	0.001	< 0.001
Naphthenic Acids	mg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1.0	< 1.0	< 1.0	*	< 0.1	0.1	1	-	-	-	-	0.1
Hydrocarbons																									
Benzene	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	*	< 0.001	-	< 0.001	*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Toluene	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	*	< 0.001	-	< 0.001	*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	*	< 0.001	-	< 0.001	*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Total Xylenes	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	< 0.002	*	< 0.002	-	< 0.002	*	< 0.003	< 0.003	< 0.003	< 0.003	< 0.00071	< 0.00071	< 0.00071	< 0.00071
VH (C6-C10)	mg/L	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	-	< 0.050	*	< 0.050	-	< 0.050	*	< 0.050	< 0.050	< 0.050	< 0.050	< 0.10	< 0.10	< 0.10	< 0.10
F2 - EPH (C10-C16)	mg/L	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	-	< 0.030	*	< 0.030	-	< 0.030	*	< 0.030	< 0.030	< 0.030	< 0.030	< 0.10	< 0.10	< 0.10	< 0.10
F1 - VPH (C6-C10)	mg/L	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	-	< 0.050	*	< 0.050	-	< 0.050	*	< 0.050	< 0.050	< 0.050	< 0.050	< 0.10	< 0.10	< 0.10	< 0.10
Polycyclic Aromatic Hydrocarbons																									
Acenaphthene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	< 0.01	*	< 0.01	-	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02
Acenaphthylene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	< 0.01	*	< 0.01	-	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02
Acridine	µg/L	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	-	< 0.07	*	< 0.07	-	< 0.07	*	< 0.07	< 0.07	< 0.07	< 0.07	-	-	-	-
Anthracene	µg/L	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	-	< 0.007	*	< 0.007	-	< 0.007	*	< 0.007	< 0.007	< 0.007	< 0.007	< 0.01	< 0.01	< 0.01	< 0.01
Benz[a]anthracene	µg/L	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	-	< 0.006	*	< 0.006	-	< 0.006	*	< 0.006	< 0.006	< 0.006	< 0.006	< 0.01	< 0.01	< 0.01	< 0.01
Benzo[a]pyrene	µg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	-	< 0.005	*	< 0.005	-	< 0.005	*	< 0.005	< 0.005	< 0.005	< 0.005	< 0.01	< 0.01	< 0.01	< 0.01
Benzo[b]fluoranthene	µg/L	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	-	< 0.08	*	< 0.08	-	< 0.08	*	< 0.08	< 0.08	< 0.08	< 0.08	< 0.01	< 0.01	< 0.01	< 0.01
Benzo[g,h,i]perylene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	< 0.02	*	< 0.02	-	< 0.02	*	< 0.02							

Parameter	Units	TSR1				TSR2				TSR3				TSR4				TSR5							
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter				
		11-May-11	10-Aug-11	22-Oct-10	10-Mar-11	4-May-10	17-Aug-10	19-Oct-10	8-Mar-11	4-May-10	17-Aug-10	19-Oct-10	8-Mar-11	4-May-10	18-Aug-10	20-Oct-10	10-Mar-11	26-May-12	10-Aug-12	17-Oct-12	10-Mar-13	26-May-16	9-Aug-16	27-Oct-16	8-Mar-17
Iron (Fe)	µg/L	460	440	470	2450	330	1830	190	1440	960	1380	1720	*	370	560	650	*	280	1470	1450	1020	502	1020	413	2210
Lead (Pb)	µg/L	0.07	< 0.05	< 0.05	< 0.05	< 0.05	0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	0.54	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn)	µg/L	20	20	<50	400	<50	<50	<50	180	60	90	130	*	< 50	50	80	*	300	150	122	88	40	136	29	363
Mercury (Hg)	µg/L	<0.002	<0.002	<0.002	0.004	0.005	0.002	<0.002	<0.002	0.003	<0.002	0.003	*	0.002	<0.002	<0.002	*	< 0.005	138.000	< 0.005	< 0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum (Mo)	µg/L	0.1	0.08	0.06	0.7	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	0.09	0.08	0.1	*	0.06	< 0.005	< 0.05	0.12	-	-	-	-
Nickel (Ni)	µg/L	0.4	0.4	0.3	0.7	0.2	0.2	0.6	< 0.1	0.2	0.2	0.5	*	0.3	0.4	0.3	*	< 0.05	0.2	0.2	0.1	<0.5	<0.5	0.7	<0.5
Selenium (Se)	µg/L	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	*	< 0.6	< 0.6	< 0.6	*	< 0.6	0.1	< 0.6	< 0.6	<0.05	<0.05	<0.05	<0.05
Silver (Ag)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	<0.01	0.01	<0.01
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Uranium	µg/L	< 0.05	< 0.05	< 0.05	0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	0.02	0.09	0.02	0.1
Vanadium	µg/L	0.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-
Zinc (Zn)	µg/L	0.7	< 0.5	< 1	1.0	< 1	4	1	2	< 1	< 1	< 1	*	< 1	1	2	*	< 0.5	< 0.5	4.9	< 0.5	<3.0	<3.0	4.4	3.6
Dissolved Metals																									
Aluminum (Al)	µg/L	3	5	3	3	< 2	3	< 2	3	2	3	< 2	*	4	4	< 2	*	< 2	< 2	< 2	< 2	1.6	2.6	2.0	1.4
Antimony (Sb)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0.1	<0.1	<0.1
Arsenic (As)	µg/L	0.2	0.5	0.2	0.5	0.1	0.3	< 0.1	< 0.1	0.2	0.4	0.1	*	0.3	0.7	0.3	*	0.2	0.6	0.3	0.3	0.3	0.6	0.2	0.4
Barium (Ba)	µg/L	10	14	11	28	10	18	14	34	14	21	18	*	13	16	13	*	32.2	67	42	35	33	58	24	54
Beryllium (Be)	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-
Boron (B)	µg/L	3	8	4	37	7	10	10	9	5	5	6	*	7	7	4	*	6	11	7	2	<10	11	<10	11
Cadmium (Cd)	µg/L	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	*	< 0.015	< 0.015	< 0.015	*	< 0.015	< 0.015	< 0.015	< 0.015	0.005	<0.005	<0.005	<0.005
Chromium (Cr)	µg/L	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	*	< 0.3	< 0.3	< 0.3	*	< 0.3	< 0.3	< 0.3	< 0.3	0.1	<0.1	<0.1	<0.1
Cobalt (Co)	µg/L	0.05	0.06	0.06	0.3	0.02	0.04	0.04	0.08	0.05	0.07	0.09	*	0.04	0.07	0.08	*	< 0.02	0.07	0.05	0.05	-	-	-	-
Copper (Cu)	µg/L	0.1	0.8	< 0.1	2	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	*	0.3	< 0.1	< 0.1	0.4	0.2	<0.2	0.2	<0.2
Iron (Fe)	µg/L	160	260	310	270	130	500	120	1080	470	790	1070	*	170	320	350	*	150	260	385	429	110	816	192	389
Lead (Pb)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn)	µg/L	10	10	<50	400	<50	190	<50	210	< 50	80	120	*	< 50	< 50	70	*	0.02	131	106	84	29	102	18	355
Mercury (Hg)	µg/L	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	*	< 0.008	< 0.008	< 0.008	*	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum (Mo)	µg/L	0.1	0.07	0.06	0.6	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	0.1	< 0.05	0.1	*	0.06	0.26	0.13	0.11	-	-	-	-
Nickel (Ni)	µg/L	0.3	0.4	0.3	0.6	0.1	0.08	< 0.05	0.08	0.2	0.2	0.1	*	0.2	0.4	0.2	*	< 0.05	0.3	0.1	0	<0.5	<0.5	<0.5	<0.5
Selenium (Se)	µg/L	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	*	< 0.6	< 0.6	< 0.6	*	< 0.6	< 0.6	< 0.6	< 0.6	<0.05	<0.05	<0.05	<0.05
Silver (Ag)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	<0.01	<0.01	<0.01
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Uranium	µg/L	< 0.05	< 0.05	< 0.05	0.19	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	0.09	0.05	< 0.05	0.03	0.09	0.01	0.1
Vanadium	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Zinc (Zn)	µg/L	1.8	1.4	1.1	4	2	0.6	2	4	1	1.8	2	*	1.3	1.2	1.6	*	< 0.5	1.6	2.0	1.9	2.8	<1.0	2.8	2.0

Notes:

Shaded and Bolded cells indicates an aquatic life guideline exceedance.

Shaded and Italicized cells indicates a drinking water guideline exceedance.

