
Appendices

Appendix A

Hydrogeologic Details

- Groundwater Elevations – Table A-1
 - Groundwater Hydrographs – Figures A-1 to A-15
 - Residential Groundwater Levels – Table A-2
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**TABLE A-1
GROUNDWATER ELEVATIONS
CODRINGTON PIT**

	BH05-2	BH05-18	BH05-19	BH05-20	BH06-1	BH12-1	BH12-2	CFRC- Well2	CFRC- Well3	CFRC- Well4
Measuring Point	185.72	191.53	185.43	183.59	183.41	204.62	206.39	ND	ND	ND
Ground Elevation	184.78	190.96	184.98	182.81	182.61	203.93	205.47	ND	ND	ND
07-Oct-05	173.87	166.76	159.52	DRY						
20-Oct-05	173.87	166.74	159.53	DRY						
26-Oct-05	173.84	166.69	159.49	DRY						
31-Jan-06	173.60	166.53	159.45	182.04						
23-Mar-06	173.95	166.49	159.38	182.39						
30-Mar-06	173.96	166.52	159.41	182.36	174.77					
21-Apr-06	174.03	166.60	159.44	182.23	174.86					
04-Dec-06	174.04	166.74	159.39	182.54	174.93					
09-Apr-07	174.31	167.03	159.58	182.54	175.13					
09-May-08	174.74	166.78	159.82	182.71	175.62					
24-Mar-10	173.71	166.47			174.67					
18-Aug-11	174.55	167.03			175.12					
16-Nov-12	173.44	166.53	159.74	179.86	174.14					
23-Nov-12						153.52	173.09			
07-Dec-12	173.41	166.54	159.71	178.97	174.10	153.64*	172.74			
11-Apr-13	173.76	167.07	159.40	Ponded	174.53	152.82	173.38	Flowing	1.4	1.94
04-Jul-13	174.21	167.00	159.54	182.54	175.03	152.9	173.90	Flowing	1.4	1.95
19-Sep-13	174.00	166.72	159.62	179.17	174.76	153.42*	173.97	Flowing	1.52	2.06
18-Oct-13							173.87			
04-Dec-13	Damaged	166.79	159.56	181.58	174.40	153.34*	173.69	Flowing	1.55	2.07
15-Apr-14	173.55	166.97	159.4	Ponded	174.57	155.34	173.33	Flowing	1.26	1.82
17-Jun-14	174.56	167.09	159.61	182.82	175.47	152.62	174.20			
15-Sep-14	174.30	166.95	159.82	181.72	175.14	155.21	173.36			
17-Sep-14								Flowing	1.46	1.97
04-Dec-14	173.93	166.76	159.79	181.76	174.73	154.86	174.02			
31-Mar-15	173.67	166.58	159.8	182.53	174.33	154.39	173.87			
01-Apr-15								Flowing	1.50	2.03
03-Jun-15	173.84	166.62	159.89	181.81	174.64	152.86	173.63			
21-Sep-15	173.52	166.51	159.62	180.41	174.28	152.84	173.46	Flowing	1.55	2.07
08-Nov-15	173.41	166.45	159.51	181.97	174.10	152.78	173.33			
11-Dec-15	173.30	166.43	159.48	181.88	174.03	152.87	173.24			

NOTES:

- 1) "m asl" indicates metres above sea level.
- 2) "*" denotes water level based on pressure transducer owing to manual measurement interference by bentonite on well pipe sides.
- 3) CFRC indicates Codrington Fish Research Centre. No elevation survey of wells, thus depths below top of casing are provided.
- 4) Blank indicates water level not measured.