* = The watercourse was frozen to the bottom

Table E2-3: Baseline Water Quality Results for Waterbodies within ALSA

Parameter	Units	Torch Lake				UNL1	
		Spring	Summer	Fall	Winter	Spring	Fall
		25-May-16	9-Aug-16	27-Oct-16	7-Mar-17	13-Jun-17	19-Oct-17
Field Measured							
Temperature	°C	14.2	20.1	1.5	-	17.1	2.9
pH	pH units	7.6	8.4	8.1	-	7.8	7.5
Specific Conductivity	µS/cm	199	224	171	-	190	203
Dissolved Oxygen (DO)	mg/L (ppm)	9.3	8.2	11.2	-	9.1	11.5
Conventional Parameters and Major Ions							
pH	pH Units	8.1	8.2	7.9	8.0	8.4	8.2
Specific Conductivity	µS/cm	212	207	197	260	217	203
Total Dissolved Solids	mg/L	102	104	110	142	119	121
Total Suspended Solids	mg/L	<3.0	<3.0	4.3	-	<3.0	5.0
Turbidity	NTU	1.2	-	-	-	2.7	1.4
Hardness	mg/L	105	105	100	129	112	103
Alkalinity	mg/L	103	106	108	141	114	121
Calcium	mg/L	28	28	26	34	33	30
Magnesium	mg/L	8.5	8.5	8.4	11	7.2	6.8
Potassium	mg/L	1.6	1.6	1.6	2.0	0.7	0.5
Sodium	mg/L	1.9	1.9	2.1	2.6	1.1	1.0
Bicarbonate	mg/L	126	129	132	172	135	148
Carbonate	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride	mg/L	<0.5	<0.5	<0.5	0.5	<0.50	<0.50
Sulphate	mg/L	<0.30	<0.3	<0.3	<0.3	<0.30	<0.30
Nutrients and Organics							
Ammonia-Nitrogen	mg/L	<0.05	0.09	0.11	0.1	0.06	<0.050
Nitrate-Nitrogen	mg/L	<0.02	<0.02	<0.02	<0.02	<0.020	<0.020
Nitrite-Nitrogen	mg/L	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Total Kjeldahl Nitrogen	mg/L	0.6	1.0	0.4	1.2	0.5	<0.20
Phosphorus, Total	mg/L	-	-	<0.02	0.02	<0.050	<0.020
Biochemical Oxygen	mg/L	<2.0	<2.0	<2.0	2.6	<2.0	<2.0
Carbon (Total Organic)	mg/L	12	12	9.3	13	9.0	8.9
Phenol (Total)	mg/L	<0.001	<0.001	0.002	<0.001	0.003	<0.0010
Naphthenic Acids	mg/L	-	-	-	0.2	<0.10	0.1
Hydrocarbons							
Benzene	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050
Toluene	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050
Ethylbenzene	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050
Total Xylenes	mg/L	<0.00071	<0.00071	<0.00071	<0.00071	<0.00071	<0.00071
VH (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
F2 - EPH (C10-C16)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
F1 - VPH (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Polycyclic Aromatic							
Acenaphthene	µg/L	<0.02	<0.02	<0.02	<0.02	<0.000010	<0.000010
Acenaphthylene	µg/L	<0.02	<0.02	<0.02	<0.02	<0.000010	<0.000010
Acridine	µg/L	-	-	-	-	<0.000010	<0.000010
Anthracene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.000010	<0.000010
Benz[a]anthracene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.000010	<0.000010
Benzo[a]pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.0000050	<0.0000050
Benzo[b]fluoranthene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.000010	<0.000010
Benzo[g,h,i]perylene	µg/L	<0.02	<0.02	<0.02	<0.02	<0.000010	<0.000010
Benzo[k]fluoranthene	µg/L	<0.005	<0.005	<0.005	<0.005	<0.000010	<0.000010
Chrysene	µg/L	<0.02	<0.02	<0.02	<0.02	<0.000010	<0.000010
Dibenz[a,h]anthracene	µg/L	<0.005	<0.005	<0.005	<0.005	<0.0000050	<0.0000050
Fluoranthene	µg/L	<0.02	<0.02	<0.02	<0.02	<0.000010	<0.000010
Fluorene	µg/L	<0.02	<0.02	<0.02	<0.02	<0.000010	<0.000010
Indeno[1,2,3,-cd]pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.000010	<0.000010
Naphthalene	µg/L	<0.05	<0.05	<0.05	<0.05	<0.000050	<0.000050

Parameter	Units	Torch Lake				UNL1	
		Spring	Summer	Fall	Winter	Spring	Fall
		25-May-16	9-Aug-16	27-Oct-16	7-Mar-17	13-Jun-17	19-Oct-17
Phenanthrene	µg/L	<0.05	<0.05	<0.05	<0.05	<0.000020	<0.000020
Pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.000010	<0.000010
Quinoline	µg/L	-	-	-	-	<0.000050	<0.000050
Total Metals							
Aluminum (Al)	µg/L	5.3	5.7	4.9	6.0	6.5	<3.0
Antimony (Sb)	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic (As)	µg/L	0.4	0.4	0.4	0.6	0.4	0.5
Barium (Ba)	µg/L	44	46	44	64	24	19
Beryllium (Be)	µg/L	-	-	-	-	-	-
Boron (B)	µg/L	14	13	14	17	<10	<10
Cadmium (Cd)	µg/L	<0.005	<0.005	0.005	0.02	<0.05	<0.05
Chromium (Cr)	µg/L	0.1	0.1	0.3	0.2	0.2	<0.1
Cobalt (Co)	µg/L	-	-	-	-	-	-
Copper (Cu)	µg/L	<0.5	<0.5	0.5	5.6	<0.5	<0.5
Iron (Fe)	µg/L	28	44	128	23	134	88
Lead (Pb)	µg/L	<0.05	<0.05	<0.05	0.1	<0.05	<0.05
Manganese (Mn)	µg/L	12	21	12	4.2	97	42
Mercury (Hg)	µg/L	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05
Molybdenum (Mo)	µg/L	-	-	-	-	<0.05	-
Nickel (Ni)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium (Se)	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Silver (Ag)	µg/L	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Thallium (Tl)	µg/L	-	-	-	-	-	-
Uranium (U)	µg/L	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Vanadium (V)	µg/L	-	-	-	-	-	-
Zinc (Zn)	µg/L	<3.0	<3.0	<3.0	12	3.3	4.3
Dissolved Metals							
Aluminum (Al)	µg/L	1.4	2.8	3.1	<1.0	1.3	<1.0
Antimony (Sb)	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic (As)	µg/L	0.4	0.4	0.4	0.5	0.4	0.5
Barium (Ba)	µg/L	42	46	43	61	24	17
Beryllium (Be)	µg/L	-	-	-	-	-	-
Boron (B)	µg/L	12	20	12	16	<10	<10
Cadmium (Cd)	µg/L	0.02	<0.005	0.008	0.008	<0.05	<0.05
Chromium (Cr)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt (Co)	µg/L	-	-	-	-	-	-
Copper (Cu)	µg/L	0.4	<0.2	0.5	0.8	<0.2	<0.2
Iron (Fe)	µg/L	11	<10	10	<10	24	<10
Lead (Pb)	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn)	µg/L	4.5	0.4	1.9	0.7	1.6	<i>0.68</i>
Mercury (Hg)	µg/L	0.006	<0.05	<0.005	<0.005	0.007	<0.05
Molybdenum (Mo)	µg/L	-	-	-	-	<0.05	-
Nickel (Ni)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium (Se)	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Silver (Ag)	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium (Tl)	µg/L	-	-	-	-	-	-
Uranium (U)	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	µg/L	-	-	-	-	-	-
Zinc (Zn)	µg/L	5.8	<1.0	3.4	6.0	2.0	<1.0

Notes:

Shaded and Bolded cells indicates an aquatic life guideline exceedance.

Shaded and Italicized cells indicates a drinking water guideline exceedance.

Appendix E3

***Sediment Quality Data from the
Aquatic Local Study Area***

Table E3-1: Baseline Sediment Quality for the Sites Within the ALSA

Parameter	Units	Sandy River					Tributaries of the Sandy River			
		SR1	SR2	SR3	SR5	TSR1	TSR2	TSR4	TSR5	
		22-Oct-10	19-Oct-10	27-Oct-16	20-Oct-10	26-Oct-16	22-Oct-10	19-Oct-10	20-Oct-10	27-Oct-16
Texture and Carbon Content										
Texture - Sand	%	82	95	79	100	86	78	95	90	96
Texture - Silt	%	14	5	10	< 1	9.3	14	5.0	8.0	2.3
Texture - Clay	%	4.0	< 1	11	< 1	4.9	8.0	< 1	2.0	2.1
Total Organic Carbon	% by wt	1.0	0.4	0.6	<0.1	0.5	0.9	0.51	1.4	0.4
Hydrocarbons										
Benzene	mg/kg	< 0.005	< 0.005	<0.005	< 0.005	<0.005	< 0.005	< 0.005	< 0.005	<0.005
Toluene	mg/kg	< 0.03	< 0.03	<0.05	< 0.03	<0.05	< 0.03	< 0.03	< 0.03	<0.05
Ethylbenzene	mg/kg	< 0.01	< 0.01	<0.015	< 0.01	<0.015	< 0.01	< 0.01	< 0.01	<0.015
Total Xylenes	mg/kg	< 0.03	< 0.03	<0.1	< 0.03	<0.1	< 0.03	< 0.03	< 0.03	<0.1
F1 - VPH (C6-C10)	mg/kg	< 5.00	< 5.00	-	< 5.00	-	< 5.00	< 5.00	< 5.00	-
F1 - VPH (C6-C10) - BTEX	mg/kg	< 5.00	< 5.00	<10	< 5.00	<10	< 5.00	< 5.00	< 5.00	<10
F2 - EPH (C10-C16)	mg/kg	< 30	< 30	<20	< 30	<20	< 30	< 30	< 30	<20
F3 - EPH (C16-C34)	mg/kg	108	33	108	< 30	26	147	< 30	59	<20
F4 - EPH (C34-C50)	mg/kg	60	35	62	< 30	26	134	< 30	34	<20
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	µg/kg (ppb)	<50 *	<50 *	<5	<50 *	<5	<50 *	<50 *	<50 *	<5
Acenaphthylene	µg/kg (ppb)	<50 *	<50 *	<5	<50 *	<5	<50 *	<50 *	<50 *	<5
Anthracene	µg/kg (ppb)	<5	<5	<4	<5	<4	<5	<5	<5	<4
Benzo(a)anthracene	µg/kg (ppb)	<100 *	<100 *	<10	<100 *	<10	<100 *	<100 *	<100 *	<10
Benzo(a)pyrene	µg/kg (ppb)	<50 *	<50 *	<10	<50 *	<10	<50 *	<50 *	<50 *	<10
Benzo(c)phenanthrene	µg/kg (ppb)	<100	<100	-	<100	-	<100	<100	<100	-
Benzo(g,h,i)perylene	µg/kg (ppb)	<100	<100	<10	<100	<10	<100	<100	<100	<10
Benzo(k)fluoranthene	µg/kg (ppb)	<50	<50	<10	<50	<10	<50	<50	<50	<10
Benzo[b+j]fluoranthene	µg/kg (ppb)	<50	<50	<10	<50	<10	<50	<50	<50	<10
Chrysene	µg/kg (ppb)	<50	<50	<10	<50	<10	<50	<50	<50	<10
Dibenzo(a,h)anthracene	µg/kg (ppb)	<100 *	<100 *	<5	<100 *	<5	<100 *	<100 *	<100 *	<5
Dibenzo(a,h)pyrene	µg/kg (ppb)	<100	<100	-	<100	-	<100	<100	<100	-
Dibenzo(a,i)pyrene	µg/kg (ppb)	<100	<100	-	<100	-	<100	<100	<100	-
Dibenzo(a,l)pyrene	µg/kg (ppb)	<100	<100	-	<100	-	<100	<100	<100	-
7,12 Dimethyl benzanthracene	µg/kg (ppb)	<100	<100	-	<100	-	<100	<100	<100	-
Fluoranthene	µg/kg (ppb)	<40	<40	<10	<40	<10	<40	<40	<40	<10
Fluorene	µg/kg (ppb)	<50 *	<50 *	<10	<50 *	<10	<50 *	<50 *	<50 *	<10
Indeno(1,2,3-cd)pyrene	µg/kg (ppb)	<100	<100	<10	<100	<10	<100	<100	<100	<10
2-Methylnaphthalene	µg/kg (ppb)	<100 *	<100 *	-	<100 *	-	<100 *	<100 *	<100 *	-
Naphthalene	µg/kg (ppb)	<15	<15	<10	<15	<10	<15	<15	<15	<10
Phenanthrene	µg/kg (ppb)	<50 *	<50 *	<10	<50 *	<10	<50 *	<50 *	<50 *	<10
Pyrene	µg/kg (ppb)	<50	<50	<10	<50	<10	<50	<50	<50	<10
Total Metals										
Antimony (Sb)	mg/kg	< 0.5	< 0.5	<0.1	< 0.5	<0.1	< 0.5	< 0.5	< 0.5	<0.1
Aluminum (Al)	mg/kg	1860	617	-	444	-	2210	1050	1450	-
Arsenic (As)	mg/kg	< 0.5	1.7	2.5	< 0.5	11	1.8	0.5	1.4	9.2
Barium (Ba)	mg/kg	24	15	37	7	35	28	12	33	30
Beryllium (Be)	mg/kg	< 0.1	< 0.1	0.2	< 0.1	<0.1	0.1	< 0.1	< 0.1	<0.1
Cadmium (Cd)	mg/kg	< 0.2	< 0.2	0.09	< 0.2	<0.02	< 0.2	< 0.2	< 0.2	<0.02
Calcium (Ca)	mg/kg	1500	1220	-	613	-	4450	1860	1890	-
Chromium (Cr)	mg/kg	3.7	1.0	8.0	1.3	3.2	4.8	1.6	2.9	2.1
Cobalt (Co)	mg/kg	1.9	1.0	2.8	0.6	0.8	2.3	1.0	1.4	0.6
Copper (Cu)	mg/kg	4.4	0.7	4.9	0.3	0.7	3.7	1.2	1.5	0.6
Iron (Fe)	mg/kg	3970	3170	-	1430	-	4420	3430	7490	-
Lead (Pb)	mg/kg	1.9	0.7	2.3	0.6	1.0	2.2	1.0	1.5	0.8
Magnesium (Mg)	mg/kg	633	332	-	249	-	1910	738	595	-
Manganese (Mn)	mg/kg	105	109	-	53	-	77	60	209	-
Mercury (Hg)	mg/kg	< 0.2*	< 0.2*	<0.005	< 0.2*	<0.005	< 0.2*	< 0.2*	< 0.2*	<0.005
Molybdenum (Mo)	mg/kg	< 0.5	< 0.5	0.3	< 0.5	<0.1	< 0.5	< 0.5	< 0.5	<0.1
Nickel (Ni)	mg/kg	2.4	1.1	7.0	0.7	1.6	4.4	1.8	2.3	1.1
Phosphorus (P)	mg/kg	175	149	-	119	-	170	135	252	-
Potassium (K)	mg/kg	205	88	-	60	-	419	193	198	-
Selenium (Se)	mg/kg	< 0.5	< 0.5	<0.2	< 0.5	<0.2	< 0.5	< 0.5	< 0.5	<0.2
Silver (Ag)	mg/kg	31	24	<0.1	7.0	<0.1	104	37	23	<0.1
Sodium (Na)	mg/kg	< 0.1	< 0.1	-	< 0.1	-	< 0.1	< 0.1	< 0.1	-
Thallium (Tl)	mg/kg	< 0.5	< 0.5	0.07	< 0.5	<0.05	< 0.5	< 0.5	< 0.5	<0.05
Tin (Sn)	mg/kg	< 0.5	< 0.5	<2.0	< 0.5	<2.0	< 0.5	< 0.5	< 0.5	<2.0
Uranium	mg/kg	4.1	1.6	0.4	1.3	0.2	6.0	2.9	3.6	0.14
Vanadium	mg/kg	< 15.0	< 15.0	13.1	< 15.0	4.7	< 15.0	< 15.0	< 15.0	4.3
Zinc (Zn)	mg/kg	12.9	3.7	16.7	2.5	6.7	13	11.5	8.6	5.2

Notes:

Shaded and Bolded cells indicates an aquatic life guideline exceedance.

Table E3-2: Baseline Sediment Quality for the Sites Within the ALSA

Parameter	Units	Torch Lake	Unnamed Lake
		TOR-01	UNL1
		27-Oct-16	19-Oct-17
Texture and Carbon Content			
Texture - Sand	%	99	<1.0
Texture - Silt	%	<1.0	88.3
Texture - Clay	%	<1.0	11.5
Total Organic Carbon	% by wt	0.4	<0.5
Hydrocarbons			
Benzene	mg/kg	<0.005	<0.14
Toluene	mg/kg	<0.05	<1.4
Ethylbenzene	mg/kg	<0.015	<0.27
Total Xylenes	mg/kg	<0.1	<1.9
F1 - VPH (C6-C10)	mg/kg	-	<270
F1 - VPH (C6-C10) - BTEX	mg/kg	<10	<270
F2 - EPH (C10-C16)	mg/kg	<20	<290
F3 - EPH (C16-C34)	mg/kg	<20	<290
F4 - EPH (C34-C50)	mg/kg	<20	<290
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	µg/kg (ppb)	<5	<0.060
Acenaphthylene	µg/kg (ppb)	<5	<0.060
Anthracene	µg/kg (ppb)	<4	<0.048
Benzo(a)anthracene	µg/kg (ppb)	<10	<0.12
Benzo(a)pyrene	µg/kg (ppb)	<10	<0.12
Benzo(c)phenanthrene	µg/kg (ppb)	-	-
Benzo(g,h,i)perylene	µg/kg (ppb)	<10	<0.12
Benzo(k)fluoranthene	µg/kg (ppb)	<10	<0.12
Benzo[b+j]fluoranthene	µg/kg (ppb)	<10	<0.12
Chrysene	µg/kg (ppb)	<10	<0.12
Dibenzo(a,h)anthracene	µg/kg (ppb)	<5	<0.060
Dibenzo(a,h)pyrene	µg/kg (ppb)	-	-
Dibenzo(a,i)pyrene	µg/kg (ppb)	-	-
Dibenzo(a,l)pyrene	µg/kg (ppb)	-	-
7,12 Dimethyl benzanthracene	µg/kg (ppb)	-	-
Fluoranthene	µg/kg (ppb)	<10	<0.12
Fluorene	µg/kg (ppb)	<10	<0.12
Indeno(1,2,3-cd)pyrene	µg/kg (ppb)	<10	<0.12
2-Methylnaphthalene	µg/kg (ppb)	-	-
Naphthalene	µg/kg (ppb)	<10	<0.12
Phenanthrene	µg/kg (ppb)	<10	<0.12
Pyrene	µg/kg (ppb)	<10	<0.12
Total Metals			
Antimony (Sb)	mg/kg	<0.1	0.2
Aluminum (Al)	mg/kg	-	-
Arsenic (As)	mg/kg	0.2	9.1
Barium (Ba)	mg/kg	5.0	294
Beryllium (Be)	mg/kg	<0.1	0.18
Cadmium (Cd)	mg/kg	<0.02	0.3
Calcium (Ca)	mg/kg	-	-

Parameter	Units	Torch Lake	Unnamed Lake
		TOR-01	UNL1
		27-Oct-16	19-Oct-17
Chromium (Cr)	mg/kg	0.6	16.3
Cobalt (Co)	mg/kg	0.2	3.3
Copper (Cu)	mg/kg	<0.5	6.5
Iron (Fe)	mg/kg	-	-
Lead (Pb)	mg/kg	0.5	3.9
Magnesium (Mg)	mg/kg	-	-
Manganese (Mn)	mg/kg	-	-
Mercury (Hg)	mg/kg	<0.005	0.07
Molybdenum (Mo)	mg/kg	<0.1	1.2
Nickel (Ni)	mg/kg	<0.5	11.3
Phosphorus (P)	mg/kg	-	-
Potassium (K)	mg/kg	-	-
Selenium (Se)	mg/kg	<0.2	0.8
Silver (Ag)	mg/kg	<0.1	<0.10
Sodium (Na)	mg/kg	-	-
Thallium (Tl)	mg/kg	<0.05	0.05
Tin (Sn)	mg/kg	<2.0	<2.0
Uranium	mg/kg	<0.05	0.4
Vanadium	mg/kg	0.9	12.6
Zinc (Zn)	mg/kg	2.2	60

Notes:

Shaded and Bolded cells indicates an aquatic life guideline exceedance.