**FIGURE A-1
GROUNDWATER ELEVATIONS**

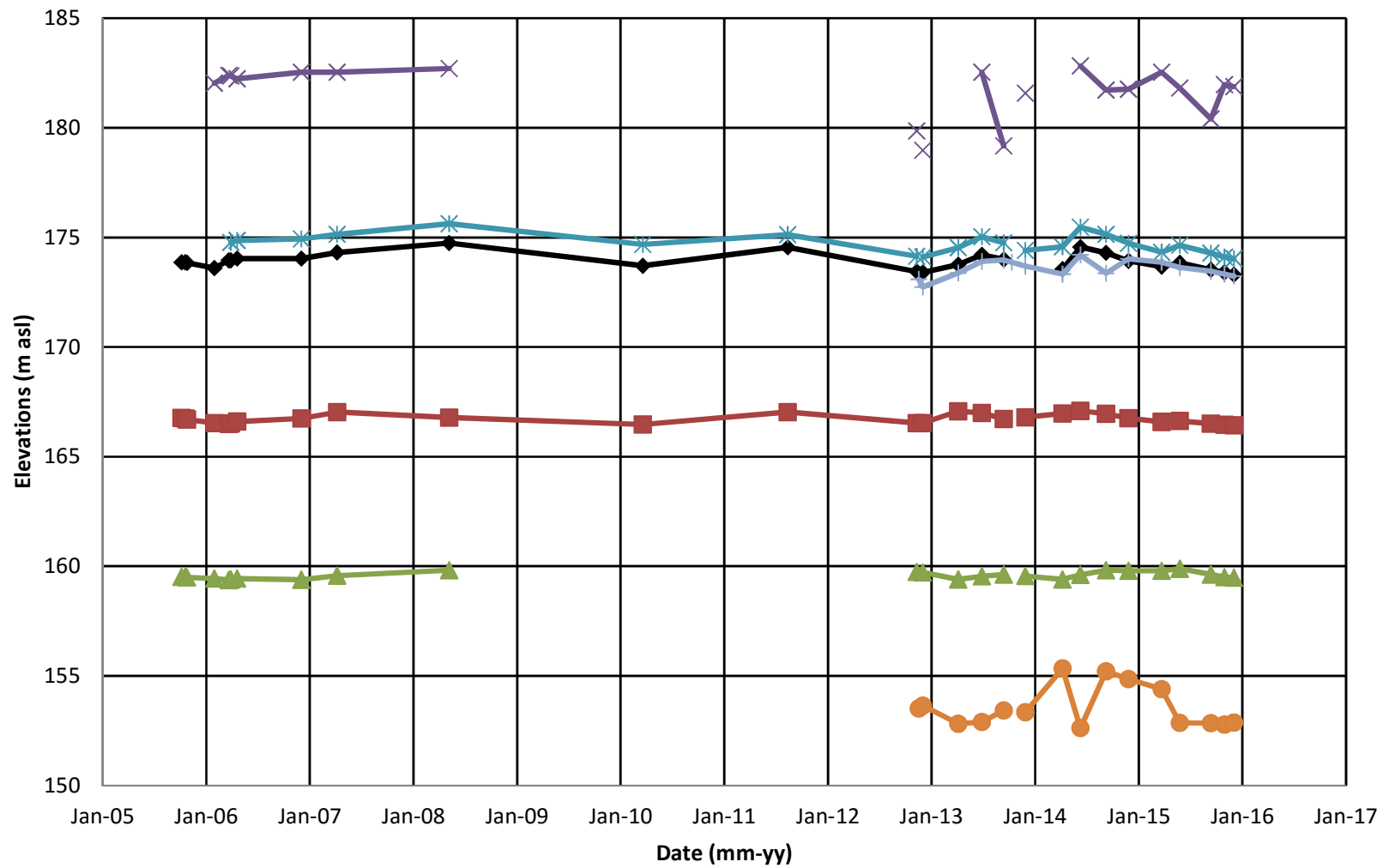


Figure A-2
BH05-2: Groundwater Elevation

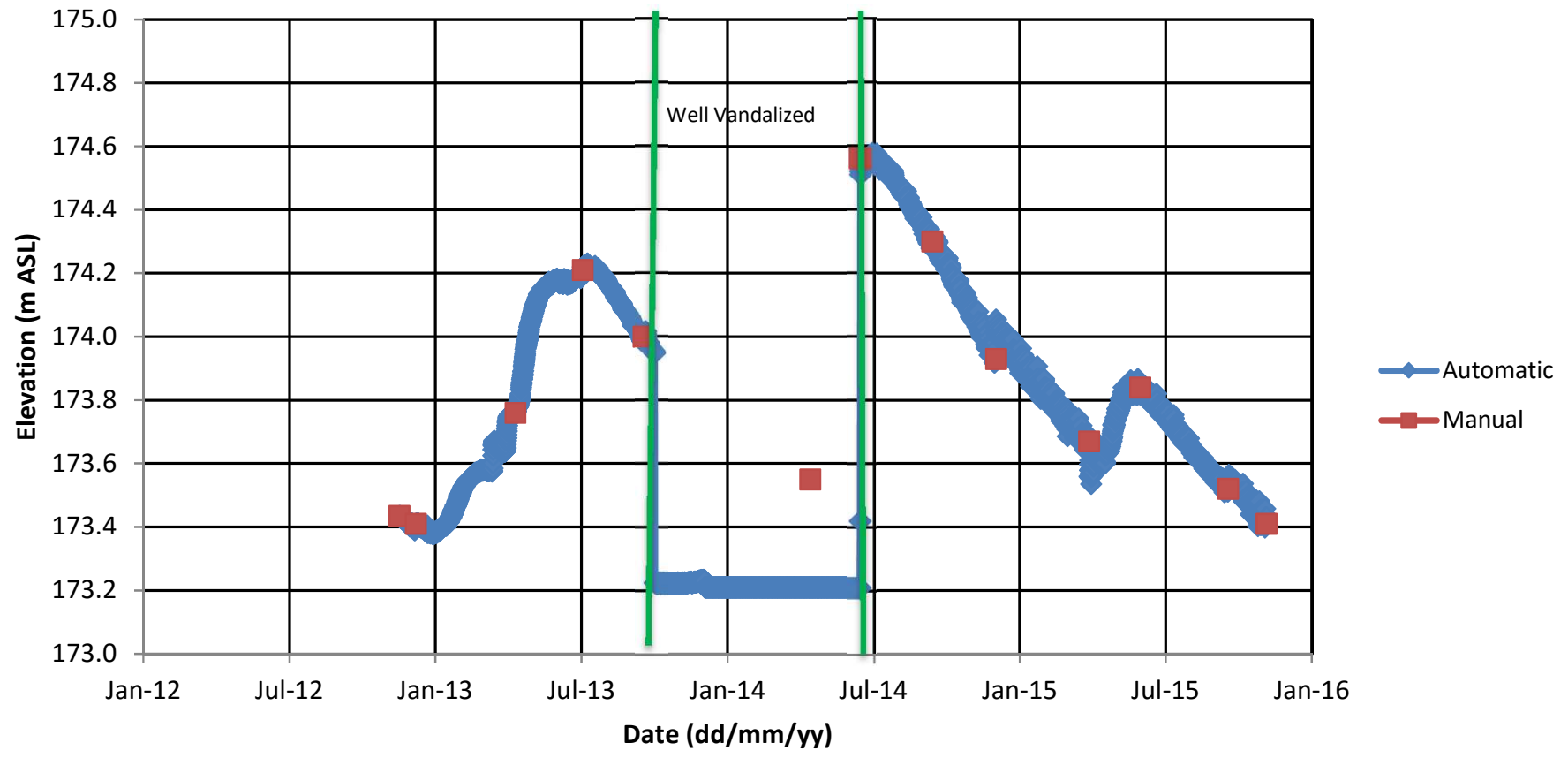


Figure A-3
BH05-2: Groundwater Temperature