Appendix E4

***Surface Water and Sediment Quality Data from the
Aquatic Regional Study Area***

Table E4-1: Baseline Water Quality for Winefred Lake

Parameter	Units	Winefred Lake											n	Number below detection	Median	Min	Max
		Spring 2007	Summer 2007	Fall 2007	28-May-12	17-Aug-12	18-Oct-12	9-Mar-13	25-May-16	9-Aug-16	28-Oct-16	7-Mar-17					
Field Measured																	
Temperature	°C	8.5	-	8.2	10.7	18.0	5.8	0.2	11.4	20.2	3.1	-	9	0	8.5	0.2	20.2
pH	pH units	8.1	-	8.5	8.7	8.9	8.2	8.1	7.7	7.9	9.0	-	9	0	8.2	7.7	9
Specific Conductivity	µS/cm	176	-	173	182	189	176	187	176	202	153	-	9	0	176	153	202
Dissolved Oxygen (DO)	mg/L	11.2	-	13.2	12.3	9.8	12.8	11.7	10.6	8.0	7.3	-	9	0	11.2	7.3	13.2
Conventional Parameters and Major Ions																	
pH	pH Units	8.3	8.5	8.4	8.2	8.3	8.1	8.0	8.1	7.9	7.9	7.8	11	0	8.12	7.84	8.5
Specific Conductivity	µS/cm	166	196	203	196	187	189	208	189	186	182	215	11	0	189	166	215
Total Dissolved Solids (TDS)	mg/L	120	135	119	112	104	176	115	93	94	101	121	11	0	115	92.5	176
Total Suspended Solids (TSS)	mg/L	3	5	6	< 2	7	14	< 2	6	<3.0	25	-	10	3	5.5	<3.0	24.6
Turbidity	NTU	-	-	-	2.4	6	6.2	1.6	-	-	-	-	4	0	4.2	1.6	6.2
Hardness	mg/L	89	93	100	84	101	99.7	118	92	91	86	107	11	0	93	84	118
Alkalinity	mg/L	96	104	112	99	102	107	115	94	95	97	115	11	0	102	93.5	115
Calcium	mg/L	25	26	28	22	27	26	32	24	25	23	29	11	0	26	21.9	31.5
Magnesium	mg/L	6.0	7.0	7	7.1	8.1	8.2	9.5	7.5	7.3	7.2	8.6	11	0	7.26	6	9.5
Potassium	mg/L	0.9	0.8	1.0	0.7	0.7	0.7	1	0.8	0.9	0.9	0.9	11	0	0.9	0.7	1
Sodium	mg/L	3.0	3.0	4.0	4	3.9	3.9	4.5	3.7	3.6	3.7	4.3	11	0	3.9	3	4.5
Bicarbonate	mg/L	117	121	133	121	125	130	140	114	116	119	141	11	0	121	114	141
Carbonate	mg/L	<5	<5	<5	< 1	< 1	< 1	< 1	<5.0	<5.0	<5.0	<5.0	11	11	-	<1	<5.0
Chloride	mg/L	1.0	1.0	<1	0.8	0.6	0.5	0.5	<0.5	<0.5	0.5	0.6	11	3	0.53	<0.5	1
Sulphate	mg/L	1.0	2.0	2.0	1.4	< 0.5	0.7	1.3	<0.3	<0.3	0.9	0.9	11	3	0.93	<0.3	2
Nutrients and Organics																	
Ammonia-Nitrogen	mg/L	<0.05	<0.05	<0.05	< 0.02	< 0.02	< 0.02	< 0.02	<0.05	0.2	0.09	<0.05	11	9	-	<0.02	0.16
Nitrate-Nitrogen	mg/L	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	<0.02	0.04	<0.02	0.03	8	6	-	<0.02	0.04
Nitrite-Nitrogen	mg/L	-	-	-	< 0.03	< 0.03	< 0.03	< 0.03	<0.01	<0.01	<0.01	0.02	8	7	-	<0.01	0.02
Total Kjeldahl Nitrogen	mg/L	0.4	0.7	0.8	0.7	0.3	0.6	0.3	0.3	0.8	0.3	0.3	11	0	0.4	0.25	0.81
Phosphorus, Total	mg/L	0.02	0.04	0.03	< 0.02	0.03	0.04	0.01	-	-	0.04	-	8	1	0.0305	<0.02	0.04
Biochemical Oxygen Demand	mg/L	<2	<2	<2	2	2	2	2	<2.0	<2.0	2.5	<2.0	11	6	2	<2.0	2.5
Carbon (Total Organic)	mg/L	9	10	11	7.8	9.6	18.1	---	10	32	8.8	10	10	0	10	7.8	32
Phenol (Total)	mg/L	<0.001	0.006	0.005	< 0.002	0.003	< 0.002	< 0.002	0.002	<0.001	<0.001	<0.001	11	7	-	<0.001	0.006
Naphthenic Acids	mg/L	<1	<1	<1	0.1	0.1	0.1	0.1	-	-	-	0.1	8	3	0.1	<1	<1
Hydrocarbons																	
Benzene	mg/L	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	8	8	-	<0.0005	< 0.001
Toluene	mg/L	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	8	8	-	<0.0005	< 0.001
Ethylbenzene	mg/L	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	8	8	-	<0.0005	< 0.001
Total Xylenes	mg/L	-	-	-	< 0.003	< 0.003	< 0.003	< 0.003	<0.00071	<0.00071	<0.00071	<0.00071	8	8	-	<0.00071	< 0.003
VH (C6-C10)	mg/L	-	-	-	< 0.050	< 0.050	< 0.050	< 0.050	<0.10	<0.10	<0.10	<0.10	8	8	-	< 0.050	<0.10
F1 - VPH (C6-C10)	mg/L	-	-	-	< 0.050	< 0.050	< 0.050	< 0.050	<0.10	<0.10	<0.10	<0.10	8	8	-	< 0.050	<0.10
F2 - EPH (C10-C16)	mg/L	-	-	-	< 0.030	< 0.030	< 0.030	< 0.030	<0.10	<0.10	<0.10	<0.10	8	8	-	< 0.030	<0.10
Polycyclic Aromatic Hydrocarbons																	
Acenaphthene	µg/L	-	-	-	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.01	<0.02
Acenaphthylene	µg/L	-	-	-	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.01	<0.02
Acridine	µg/L	-	-	-	< 0.07	< 0.07	< 0.07	< 0.07	-	-	-	-	4	4	-	< 0.07	< 0.07
Anthracene	µg/L	-	-	-	< 0.007	< 0.007	< 0.007	< 0.007	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.007	<0.01
Benz[a]anthracene	µg/L	-	-	-	< 0.006	< 0.006	< 0.006	< 0.006	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.006	<0.01
Benzo[a]pyrene	µg/L	-	-	-	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	<0.005	<0.005	<0.005	8	8	-	< 0.005	< 0.005
Benzo[b]fluoranthene	µg/L	-	-	-	< 0.08	< 0.08	< 0.08	< 0.08	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.08	<0.01
Benzo[g,h,i]perylene	µg/L	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	<0.02	<0.02	<0.02	<0.02	8	8	-	<0.02	<0.02
Benzo[k]fluoranthene	µg/L	-	-	-	< 0.08	< 0.08	< 0.08	< 0.08	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.08	<0.01
Chrysene	µg/L	-	-	-	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.01	<0.02
Dibenz[a,h]anthracene	µg/L	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	<0.005	<0.005	<0.005	<0.005	8	8	-	< 0.02	<0.005
Fluoranthene	µg/L	-	-	-	< 0.04	< 0.04	< 0.04	< 0.04	<0.02	<0.02	<0.02	<0.02	8	8	-	<0.02	< 0.04
Fluorene	µg/L	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.02	< 0.02
Indeno[1,2,3-cd]pyrene	µg/L	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	<0.01	<0.01	<0.01	<0.01	8	8	-	<0.01	< 0.02
Naphthalene	µg/L	-	-	-	< 0.07	< 0.07	< 0.07	< 0.07	<0.05	<0.05	<0.05	<0.05	8	8	-	<0.05	< 0.07
Phenanthrene	µg/L	-	-	-	< 0.01	< 0.01	< 0.01	< 0.01	<0.05	<0.05	<0.05	<0.05	8	8	-	< 0.01	<0.05