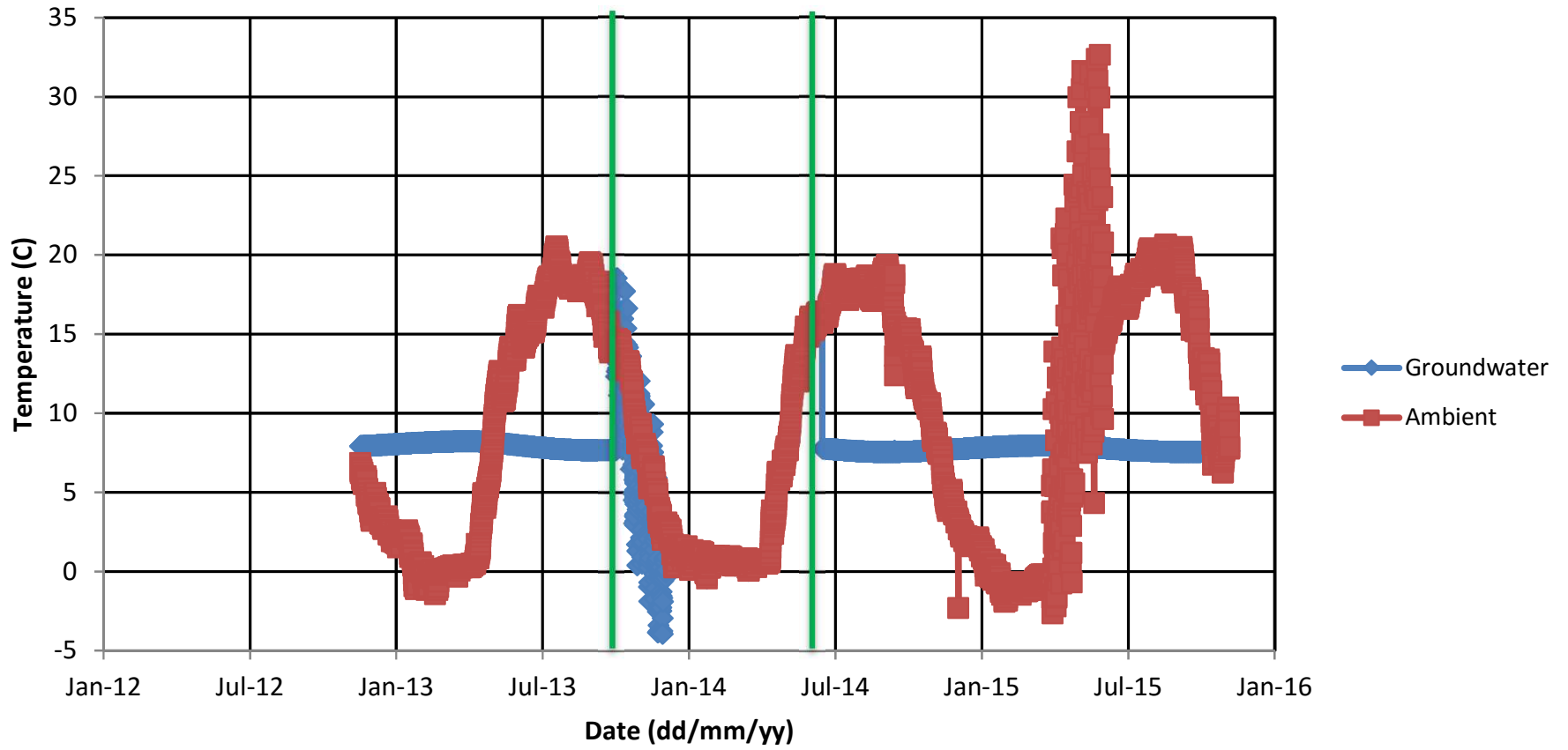


Figure A-4
BH05-18: Groundwater Elevation

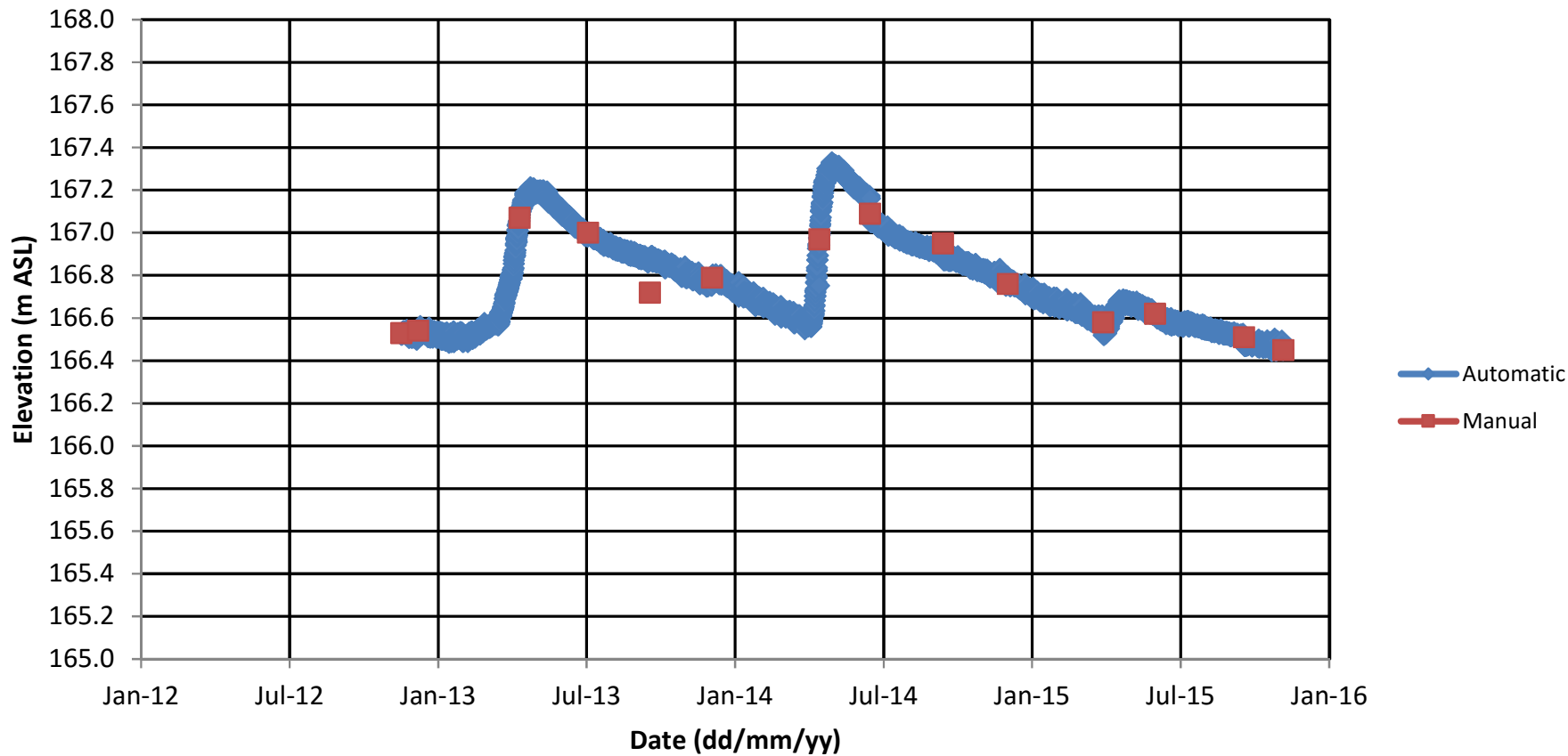


Figure A-5
BH05-18: Groundwater Temperature

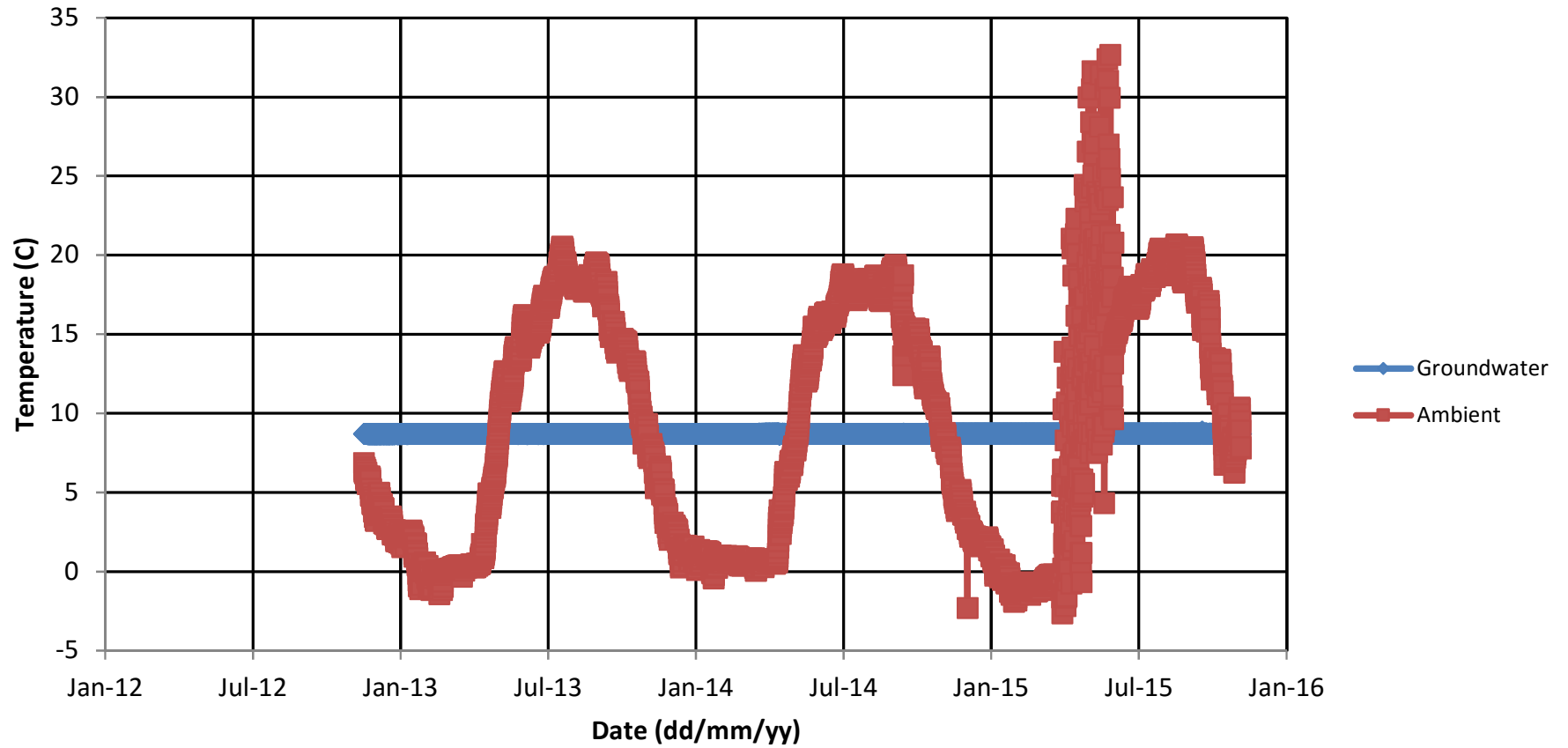


Figure A-6
BH05-19: Groundwater Elevation

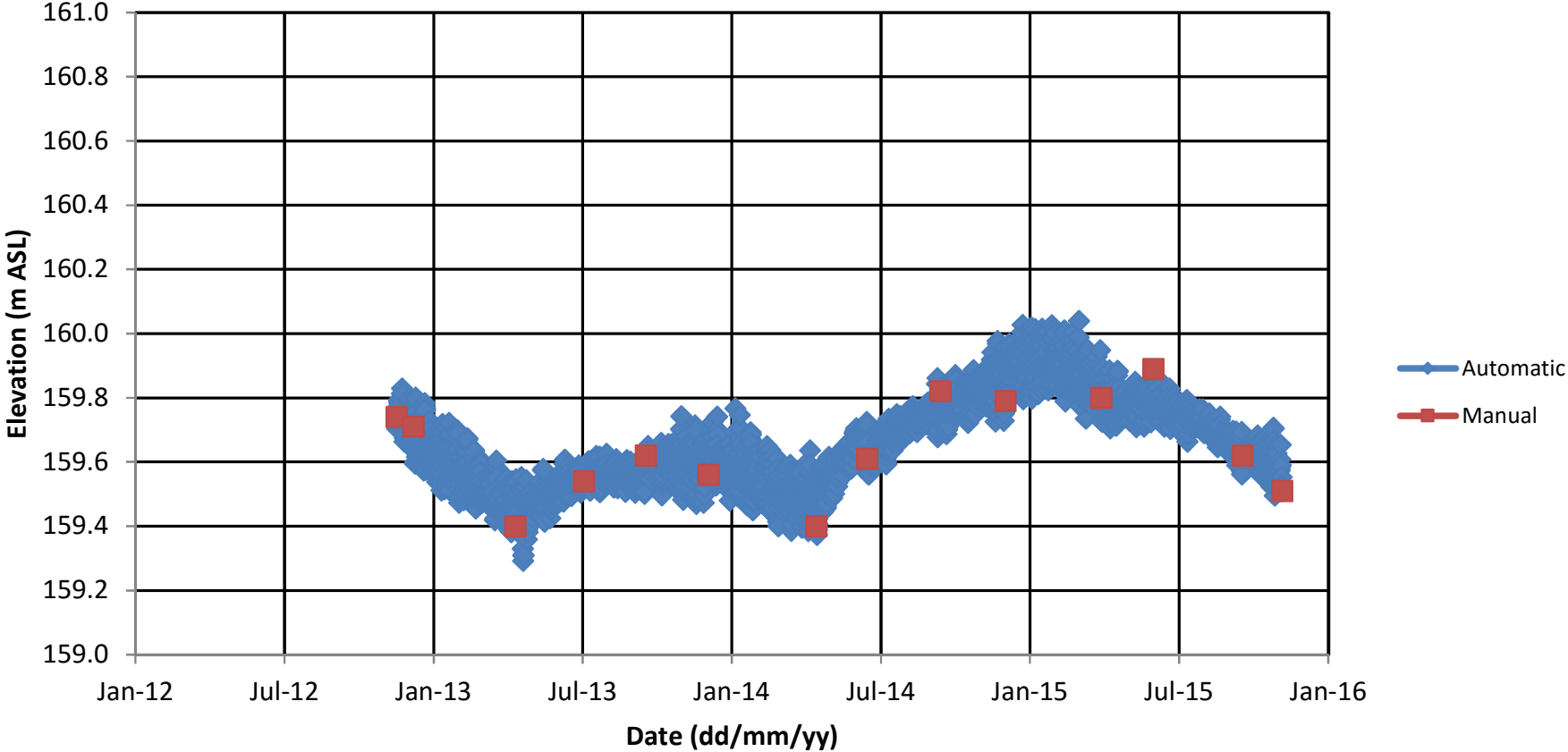


Figure A-7
BH05-19: Groundwater Temperature

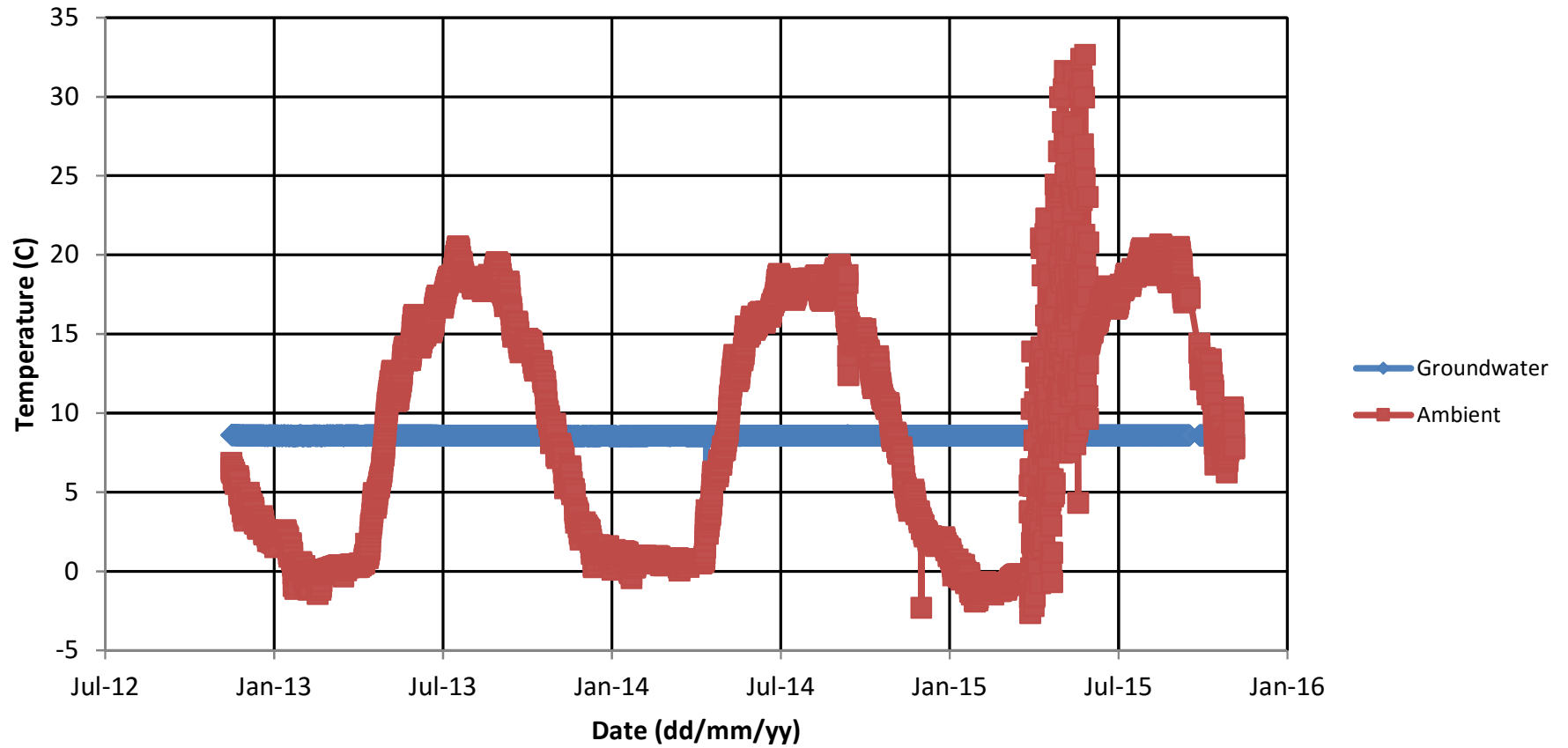
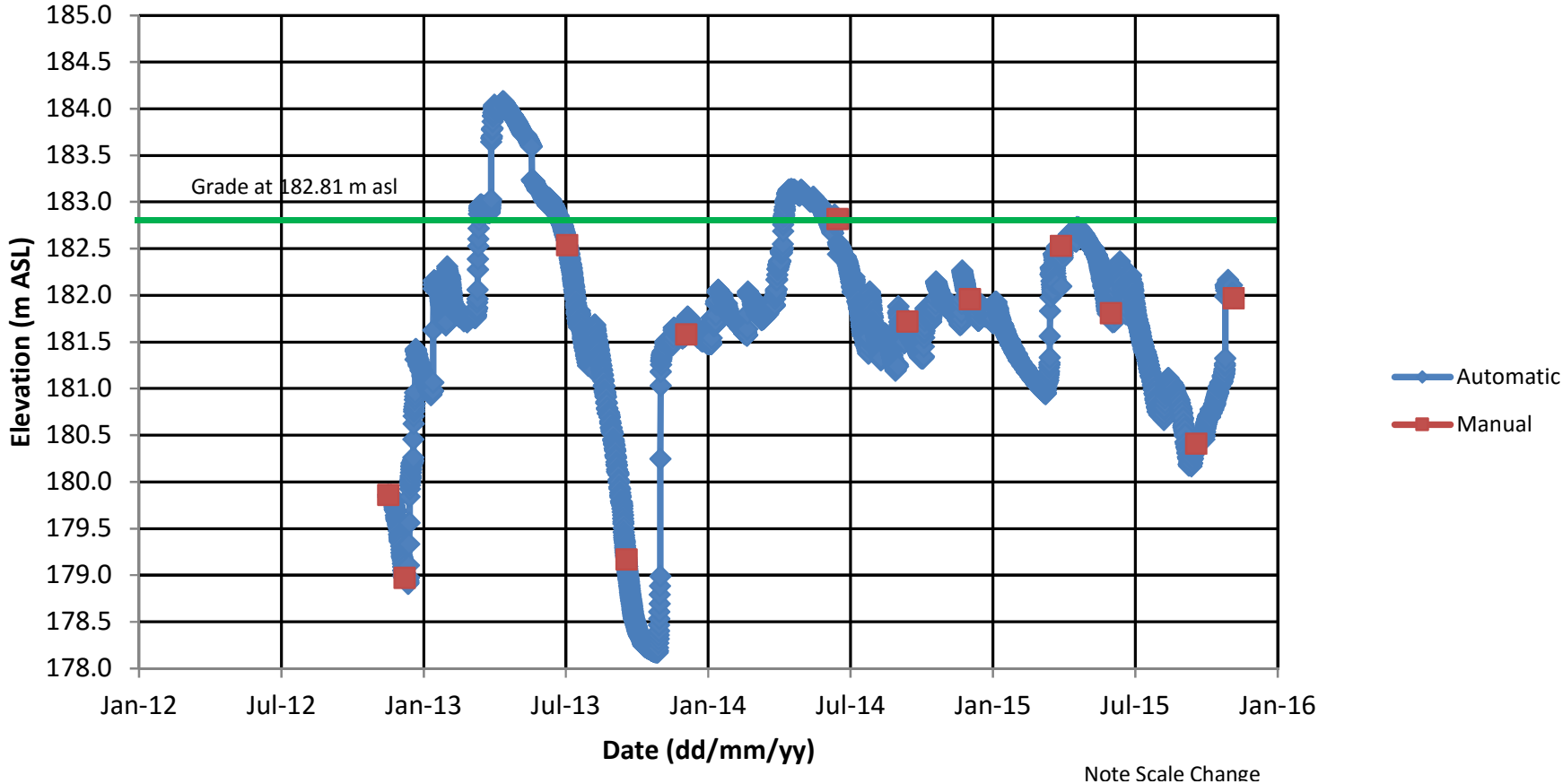