Parameter	Units	Winefred Lake											n	Number below detection	Median	Min	Max	
		Spring 2007	Summer 2007	Fall 2007	28-May-12	17-Aug-12	18-Oct-12	9-Mar-13	25-May-16	9-Aug-16	28-Oct-16	7-Mar-17						
Pyrene	µg/L	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	< 0.01	8	8	-	< 0.01	< 0.02	
Quinoline	µg/L	-	-	-	< 0.06	< 0.06	< 0.06	< 0.06	-	-	-	-	4	4	-	< 0.06	< 0.06	
Total Metals																		
Aluminum (Al)	µg/L	40	< 20	< 20	15	< 2	76	13	12	9	150	4.9	11	3	11.8	< 2	150	
Antimony (Sb)	µg/L	1.3	< 0.4	1.4	< 0.05	< 0.05	< 0.05	0.17	< 0.1	0.2	< 0.1	< 0.1	11	7	0.735	< 0.05	1.4	
Arsenic (As)	µg/L	0.5	0.8	0.5	0.4	0.6	0.7	0.5	0.5	0.8	0.6	0.5	11	0	0.5	0.4	0.8	
Barium (Ba)	µg/L	25	25	28	24.7	23.2	25.4	25.4	26	26	25	29	11	0	25.4	23.2	28.7	
Beryllium (Be)	µg/L	< 0.5	< 0.5	< 0.5	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	7	7	-	< 0.1	< 0.5	
Boron (B)	µg/L	< 20	< 20	< 20	14	15	17	10	15	17	15	17	11	4	15	< 20	17	
Cadmium (Cd)	µg/L	< 0.2	< 0.2	< 0.2	< 0.015	< 0.015	0.082	0.348	< 0.005	< 0.005	0.03	0.03	11	6	0.0557	< 0.005	0.348	
Chromium (Cr)	µg/L	0.9	< 0.8	< 0.8	< 0.3	< 0.3	< 0.3	< 0.3	0.1	0.1	0.7	< 0.1	11	7	0.42	< 0.3	0.9	
Cobalt (Co)	µg/L	0.4	2.4	< 0.1	0.02	0.02	0.05	0.02	-	-	-	-	7	1	0.05	0.02	2.4	
Copper (Cu)	µg/L	< 1	< 1	< 1	0.5	0.2	0.4	1	< 0.5	< 0.5	1.2	0.5	11	5	0.5	< 0.5	1.17	
Iron (Fe)	µg/L	80	70	50	100	108	212	45	171	125	668	32	11	0	100	32	668	
Lead (Pb)	µg/L	0.1	< 0.1	< 0.1	< 0.05	< 0.05	0.12	0.3	0.08	< 0.05	0.2	0.1	11	5	0.13	< 0.05	0.3	
Manganese (Mn)	µg/L	28	51	24	40	62	71	7.9	85	212	24	46	11	0	46.2	7.85	212	
Mercury (Hg)	µg/L	< 0.0006	< 0.0006	< 0.0006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	11	11	-	< 0.005	< 0.005	
Molybdenum (Mo)	µg/L	0.2	0.2	0.2	0.08	0.05	0.09	0.14	-	-	-	-	7	0	0.14	0.05	0.2	
Nickel (Ni)	µg/L	0.4	0.6	0.7	0.12	< 0.05	0.2	0.14	< 0.5	< 0.5	< 0.5	< 0.5	11	5	0.3	0.12	0.7	
Selenium (Se)	µg/L	< 0.4	< 0.4	< 0.4	< 0.6	< 0.6	< 0.6	< 0.6	< 0.05	< 0.05	< 0.05	< 0.05	11	11	-	< 0.05	< 0.6	
Silver (Ag)	µg/L	0.002	0.0002	0	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	0.01	< 0.01	11	7	-	< 0.01	0.012	
Thallium (Tl)	µg/L	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	7	7	-	< 0.05	< 0.1	
Uranium (U)	µg/L	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	0.02	0.01	0.02	0.01	11	7	-	< 0.05	< 0.1	
Vanadium (V)	µg/L	0.3	< 0.2	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	7	6	0.3	0.3	0.3	
Zinc (Zn)	µg/L	5	4	9	1.5	29	5	6	7	< 3.0	4	10	11	1	5	< 3.0	28.9	
Dissolved Metals																		
Aluminum (Al)	µg/L	< 10	< 10	< 10	15	< 2	< 2	< 2	1.8	3	1.8	< 1.0	11	7	-	< 2	< 10	
Antimony (Sb)	µg/L	0.5	< 0.4	0.6	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	11	9	-	< 0.05	0.6	
Arsenic (As)	µg/L	< 0.4	0.7	1.2	0.4	0.7	0.5	0.5	0.4	0.6	0.4	0.5	11	1	0.5	0.2	1.2	
Barium (Ba)	µg/L	23	23	27	24	24	27	24	23	23	25	28	11	0	24.1	22.9	27.6	
Boron (B)	µg/L	< 20	30	20	15	14	15	11	13	26	14	18	7	7	-	< 0.1	< 0.5	
Beryllium (Be)	µg/L	< 0.5	< 0.5	< 0.5	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	11	1	15	10	30	
Cadmium (Cd)	µg/L	< 0.2	< 0.1	< 0.1	< 0.015	< 0.015	0.019	0.175	0.03	< 0.005	0.02	0.01	11	6	0.0205	0.01	0.175	
Chromium (Cr)	µg/L	< 0.4	< 0.4	< 0.4	< 0.3	< 0.3	0.3	< 0.3	0.1	< 0.1	< 0.1	< 0.1	11	9	-	0.11	0.3	
Cobalt (Co)	µg/L	0.4	2.4	< 0.1	< 0.02	< 0.02	< 0.02	< 0.02	-	-	-	-	7	5	-	0.4	2.4	
Copper (Cu)	µg/L	< 1	< 0.6	1.6	0.3	0.6	< 0.1	1.5	0.5	0.4	0.8	0.4	11	3	0.45	0.05	1.6	
Iron (Fe)	µg/L	8	10	10	90	4	4	5	52	37	33	16	11	0	10	3.6	90	
Lead (Pb)	µg/L	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	11	11	-	< 0.05	< 0.1	
Manganese (Mn)	µg/L	3	11	< 10	40	0.58	0.6	0.07	26	66	12	2.0	11	1	5	< 10	65.5	
Mercury (Hg)	µg/L	< 0.0006	< 0.0006	< 0.0007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	11	11	-	< 0.0007	< 0.005	
Molybdenum (Mo)	µg/L	0.1	0.2	0.2	0.19	0.11	0.21	0.13	-	-	-	-	7	0	0.19	0.1	0.21	
Nickel (Ni)	µg/L	0.5	2	0.7	0.12	< 0.05	0.05	0.11	< 0.5	< 0.5	< 0.5	< 0.5	11	5	0.31	< 0.05	2	
Selenium (Se)	µg/L	< 0.4	< 0.4	< 0.4	< 0.6	< 0.6	< 0.6	< 0.6	< 0.05	< 0.05	< 0.05	< 0.05	11	11	-	< 0.05	< 0.6	
Silver (Ag)	µg/L	0.0007	< 0.0005	< 0.0006	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	11	10	-	< 0.0006	< 0.1	
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	7	7	-	< 0.05	< 0.05	
Uranium (U)	µg/L	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	0.02	0.01	0.01	< 0.01	11	8	-	< 0.05	< 0.1	
Vanadium (V)	µg/L	0.2	< 0.1	4	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	7	5	-	< 0.05	4	
Zinc (Zn)	µg/L	5.0	< 2	6	3.9	2.7	2.3	6.7	64	< 1.0	6.4	6.7	11	2	5	0.5	64.2	

Notes:

Shaded and **Bolded** cells indicates an aquatic life guideline exceedance.

Shaded and *Italicized* cells indicates a drinking water guideline exceedance.

Table E4-2: Baseline Sediment Quality for the Waterbody Sites Within the ARSA

Parameter	Units	Grist Lake		Winefred Lake	
		17-Oct-12	28-Oct-16	17-Oct-12	28-Oct-16
Texture and Carbon Content					
Texture - Sand	%	70	81	68	71
Texture - Silt	%	28	14	28	19
Texture - Clay	%	2	5	4	10
Total Organic Carbon	% by wt	7	10	10	15
Hydrocarbons					
Benzene	mg/kg	* < 0.025	0.013	* < 0.025	0.02
Toluene	mg/kg	* < 0.15	0.076	* < 0.15	0.14
Ethylbenzene	mg/kg	* < 0.05	< 0.015	* < 0.05	< 0.015
Total Xylenes	mg/kg	* < 0.15	< 0.1	* < 0.15	< 0.1
F1 - VPH (C6-C10)	mg/kg	* < 25	< 10	* < 25	< 10
F1 - VPH (C6-C10) - BTEX	mg/kg	< 5.00	< 10	< 5.00	< 10
F2 - EPH (C10-C16)	mg/kg	< 30	< 110	< 30	< 160
F3 - EPH (C16-C34)	mg/kg	171	251	278	825
F4 - EPH (C34-C50)	mg/kg	33	1650	< 30	2330
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	µg/kg (ppb)	< 0.05	< 0.015	< 0.05	< 0.02
Acenaphthylene	µg/kg (ppb)	< 0.05	< 0.015	< 0.05	< 0.02
Anthracene	µg/kg (ppb)	< 0.0046	< 0.012	< 0.0046	< 0.016
Benzo(a)anthracene	µg/kg (ppb)	< 0.07	< 0.03	< 0.07	< 0.04
Benzo(a)pyrene	µg/kg (ppb)	< 0.05	< 0.03	< 0.05	< 0.04
Benzo(c)phenanthrene	µg/kg (ppb)	< 0.1	-	< 0.1	-
Benzo(g,h,i)perylene	µg/kg (ppb)	< 0.1	< 0.03	< 0.1	< 0.04
Benzo(k)fluoranthene	µg/kg (ppb)	< 0.05	< 0.03	< 0.05	< 0.04
Benzo[b+j]fluoranthene	µg/kg (ppb)	< 0.05	< 0.03	< 0.05	< 0.04
Chrysene	µg/kg (ppb)	< 0.05	< 0.03	< 0.05	< 0.04
Dibenzo(a,h)anthracene	µg/kg (ppb)	< 0.1	< 0.015	< 0.1	< 0.02
Dibenzo(a,h)pyrene	µg/kg (ppb)	< 0.1	-	< 0.1	-
Dibenzo(a,i)pyrene	µg/kg (ppb)	< 0.1	-	< 0.1	-
Dibenzo(a,l)pyrene	µg/kg (ppb)	< 0.1	-	< 0.1	-
7,12 Dimethyl benzanthracene	µg/kg (ppb)	< 0.1	-	< 0.1	-
Fluoranthene	µg/kg (ppb)	< 0.032	< 0.03	< 0.032	< 0.04
Fluorene	µg/kg (ppb)	< 0.05	< 0.03	< 0.05	< 0.04
Indeno(1,2,3-cd)pyrene	µg/kg (ppb)	< 0.1	< 0.03	< 0.1	< 0.04
2-Methylnaphthalene	µg/kg (ppb)	< 0.1	-	< 0.1	-
Naphthalene	µg/kg (ppb)	< 0.013	< 0.03	< 0.013	< 0.04
Phenanthrene	µg/kg (ppb)	< 0.046	< 0.03	< 0.046	< 0.04
Pyrene	µg/kg (ppb)	< 0.034	< 0.03	< 0.034	< 0.04