Figure A-8
BH05-20: Groundwater Elevation



Note Scale Change

Figure A-9
BH05-20: Groundwater Temperature

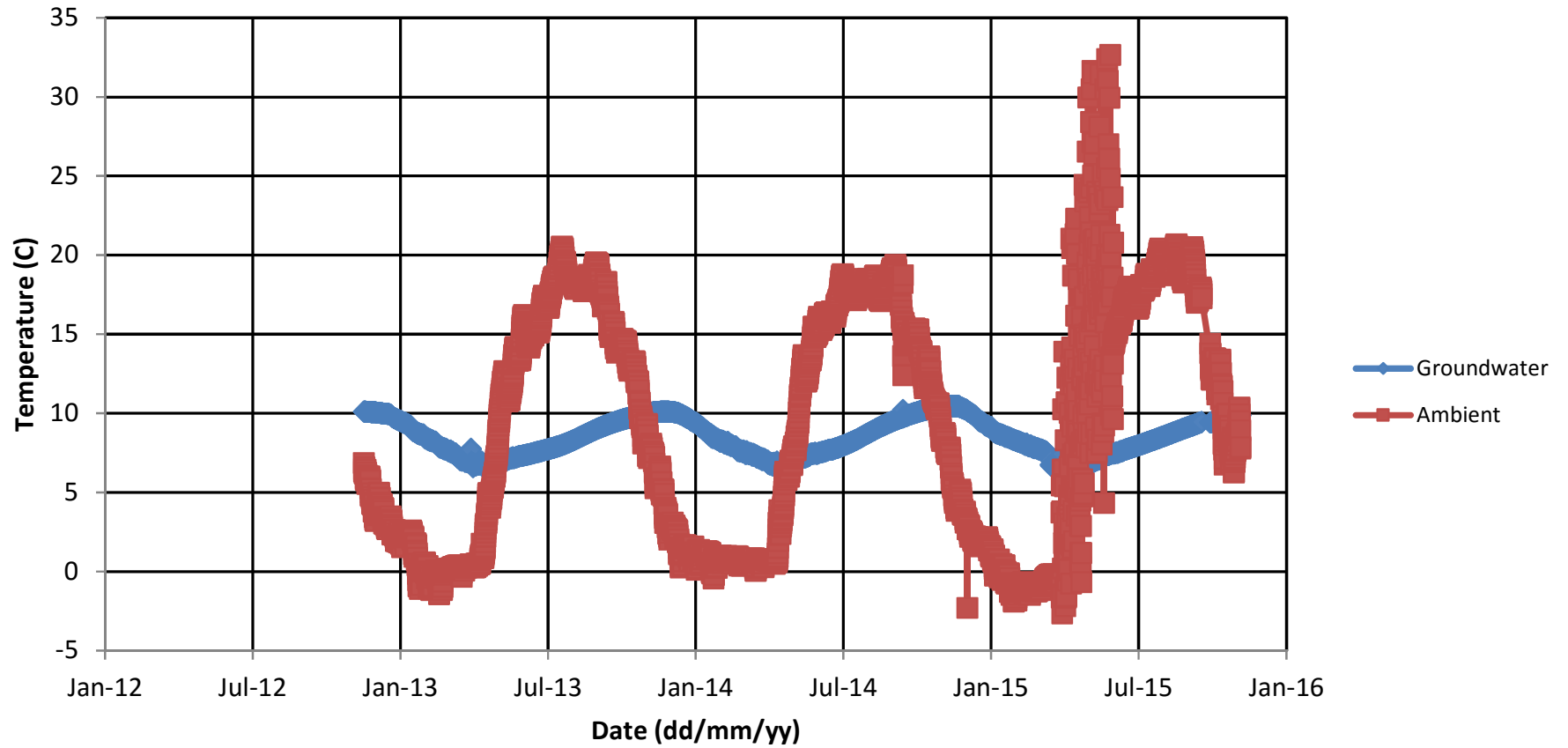
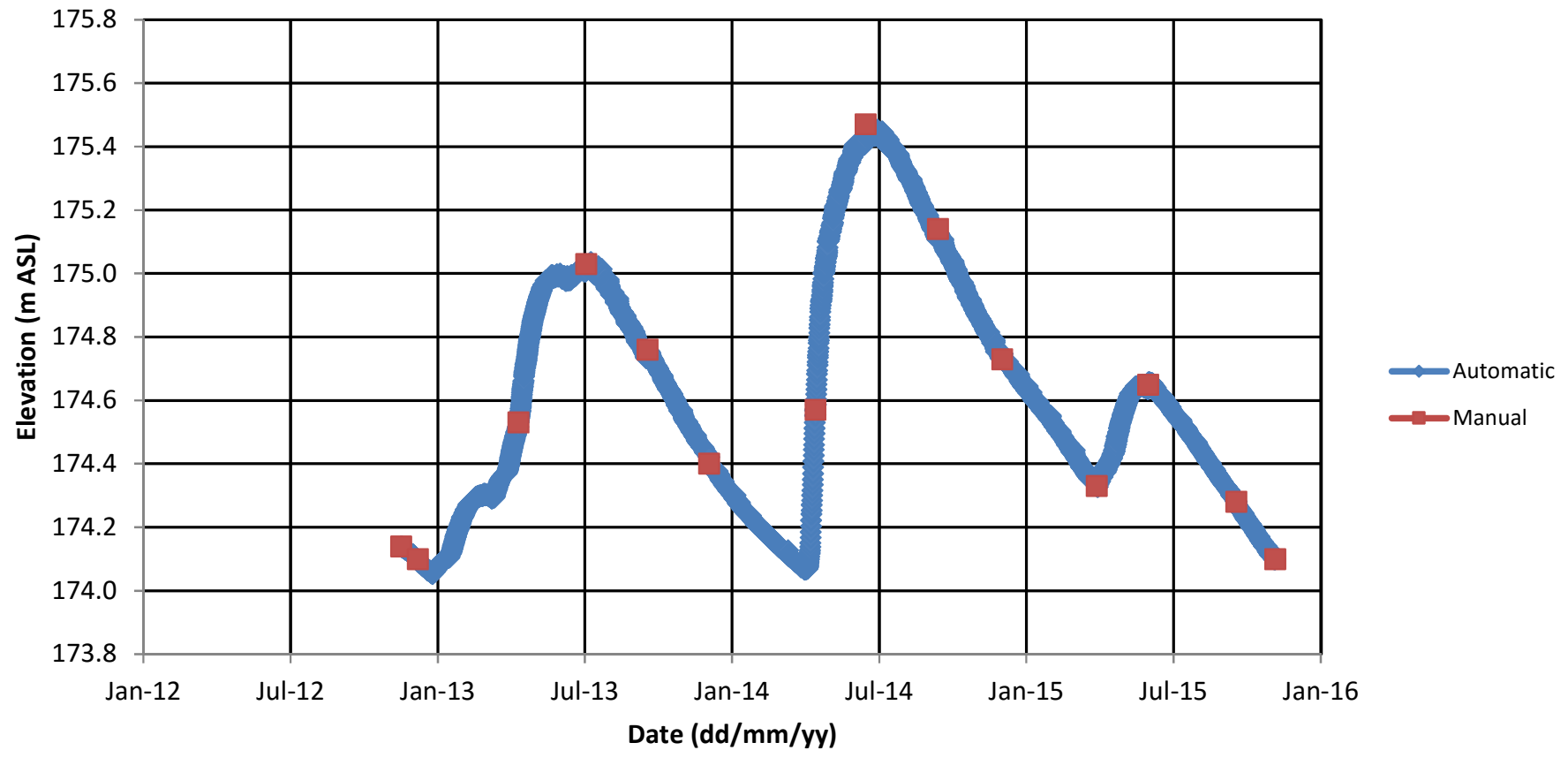