Parameter	Units	Grist Lake		Winefred Lake	
		17-Oct-12	28-Oct-16	17-Oct-12	28-Oct-16
Total Metals					
Antimony (Sb)	mg/kg	< 0.5	0.1	< 0.5	0.2
Aluminum (Al)	mg/kg	4320	-	5120	-
Arsenic (As)	mg/kg	4	4.3	4	6.9
Barium (Ba)	mg/kg	65	81	76	249
Beryllium (Be)	mg/kg	0.2	0.3	0.3	0.5
Cadmium (Cd)	mg/kg	< 0.2	0.22	< 0.2	0.46
Calcium (Ca)	mg/kg	8960	-	7000	-
Chromium (Cr)	mg/kg	8	11	10	21
Cobalt (Co)	mg/kg	4	4	6	8
Copper (Cu)	mg/kg	7	9	7	16
Iron (Fe)	mg/kg	9430	-	28300	-
Lead (Pb)	mg/kg	4	6	8	11
Magnesium (Mg)	mg/kg	3880	-	3230	-
Manganese (Mn)	mg/kg	160	-	394	-
Mercury (Hg)	mg/kg	< 0.2	0.05	< 0.2	0.05
Molybdenum (Mo)	mg/kg	< 0.5	0.5	0.5	0.6
Nickel (Ni)	mg/kg	10.4	12	10.6	22
Phosphorus (P)	mg/kg	457	-	864	-
Potassium (K)	mg/kg	818	-	902	-
Selenium (Se)	mg/kg	< 0.5	0.5	< 0.5	0.8
Silver (Ag)	mg/kg	211	<0.1	166	<0.1
Sodium (Na)	mg/kg	< 0.1	-	< 0.1	-
Thallium (Tl)	mg/kg	< 0.5	0.08	< 0.5	0.2
Tin (Sn)	mg/kg	< 0.5	<2.0	0.6	<2.0
Uranium	mg/kg	11	0.5	14.7	0.9
Vanadium	mg/kg	< 15.0	17	< 15.0	32
Zinc (Zn)	mg/kg	28	44	46	75

Notes:

Shaded and Bolded cells indicates an aquatic life guideline exceedance.

* indicates that the MDL is higher than the guideline value and therefore an exceedance is unknown.

Table E4-3: Baseline Water Quality for Grist Lake

Parameter	Units	Grist Lake								n	Number below detection	Median	Min	Max
		27-May-12	17-Aug-12	18-Oct-12	9-Mar-13	25-May-16	9-Aug-16	28-Oct-16	7-Mar-17					
Field Measured														
Temperature	°C	9.7	19.4	8.3	0.6	10.8	19.9	5.7	-	7	0	9.7	0.6	19.9
pH	pH units	8.4	8.8	8.0	8.0	8.4	8.2	8.2	-	7	0	8.2	8.0	8.8
Specific Conductivity	µS/cm	221	221	208	142	208	210	186	-	7	0	208	142	221
Dissolved Oxygen (DO)	mg/L	11.7	-	8.8	6.0	10.9	8.9	8.2	-	6	0	8.8	6.0	11.7
Conventional Parameters and Major Ions														
pH	pH Units	8.37	8.41	8.1	8.06	8.1	8.2	8.0	8.1	8	0	8.1	8.0	8.4
Specific Conductivity	µS/cm	235	226	222	229	224	219	220	239	8	0	225	219	239
Total Dissolved Solids (TDS)	mg/L	144	144	124	116	111	112	126	136	8	0	125	111	144
Total Suspended Solids (TSS)	mg/L	< 2	3	2	< 2	<3.0	<3.0	<3.0	-	7	5	-	<2	3
Turbidity	NTU	0.9	1.3	1.5	0.9	-	-	-	-	4	0	1.1	0.9	1.5
Hardness	mg/L	107	123	119	126	109	109	110	117	8	0	114	107	126
Alkalinity	mg/L	128	121	126	123	111	113	117	127	8	0	122	111	128
Calcium	mg/L	29	34	32	34	29	30	30	32	8	0	31	29	34
Magnesium	mg/L	8.7	9.5	9.5	10	8.7	8.3	8.7	9.1	8	0	9	8.3	10
Potassium	mg/L	0.8	0.8	0.9	1.1	0.9	0.8	0.8	0.9	8	0	0.9	0.8	1.1
Sodium	mg/L	4.7	4.4	4.4	4.7	4.1	4.0	4.1	4.3	8	0	4.4	4.0	4.7
Bicarbonate	mg/L	153	148	154	150	136	137	143	155	8	0	149	136	155
Carbonate	mg/L	2	< 1	< 1	< 1	<5.0	<5.0	<5.0	<5.0	8	7	-	<1	2
Chloride	mg/L	0.7	0.4	0.5	0.5	<0.5	<0.5	<0.5	<0.5	8	4	0.5	0.4	0.7
Sulphate	mg/L	1.4	< 0.5	1.5	1.9	1.0	1.1	1.1	1.4	8	1	1.3	<0.5	1.9
Nutrients and Organics														
Ammonia-Nitrogen	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.05	<0.05	<0.05	<0.05	8	8	-	<0.02	9
Nitrate-Nitrogen	mg/L	< 0.05	< 0.05	< 0.05	0.05	<0.02	<0.02	<0.02	0.06	8	6	-	<0.02	6
Nitrite-Nitrogen	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	<0.01	<0.01	<0.01	<0.01	8	8	-	<0.01	7
Total Kjeldahl Nitrogen	mg/L	0.3	0.2	0.4	0.2	0.3	0.5	<0.2	0.2	8	1	0.25	<0.2	0.81
Total Phosphorus	mg/L	< 0.02	0.01	0.01	0.02	-	-	<0.02	-	5	2	-	<0.02	0.02
Biochemical Oxygen Demand	mg/L	2	2	2	2	<2.0	<2.0	<2.0	<2.0	8	4	2	<2.0	6
Total Organic Carbon	mg/L	8.2	8.6	22.5	8.3	9.3	11	9.5	10	8	0	9	8	32
Phenol (Total)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.001	<0.001	<0.001	<0.001	8	8	-	<0.001	< 0.002
Naphthenic Acids	mg/L	0.1	0.1	0.1	0.1	-	-	-	0.1	5	0	0.1	0.1	0.13
Hydrocarbons														
Benzene	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	8	8	-	<0.0005	< 0.001
Toluene	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	8	8	-	<0.0005	< 0.001
Ethylbenzene	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	<0.0005	<0.0005	<0.0005	<0.0005	8	8	-	<0.0005	< 0.001
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	<0.00071	<0.00071	<0.00071	<0.00071	8	8	-	<0.00071	< 0.003
VH (C6-C10)	mg/L	< 0.050	< 0.050	< 0.050	< 0.050	<0.10	<0.10	<0.10	<0.10	8	8	-	< 0.050	<0.10
F1 - VPH (C6-C10)	mg/L	< 0.050	< 0.050	< 0.050	< 0.050	<0.10	<0.10	<0.10	<0.10	8	8	-	< 0.050	<0.10
F2 - EPH (C10-C16)	mg/L	< 0.030	< 0.030	< 0.030	< 0.030	<0.10	<0.10	<0.10	<0.10	8	8	-	< 0.030	<0.10
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.01	<0.02
Acenaphthylene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.01	<0.02
Acridine	µg/L	< 0.07	< 0.07	< 0.07	< 0.07	-	-	-	-	4	4	-	< 0.07	< 0.07
Anthracene	µg/L	< 0.007	< 0.007	< 0.007	< 0.007	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.007	<0.01
Benz[a]anthracene	µg/L	< 0.006	< 0.006	< 0.006	< 0.006	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.006	<0.01
Benzo[a]pyrene	µg/L	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	<0.005	<0.005	<0.005	8	8	-	< 0.005	< 0.005
Benzo[b]fluoranthene	µg/L	< 0.08	< 0.08	< 0.08	< 0.08	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.08	<0.01
Benzo[g,h,i]perylene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.02	<0.02
Benzo[k]fluoranthene	µg/L	< 0.08	< 0.08	< 0.08	< 0.08	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.08	<0.01
Chrysene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.01	<0.02
Dibenz[a,h]anthracene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.005	<0.005	<0.005	<0.005	8	8	-	< 0.02	<0.005
Fluoranthene	µg/L	< 0.04	< 0.04	< 0.04	< 0.04	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.02	< 0.04
Fluorene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.02	<0.02	<0.02	<0.02	8	8	-	< 0.02	< 0.02
Indeno[1,2,3,-cd]pyrene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.01	< 0.02
Naphthalene	µg/L	< 0.07	< 0.07	< 0.07	< 0.07	<0.05	<0.05	<0.05	<0.05	8	8	-	< 0.05	< 0.07
Phenanthrene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	<0.05	<0.05	<0.05	<0.05	8	8	-	< 0.01	<0.05
Pyrene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.01	< 0.02
Quinoline	µg/L	< 0.06	< 0.06	< 0.06	< 0.06	-	-	-	-	4	4	-	< 0.06	< 0.06

Parameter	Units	Grist Lake								n	Number below detection	Median	Min	Max
		27-May-12	17-Aug-12	18-Oct-12	9-Mar-13	25-May-16	9-Aug-16	28-Oct-16	7-Mar-17					
Total Metals														
Aluminum (Al)	µg/L	27	< 2	12	12	5	11	13	4	8	1	11	<2	27
Antimony (Sb)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0.1	<0.1	<0.1	8	8	-	<0.05	<0.1
Arsenic (As)	µg/L	0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.6	8	0	0.6	0.5	0.6
Barium (Ba)	µg/L	28	26	27.7	27.2	27	28	29	34	8	0	28	26	34
Beryllium (Be)	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	4	4	-	<0.1	<0.1
Boron (B)	µg/L	16	15	16	11	16	16	16	17	8	0	16	11	17
Cadmium (Cd)	µg/L	< 0.015	0.04	0.21	0.02	<0.005	<0.005	0.006	0.01	8	3	0.023	<0.005	0.212
Chromium (Cr)	µg/L	< 0.3	< 0.3	< 0.3	< 0.3	0.1	0.3	0.2	<0.1	8	5	0.22	<0.3	0.25
Cobalt (Co)	µg/L	< 0.02	0.05	0.03	0.03	-	-	-	-	4	1	0.03	<0.02	0.05
Copper (Cu)	µg/L	0.5	0.3	0.7	1.3	<0.5	<0.5	<0.5	<0.5	8	4	0.6	<0.5	1.3
Iron (Fe)	µg/L	20	13	29	25	18	18	67	<10	8	1	19	<10	67
Lead (Pb)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	0.09	<0.05	0.07	8	6	-	<0.05	0.088
Manganese (Mn)	µg/L	<10	10	10	4	10	10	28	4	8	1	10	<10	28
Mercury (Hg)	µg/L	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	<0.005	<0.005	<0.005	8	8	-	<0.005	<0.005
Molybdenum (Mo)	µg/L	0.24	0.2	0.22	0.27	-	-	-	-	4	0	0.23	0.2	0.27
Nickel (Ni)	µg/L	0.15	< 0.05	0.15	0.25	<0.5	<0.5	<0.5	<0.5	8	5	0.15	<0.5	0.25
Selenium (Se)	µg/L	< 0.6	< 0.6	< 0.6	< 0.6	<0.05	<0.05	<0.05	<0.05	8	8	-	<0.05	<0.6
Silver (Ag)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	<0.01	<0.01	<0.01	8	8	-	<0.01	<0.05
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	4	4	-	< 0.05	< 0.05
Uranium (U)	µg/L	< 0.05	0.08	0.08	< 0.05	0.05	0.06	0.05	0.04	8	2	0.05	<0.05	<0.1
Vanadium (V)	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	4	4	-	<0.1	<0.1
Zinc (Zn)	µg/L	< 0.5	< 0.5	2	3	<3	<3.0	5	6	8	4	4	<3.0	6
Dissolved Metals														
Aluminum (Al)	µg/L	27	< 2	< 2	< 2	1.4	6	<1.0	<1.0	8	5	6	<2	27
Antimony (Sb)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0.1	<0.1	<0.1	8	8	-	<0.05	<0.1
Arsenic (As)	µg/L	0.6	0.5	0.6	0.6	0.4	0.7	0.6	0.6	8	0	0.6	0.39	0.74
Barium (Ba)	µg/L	28	30	22	26	28	28	30	31	8	0	28	22	31
Boron (B)	µg/L	18	15	16	10	15	25	15	18	4	4	-	<0.1	<0.1
Beryllium (Be)	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-	8	0	16	10	25
Cadmium (Cd)	µg/L	< 0.015	< 0.015	0.028	0.016	0.006	<0.005	<0.005	0.007	8	4	0.01	<0.005	0.03
Chromium (Cr)	µg/L	< 0.3	< 0.3	0.4	0.7	0.1	<0.1	<0.1	<0.1	8	5	0.4	<0.1	0.7
Cobalt (Co)	µg/L	0.02	< 0.02	< 0.02	< 0.02	-	-	-	-	4	3	-	<0.02	0.02
Copper (Cu)	µg/L	0.7	0.3	< 0.1	1.7	0.3	0.3	0.5	0.7	8	1	0.4	<0.1	1.7
Iron (Fe)	µg/L	20	1.9	10	2.9	<10	<10	<10	<10	8	4	6	<10	20
Lead (Pb)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	8	8	-	<0.05	<0.05
Manganese (Mn)	µg/L	<10	0.53	1.12	< 0.05	6.9	2.2	0.6	0.6	8	2	0.9	<0.05	<10
Mercury (Hg)	µg/L	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	<0.005	<0.005	<0.005	8	8	-	< 0.005	< 0.005
Molybdenum (Mo)	µg/L	0.25	0.28	0.11	0.26	-	-	-	-	4	0	0.26	0.11	0.28
Nickel (Ni)	µg/L	0.16	0.12	< 0.05	0.18	<0.5	<0.5	<0.5	<0.5	8	5	0.16	<0.05	0.18
Selenium (Se)	µg/L	< 0.6	< 0.6	< 0.6	< 0.6	<0.05	<0.05	<0.05	0.06	8	7	-	<0.05	<0.6
Silver (Ag)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	<0.01	<0.01	<0.01	8	8	-	< 0.05	<0.01
Thallium (Tl)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	4	4	-	< 0.05	< 0.05
Uranium (U)	µg/L	0.05	0.05	< 0.05	< 0.05	0.06	0.06	0.04	0.05	8	2	0.05	<0.05	0.057
Vanadium (V)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-	4	4	-	< 0.05	< 0.05
Zinc (Zn)	µg/L	2	3	2	4	3	<1.0	6	4	8	1	3	<1.0	6

Notes:
Shaded and **Bolded** cells indicates an aquatic life guideline exceedance.
Shaded and *Italicized* cells indicates a drinking water guideline exceedance.

Appendix E5

***Lake Acidification Assessment Results
(Air Quality Regional Study Area)***

Table E5-1: Acid Sensitivity Rating Results Based on Saffran and Trew (1996)

Receptor	Lake Identifier	Study Area	Easting	Northing	Total Alkalinity (mg/L CaCO ₃)	pH (pH Units)	Calcium (mg/L)	Overall Sensitivity Rating
A503	Torch Lake	ALSA	523344	6133473	107	8.1	28	Least
A504	Unnamed Lake (UNL-01)	ALSA	517026	6132147	118	8.3	32	Least
A221	Unnamed Lake	ALSA	525364	6133813	108	8.3	30	Least
A384	Winefred Lake	ARSA	524059	6148850	102	8.1	26	Least
A103	Grist Lake	ARSA	533790	6137579	117	8.2	30	Least
A220	Unnamed Lake	ARSA	544256	6146946	77	8.9	21	Least
A029	354 (94)	AQRSA	515689	6179207	17	7.2	5.1	Moderate
A065	Behan Lake	AQRSA	465073	6127386	58	8.2	15	Least
A078	Christina Lake	AQRSA	510497	6163430	98	8.1	25	Least
A081	Clyde Lake	AQRSA	470371	6128275	68	7.9	18	Least
A106	Heart Lake	AQRSA	468042	6098615	157	8.9	32	Least
A113	Kirby Lake	AQRSA	514752	6146748	125	8.1	31	Least
A115	Logan Lake	AQRSA	476594	6104126	147	9.2	33	Least
A212	Unnamed Lake	AQRSA	533413	6186732	58	7.9	15	Least
A214	Unnamed Lake	AQRSA	516749	6175506	29	7.8	8.0	Low
A215	Unnamed Lake	AQRSA	528843	6167222	45	7.8	12	Least
A216	Unnamed Lake	AQRSA	502623	6165273	60	7.9	20	Least
A217	Unnamed Lake	AQRSA	547077	6178511	82	8.1	22	Least
A218	Unnamed Lake	AQRSA	548174	6173885	73	8.3	20	Least
A219	Unnamed Lake	AQRSA	558659	6173086	49	7.9	13	Least
A224	Unnamed Lake	AQRSA	464181	6147797	42	8.3	11	Least
A225	Unnamed Lake	AQRSA	475749	6144008	52	7.7	14	Least
A226	Unnamed Lake	AQRSA	492608	6137456	64	8.0	17	Least
A227	Unnamed Lake	AQRSA	468315	6136636	30	7.6	7.6	Low
A230	Unnamed Lake	AQRSA	475611	6118969	66	8.7	17	Least
A235	Unnamed Lake	AQRSA	470754	6106015	162	8.5	39	Least
A383	Wiau Lake	AQRSA	480473	6139348	77	8.3	21	Least
A426	Ipiatik Lake	AQRSA	496692	6127900	67	7.5	17	Low
A431	Primrose Lake	AQRSA	574117	6085253	116	8.0	29	Least
A432	Hay Lake	AQRSA	510861	6149793	105	8.2	28	Least
A433	WB-24	AQRSA	506918	6172334	43	7.6	12	Least
A435	WB-25	AQRSA	501381	6170358	11	6.9	2.5	Moderate
A437	WB-5	AQRSA	515893	6162017	86	8.1	21	Least
A438	WB-6	AQRSA	515917	6160163	54	7.8	14	Least
A439	WB 13-04	AQRSA	523259	6162407	101	9.0	26	Least
A440	WB-07	AQRSA	517042	6155814	54	7.9	14	Least
A441	WB-30	AQRSA	509259	6168749	124	7.9	30	Least
A442	WB-2-07	AQRSA	520503	6172431	61	7.8	16	Least
A443	L-09	AQRSA	492552	6176383	2.5	5.5	3.5	High
A444	L-08	AQRSA	493455	6176261	9.0	6.7	3.0	High
A445	L-01	AQRSA	500276	6175212	80	7.9	22	Least
A446	L-02	AQRSA	498991	6173407	95	7.8	23	Least
A447	L-07	AQRSA	495650	6171724	42	7.2	11	Low
A448	L-06	AQRSA	495503	6170627	34	7.4	11	Low
A449	L2	AQRSA	501144	6156321	95	7.8	23	Least
A450	L3	AQRSA	502011	6156321	22	7.2	7.0	Low
A451	SW4	AQRSA	508517	6151937	98	7.7	25	Least
A453	UN2	AQRSA	498407	6153166	216	7.6	56	Least
A454	UP1	AQRSA	498279	6151635	27	8.0	9.4	Low
A455	WB1	AQRSA	508918	6159230	136	8.1	29	Least
A456	WB11	AQRSA	505562	6155040	87	8.2	22	Least