Figure A-10
BH06-1: Groundwater Elevation



**TABLE A-2
RESIDENTIAL GROUNDWATER LEVELS - WATER WELLS
CODRINGTON PIT**

LOCATION												
TYPE OF WELL	Drilled	Dug	Dug	Drilled	Drilled	Dug	Dug	Dug	Drilled	Dug	Dug	Dug
DATE												
26-Jul-11		2.74	1.4	9.79								
29-Jul-11					NA							
18-Aug-11	No Access					3.23	3.14		No Access	2.14		
19-Aug-11												3.47
28-Sep-11								No Access				
10-Apr-03												
11-Apr-13		NA										
12-Apr-13			NP									
13-Apr-13												0.99
15-Apr-13		NA										
04-Jul-13										1.31		NA
05-Jul-13		2.73										
19-Sep-13		2.89										3.56
20-Sep-13										2.39		
04-Dec-13										1.64		
07-Dec-13		2.79										
16-Sep-14		2.8								2.11		NA
03-Jun-15											1.68	
21-Sep-15										2.3	2.45	3.48
11-Dec-15											1.46	

NOTES:

- 1) Groundwater levels in metres below top of well casing.
- 2) NA indicates not available owing to resident not home.
- 3) NP indicates no permission granted to access well and request for removal from monitoring program.

Appendix B

Groundwater Chemical Results

- Groundwater Quality – Table B-1
 - Time-Concentration Graphs – Figures B-1 to B-3
 - Residential Groundwater Quality – Tables B-2 to B-6
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**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING WELLS			
			BH05-2 15-Apr-14	BH05-2 15-Sep-14	BH05-2 31-Mar-15	BH05-2 21-Sep-15
Field Parameters						
pH	pH	6.5 - 8.5	7.65	7.35	8.4	7.16
Temperature	°C	15	3.8	9.2	5.7	10.8
Conductivity	(µS/cm)		422	397	430	420
Dissolved Oxygen	mg/L		10.86	9.3	10.4	11.9
Turbidity	NTU	5	>200	>200	>200	>200
Inorganics						
TDS	mg/L	500	236	250	212	238
Hardness (CaCO ₃)	mg/L	80 - 100	209	250	226	239
Total Ammonia-N	mg/L		0.49	<0.02	0.08	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02
Conductivity	uS/cm		398	471	429	422
Dissolved Organic Carbon	mg/L	5.0	1.5	1	1.9	1.5
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	8.13	8.05	8.01	8.03
Sulphate (SO ₄)	mg/L	500	2.84	3.35	3.78	2.19
Alkalinity (Total as CaCO ₃)	mg/L		191	228	224	223
Chloride (Cl)	mg/L	250	1	1.13	1.24	0.94
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	0.08	0.07	0.15	0.06
Nitrate + Nitrite	mg/L	10.0	0.08	0.07	0.15	<0.07
Metals						
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	0.004	0.004
Barium (Ba)	mg/L	1.0	0.022	0.032	0.028	0.026
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		78.5	91.8	84.3	89.6
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		3.27	4.95	3.79	3.65
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.004
Phosphorus (P)	mg/L		0.04		0.98	0.44
Potassium (K)	mg/L		0.47	0.69	0.53	0.67
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	0.81	0.96	0.94	0.75
Strontium (Sr)	mg/L		0.107	0.134	0.113	0.108
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005

NOTES:

1. ODWQO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING WELLS			
			BH05-18 15-Apr-14	BH05-18 15-Sep-14	BH05-18 31-Mar-15	BH05-18 21-Sep-15
Field Parameters						
pH	pH	6.5 - 8.5	7.74	7.83	7.62	7.07
Temperature	°C	15	6	10.4	6.4	10.1
Conductivity	(µS/cm)		450	381	426	382
Dissolved Oxygen	mg/L		10.32	9.1	11.0	10.6
Turbidity	NTU	5	>200	>200	>200	>200
Inorganics						
TDS	mg/L	500	280	254	232	276
Hardness (CaCO3)	mg/L	80 - 100	201	218	208	247
Total Ammonia-N	mg/L		0.33	0.04	0.2	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02
Conductivity	uS/cm		451	435	420	445
Dissolved Organic Carbon	mg/L	5.0	1.1	0.8	1.3	1.2
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	8.16	8.08	8.07	8.02
Sulphate (SO4)	mg/L	500	4.3	5.02	4.69	4.6
Alkalinity (Total as CaCO3)	mg/L		158	163	170	171
Chloride (Cl)	mg/L	250	8.1	7.81	7.24	8.25
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	10.8	9.39	9.26	12
Nitrate + Nitrite	mg/L	10.0	10.8	9.39	9.26	12
Metals						
Aluminum (Al)	mg/L	0.1	<0.004	0.004	<0.004	<0.004
Barium (Ba)	mg/L	1.0	0.051	0.056	0.054	0.064
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		64.6	71.9	66.7	82.8
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		9.66	9.36	10	9.82
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.003
Phosphorus (P)	mg/L		0.04		2.7	2.37
Potassium (K)	mg/L		0.73	0.8	0.69	1.12
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	2.13	2.52	2.31	2.57
Strontium (Sr)	mg/L		0.123	0.132	0.113	0.117
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005