Receptor	Lake Identifier	Study Area	Easting	Northing	Total Alkalinity (mg/L CaCO ₃)	pH (pH Units)	Calcium (mg/L)	Overall Sensitivity Rating
A458	WB12	AQRSA	500749	6158370	51	7.9	14	Least
A459	WB3	AQRSA	512482	6159120	35	7.8	9.0	Low
A460	WB4	AQRSA	513679	6160690	57	7.7	18	Least
A461	WB8	AQRSA	516150	6152620	67	8.0	19	Least
A462	WB9	AQRSA	518934	6149190	92	8.2	25	Least
A463	WQ1 (SW2a)	AQRSA	507795	6150817	106	7.9	26	Least
A486	WB 3-07	AQRSA	509795	6169983	36	7.6	9.0	Low
A487	WB 4-07	AQRSA	527280	6170976	39	7.8	12	Low
A490	WB 7-04	AQRSA	515450	6170023	32	7.6	8.0	Low
A491	WB 5-04	AQRSA	513525	6175472	24	7.5	7.0	Low
A492	WB 8-04	AQRSA	514431	6168793	64	8.0	18	Least
A493	WB 9-04	AQRSA	515711	6168936	62	7.9	17	Least
A494	WB 11-04	AQRSA	522016	6168496	50	8.0	14	Least
A495	WB 16-04	AQRSA	509779	6174077	76	8.0	20	Least
A496	WB 15-04	AQRSA	513212	6167678	31	6.8	11	Low
A498	WB 29	AQRSA	508500	6170350	42	7.7	11	Least
A500	Canoe Lake	AQRSA	539059	6090511	162	9.3	28	Least

Note: Legend for Acid Sensitivity Ratings (Saffran and Trew, 1996)

Parameter	Unit	High	Moderate	Low	Least
Alkalinity	mg/L	0 - 10	11 - 20	21 - 40	> 40
pH	pH Unit	0 - 6.5	6.6 - 7.0	7.1 - 7.5	> 7.5
Calcium	mg/L	0 - 4	5 - 8	9 - 25	> 25

Table E5-2: Calculated Critical Loads and Predicted Acid Deposition in the ALSA, ARSA, and AQRSA (keq H⁺/ha/yr)

Receptor	Lake Identifier	Study Area	Critical Load [CL] (keq H ⁺ / ha / yr)	Baseline	Application	PDC
				PAI-CL	PAI-CL	PAI-CL
A503	Torch Lake	ALSA	1.62	1.06	1.03	1.03
A504	Unnamed Lake (UNL-01)	ALSA	1.60	1.38	1.37	1.37
A221	Unnamed Lake	ALSA	1.69	1.28	1.26	1.26
A384	Winefred Lake	ARSA	1.50	1.37	1.36	1.36
A103	Grist Lake	ARSA	1.74	1.60	1.59	1.59
A220	Unnamed Lake	ARSA	1.24	1.08	1.08	1.08
A029	354 (94)	AQRSA	0.31	0.12	0.12	0.11
A065	Behan Lake	AQRSA	0.95	0.86	0.86	0.86
A078	Christina Lake	AQRSA	1.59	1.34	1.34	1.33
A081	Clyde Lake	AQRSA	1.13	1.03	1.03	1.03
A106	Heart Lake	AQRSA	2.60	2.53	2.53	2.52
A113	Kirby Lake	AQRSA	1.86	1.59	1.59	1.58
A115	Logan Lake	AQRSA	2.42	2.34	2.34	2.34
A212	Unnamed Lake	AQRSA	0.96	0.83	0.83	0.83
A214	Unnamed Lake	AQRSA	0.48	0.27	0.27	0.27
A215	Unnamed Lake	AQRSA	0.68	0.47	0.47	0.47
A216	Unnamed Lake	AQRSA	1.19	0.97	0.97	0.96
A217	Unnamed Lake	AQRSA	1.39	1.26	1.26	1.26
A218	Unnamed Lake	AQRSA	1.19	1.06	1.06	1.06
A219	Unnamed Lake	AQRSA	0.77	0.66	0.66	0.65
A224	Unnamed Lake	AQRSA	0.65	0.57	0.57	0.57
A225	Unnamed Lake	AQRSA	0.88	0.77	0.77	0.77
A226	Unnamed Lake	AQRSA	1.04	0.90	0.90	0.90
A227	Unnamed Lake	AQRSA	0.52	0.42	0.42	0.42
A230	Unnamed Lake	AQRSA	1.08	0.97	0.97	0.97
A235	Unnamed Lake	AQRSA	2.70	2.61	2.61	2.61
A383	Wiau Lake	AQRSA	1.24	1.13	1.13	1.13
A426	Ipiatik Lake	AQRSA	0.97	0.83	0.83	0.83
A431	Primrose Lake	AQRSA	1.77	1.70	1.70	1.69
A432	Hay Lake	AQRSA	1.66	1.43	1.43	1.42
A433	WB-24	AQRSA	0.68	0.45	0.45	0.44
A435	WB-25	AQRSA	0.19	-0.02	-0.02	-0.03
A437	WB-5	AQRSA	1.38	1.13	1.13	1.12
A438	WB-6	AQRSA	0.88	0.63	0.63	0.62
A439	WB 13-04	AQRSA	1.61	1.35	1.35	1.35
A440	WB-07	AQRSA	0.85	0.61	0.61	0.60
A441	WB-30	AQRSA	2.02	1.72	1.72	1.71
A442	WB-2-07	AQRSA	0.90	0.65	0.65	0.64
A443	L-09	AQRSA	0.20	0.05	0.05	0.04
A444	L-08	AQRSA	0.18	0.03	0.03	0.02
A445	L-01	AQRSA	1.32	1.13	1.13	1.12
A446	L-02	AQRSA	1.57	1.39	1.39	1.38
A447	L-07	AQRSA	0.66	0.49	0.49	0.48
A448	L-06	AQRSA	0.67	0.49	0.49	0.48
A449	L2	AQRSA	1.57	1.36	1.36	1.35
A450	L3	AQRSA	0.44	0.22	0.22	0.21
A451	SW4	AQRSA	1.58	1.27	1.27	1.26
A453	UN2	AQRSA	3.15	2.94	2.94	2.93
A454	UP1	AQRSA	0.52	0.33	0.33	0.32
A455	WB1	AQRSA	2.11	1.70	1.70	1.69
A456	WB11	AQRSA	1.38	1.13	1.12	1.11
A458	WB12	AQRSA	0.85	0.64	0.64	0.63
A459	WB3	AQRSA	0.55	0.25	0.25	0.24
A460	WB4	AQRSA	1.10	0.84	0.84	0.83

Receptor	Lake Identifier	Study Area	Critical Load [CL] (keq H+ / ha / yr)	Baseline	Application	PDC
				PAI-CL	PAI-CL	PAI-CL
A461	WB8	AQRSA	1.10	0.86	0.86	0.85
A462	WB9	AQRSA	1.42	1.15	1.15	1.15
A463	WQ1 (SW2a)	AQRSA	1.60	1.36	1.36	1.35
A486	WB 3-07	AQRSA	0.55	0.29	0.29	0.28
A487	WB 4-07	AQRSA	0.65	0.46	0.46	0.45
A490	WB 7-04	AQRSA	0.56	0.29	0.29	0.28
A491	WB 5-04	AQRSA	0.37	0.16	0.16	0.15
A492	WB 8-04	AQRSA	1.09	0.84	0.84	0.83
A493	WB 9-04	AQRSA	1.02	0.73	0.73	0.73
A494	WB 11-04	AQRSA	0.82	0.51	0.51	0.50
A495	WB 16-04	AQRSA	1.19	0.94	0.94	0.93
A496	WB 15-04	AQRSA	0.56	0.31	0.31	0.30
A498	WB 29	AQRSA	0.68	0.43	0.43	0.42
A500	Canoe Lake	AQRSA	2.72	2.57	2.57	2.57

Note:

Bolded and shaded values indicate conditions where predicted acid deposition is greater than the calculated critical loads.