NOTES:

1. ODWQO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING WELLS			
			BH05-19 15-Apr-14	BH05-19 15-Sep-14	BH05-19 31-Mar-15	BH05-19 21-Sep-15
DATE						
Field Parameters						
pH	pH	6.5 - 8.5	7.82	6.7	7.96	7.37
Temperature	°C	15	5.4	12.6	9.6	18
Conductivity	(µS/cm)		465	406	484	393
Dissolved Oxygen	mg/L		11.21	10.2	10.5	8.5
Turbidity	NTU	5	>200	>200	>200	>200
Inorganics						
TDS	mg/L	500	274	290	232	256
Hardness (CaCO ₃)	mg/L	80 - 100	208	236	236	250
Total Ammonia-N	mg/L		0.06	0.06	0.26	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02
Conductivity	uS/cm		453	452	467	431
Dissolved Organic Carbon	mg/L	5.0	1	2	1.4	2.1
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	8.08	8.12	8.02	8.06
Sulphate (SO ₄)	mg/L	500	6.98	6.82	6.33	6.51
Alkalinity (Total as CaCO ₃)	mg/L		190	196	217	202
Chloride (Cl)	mg/L	250	2.93	2.53	3.29	2.71
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	5.52	4.91	6.01	4
Nitrate + Nitrite	mg/L	10.0	5.52	4.91	6.01	4
Metals						
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	<0.004	0.011
Barium (Ba)	mg/L	1.0	0.067	0.066	0.068	0.074
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		63.9	74.5	74.4	81.3
Chromium (Cr)	mg/L	0.05	0.011	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		11.8	12.1	12.3	11.5
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		0.004	<0.003	<0.003	0.003
Phosphorus (P)	mg/L		0.66		<0.05	0.08
Potassium (K)	mg/L		0.75	0.94	0.88	1.18
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	1.96	1.96	1.91	2.18
Strontium (Sr)	mg/L		0.146	0.149	0.134	0.137
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING WELLS			
			BH05-20 17-Jun-14	BH05-20 15-Sep-14	BH05-20 31-Mar-15	BH05-20 21-Sep-15
DATE						
Field Parameters						
pH	pH	6.5 - 8.5	7.78*	7.5	8.28	7
Temperature	°C	15		13.1	6.5	11.8
Conductivity	(µS/cm)		542*	494	598	510
Dissolved Oxygen	mg/L			7	3.8	5.34
Turbidity	NTU	5	>200	>200	>200	>200
Inorganics						
TDS	mg/L	500	336	314	316	332
Hardness (CaCO3)	mg/L	80 - 100	247	294	297	335
Total Ammonia-N	mg/L		0.29	<0.02	0.03	<0.02
Ammonia (unionized)	mg/L		<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		542	546	596	589
Dissolved Organic Carbon	mg/L	5.0	2.5	1.4	1	0.9
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	7.78	8.22	7.94	7.94
Sulphate (SO4)	mg/L	500	8.12	8.18	7.46	7
Alkalinity (Total as CaCO3)	mg/L		292	261	305	297
Chloride (Cl)	mg/L	250	2.84	3.14	4.36	4.17
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	<0.05	<0.05	<0.10	<0.05
Nitrate + Nitrite	mg/L	10.0	<0.07	<0.07	<0.07	<0.07
Metals						
Aluminum (Al)	mg/L	0.1	<0.004	0.013	<0.004	<0.004
Barium (Ba)	mg/L	1.0	0.017	0.019	0.016	0.017
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		81.5	99.6	100	115
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		10.5	11	11.4	11.6
Manganese (Mn)	mg/L	0.05	<0.002	0.022	0.003	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.005
Phosphorus (P)	mg/L				0.43	1.13
Potassium (K)	mg/L		0.45	0.51	0.38	1.19
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	4.56	5.17	6.23	5.94
Strontium (Sr)	mg/L		0.175	0.197	0.173	0.167
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005

NOTES:

1. ODWQO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING WELLS			
			BH06-1 15-Apr-14	BH06-1 15-Sep-14	BH06-1 31-Mar-15	BH06-1 21-Sep-15
Field Parameters						
pH	pH	6.5 - 8.5	7.71	7.63	7.81	7.28
Temperature	°C	15	6.6	9	7.6	8.9
Conductivity	(µS/cm)		477	414	523	434
Dissolved Oxygen	mg/L		9.92	9	10.3	8.85
Turbidity	NTU	5	>200	>200	>200	158
Inorganics						
TDS	mg/L	500	306	272	242	266
Hardness (CaCO3)	mg/L	80 - 100	233	235	259	272
Total Ammonia-N	mg/L		0.94	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02
Conductivity	uS/cm		449	430	489	495
Dissolved Organic Carbon	mg/L	5.0	1.1	0.7	1.2	0.7
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	8.06	8.19	7.98	8.02
Sulphate (SO4)	mg/L	500	7.73	7.84	9.05	8.14
Alkalinity (Total as CaCO3)	mg/L		216	203	255	252
Chloride (Cl)	mg/L	250	1.2	1.37	1.68	1.32
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	0.08	<0.05	<0.10	0.05
Nitrate + Nitrite	mg/L	10.0	0.08	<0.07	<0.07	<0.07
Metals						
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	<0.004	<0.004
Barium (Ba)	mg/L	1.0	0.029	0.029	0.032	0.031
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		81.8	81.6	90.5	96.5
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		7.08	7.69	7.99	7.61
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.005
Phosphorus (P)	mg/L		0.35		0.66	0.12
Potassium (K)	mg/L		0.58	0.63	0.63	0.8
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	1.56	1.46	1.68	1.76
Strontium (Sr)	mg/L		0.15	0.156	0.149	0.14
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING WELLS		
			BH12-1 15-Sep-14	BH12-1 31-Mar-15	BH12-1 21-Sep-15
DATE					
Field Parameters					
pH	pH	6.5 - 8.5	7.83	8.6	7.92
Temperature	°C	15	12.3	10	12.9
Conductivity	(µS/cm)		471	532	460
Dissolved Oxygen	mg/L		7.2	9.1	10.7
Turbidity	NTU	5	>200	>200	>200
Inorganics					
TDS	mg/L	500	294	258	294
Hardness (CaCO3)	mg/L	80 - 100	266	242	233
Total Ammonia-N	mg/L		0.1	0.14	<0.10
Ammonia (unionized)	mg/L		<0.02	<0.02	<0.02
Conductivity	uS/cm		557	505	514
Dissolved Organic Carbon	mg/L	5.0	2	2.5	1.7
Orthophosphate (P)	mg/L		<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	8.18	8.07	8.15
Sulphate (SO4)	mg/L	500	20.3	15.9	17
Alkalinity (Total as CaCO3)	mg/L		245	241	241
Chloride (Cl)	mg/L	250	4.34	4.34	3.62
Nitrite (N)	mg/L	1.0	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	1.65	1.96	1.54
Nitrate + Nitrite	mg/L	10.0	1.65	1.96	1.54
Metals					
Aluminum (Al)	mg/L	0.1	0.005	0.291	0.059
Barium (Ba)	mg/L	1.0	0.07	0.089	0.094
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	0.019	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		75.3	69.1	66
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	0.217	0.015
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		18.9	16.8	16.5
Manganese (Mn)	mg/L	0.05	<0.002	0.036	0.028
Molybdenum (Mo)	mg/L		0.003	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	0.004
Phosphorus (P)	mg/L			1.77	4.08
Potassium (K)	mg/L		3.21	2.17	2.32
Silver (Ag)	mg/L		<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	11.8	10.4	13
Strontium (Sr)	mg/L		0.812	0.396	0.294
Vanadium (V)	mg/L		<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	0.257	0.025	0.04

NOTES:

1. ODWQO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-1
GROUNDWATER QUALITY - ONSITE MONITORING WELLS
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	BH12-2	BH12-2	BH12-2	BH12-2
			15-Apr-14	15-Sep-14	31-Mar-15	21-Sep-15
Field Parameters						
pH	pH	6.5 - 8.5	7.77	7.48	8.2	7.4
Temperature	°C	15	6.7	9.3	9.3	9.9
Conductivity	(µS/cm)		445	390	440	388
Dissolved Oxygen	mg/L		10.01	8.8	10.4	9.37
Turbidity	NTU	5	>200	>200	>200	>200
Inorganics						
TDS	mg/L	500	264	256	228	230
Hardness (CaCO3)	mg/L	80 - 100	224	257	233	194
Total Ammonia-N	mg/L		0.27	<0.02	0.03	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02
Conductivity	uS/cm		442	459	451	432
Dissolved Organic Carbon	mg/L	5.0	2.2	0.7	3.5	1.6
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10
pH	pH	6.5 - 8.5	8.04	8.14	8.03	8.04
Sulphate (SO4)	mg/L	500	7.94	8.07	8.07	7.54
Alkalinity (Total as CaCO3)	mg/L		209	216	226	217
Chloride (Cl)	mg/L	250	1.89	2.27	2.77	1.6
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05
Nitrate (N)	mg/L	10.0	0.36	0.74	0.86	0.41
Nitrate + Nitrite	mg/L	10.0	0.36	0.74	0.86	0.41
Metals						
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	0.034	<0.004
Barium (Ba)	mg/L	1.0	0.186	0.087	0.084	0.08
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001
Calcium (Ca)	mg/L		74	86.6	76.3	61.9
Chromium (Cr)	mg/L	0.05	0.013	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		0.007	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	0.189	<0.010	0.038	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		9.44	9.92	10.2	9.5
Manganese (Mn)	mg/L	0.05	0.95	<0.002	0.004	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		0.016	<0.003	<0.003	0.004
Phosphorus (P)	mg/L		1.07		0.8	0.72
Potassium (K)	mg/L		0.89	1.14	0.88	0.86
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	1.81	1.77	1.75	1.77
Strontium (Sr)	mg/L		1.02	0.147	0.139	0.125
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	0.012	<0.005	0.009	<0.005

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE B-2
GROUNDWATER QUALITY RESULTS -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	DATE		
			26-Jul-11	05-Jul-13	16-Sep-14
TDS	mg/L	500 (AO)	285	252	336
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	270	249	304
Total Ammonia-N	mg/L		0.32	0.21	<0.02
Conductivity	umho/cm		517	496	561
Dissolved Organic Carbon	mg/L	5 (AO)	1.8	1.6	1.8
Orthophosphate (P)	mg/L		<0.01	<0.50	<0.20
pH	pH	6.5 - 8.5 (OG)	7.87	8.49	8.11
Sulphate (SO ₄)	mg/L	500 (AO)	5	3.5	5.63
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	262	258	280
Chloride (Cl)	mg/L	250 (AO)	5	3.22	8.17
Nitrite (N)	mg/L	1.0 (*)	<0.01	<0.25	<0.10
Nitrate (N)	mg/L	10.0 (*)	0.7	<0.25	1.6
Nitrate + Nitrite	mg/L		0.7	<0.07	1.6
Microbiological					
Total Coliforms	CFU/100mL	NOT DETECTED	>2000	0	ND
Fecal Streptococcus	CFU/100mL			<1	ND
Heterotrophic Plate Count	CFU/1mL			0	55
Coliform Background Count	CFU/100mL			0	ND
Escherichia coli	CFU/100mL	NOT DETECTED	7 (1)	0	ND
Metals					
Aluminum (Al)	µg/L	100 (OG)	15	<4	<4
Barium (Ba)	µg/L	1,000 (MAC)*	43	32	45
Beryllium (Be)	µg/L		<0.5	<1	<1
Boron (B)	µg/L	5,000 (IMAC)	17	<10	11
Cadmium (Cd)	µg/L	5 (MAC)*	<0.1	<2	<2
Calcium (Ca)	µg/L		99,000	92,400	113,000
Chromium (Cr)	µg/L	50 (MAC)*	<5	<3	<3
Cobalt (Co)	µg/L		<0.5	<1	<1
Copper (Cu)	µg/L	1,000 (AO)	<1	15	11
Iron (Fe)	µg/L	300 (AO)	<100	91	<10
Lead (Pb)	µg/L	10 (MAC)*	<0.5	<2	<2
Magnesium (Mg)	µg/L		4,700	4,330	5,350
Manganese (Mn)	µg/L	50 (MAC)*	23	60	2
Molybdenum (Mo)	µg/L		<0.5	<2	<2
Nickel (Ni)	µg/L		<1	<3	<3
Phosphorus (P)	µg/L		<100	<50	
Potassium (K)	µg/L		<200	260	260
Silver (Ag)	µg/L		<0.1	<2	<2
Sodium (Na)	µg/L	(**)	2,800	2,350	4,080
Strontium (Sr)	µg/L		170	176	183
Vanadium (V)	µg/L		<0.5	<2	<2
Zinc (Zn)	µg/L	5,000 (AO)	<5	7	20

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. ug/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE B-3
GROUNDWATER QUALITY RESULTS -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	18-Aug-11	04-Jul-13	16-Sep-14	21-Sep-15
DATE						
TDS	mg/L	500 (AO)	314	330	308	322
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	280	294	285	314
Total Ammonia-N	mg/L		<0.05	0.23	0.04	<0.02
Conductivity	umho/cm		556	627	563	639
Dissolved Organic Carbon	mg/L	5 (AO)	1.1	1.7	1.1	1.2
Orthophosphate (P)	mg/L		0.01	<0.50	<0.20	<0.50
pH	pH	6.5 - 8.5 (OG)	7.87	8.27	8.13	7.89
Sulphate (SO ₄)	mg/L	500 (AO)	8	8.7	7.6	7.85
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	264	292	270	288
Chloride (Cl)	mg/L	250 (AO)	16	15.2	18	18.6
Nitrite (N)	mg/L	1.0 (*)	<0.01	<0.25	<0.10	<0.25
Nitrate (N)	mg/L	10.0 (*)	0.1	1.18	<0.10	<0.25
Nitrate + Nitrite	mg/L		0.1	1.18	<0.07	<0.07
Microbiological						
Total Coliforms	CFU/100mL	NOT DETECTED	30	128	ND	Overgrowth
Fecal Streptococcus/Enterococci	CFU/100mL			<1	ND	<1
Heterotrophic Plate Count	CFU/1mL			90	710	ND
Coliform Background Count	CFU/100mL			34	ND	ND
Escherichia coli	CFU/100mL	NOT DETECTED	0	0	ND	ND
Metals						
Aluminum (Al)	µg/L	100 (OG)	6	<4	<4	5
Barium (Ba)	µg/L	1,000 (MAC)*	43	51	41	56
Beryllium (Be)	µg/L		<0.5	<1	<1	<1
Boron (B)	µg/L	5,000 (IMAC)	11	15	16	13
Cadmium (Cd)	µg/L	5 (MAC)*	<0.1	<2	<2	<1
Calcium (Ca)	µg/L		100,000	104,000	101,000	112000
Chromium (Cr)	µg/L	50 (MAC)*	<5	<1	<3	<3
Cobalt (Co)	µg/L		<0.5	<1	<1	<1
Copper (Cu)	µg/L	1,000 (AO)	7	48	8	18
Iron (Fe)	µg/L	300 (AO)	<100	<10	<10	10
Lead (Pb)	µg/L	10 (MAC)*	1.2	<2	<2	<2
Magnesium (Mg)	µg/L		7,200	8,300	8,060	8340
Manganese (Mn)	µg/L	50 (MAC)*	7	<2	18	5
Molybdenum (Mo)	µg/L		<0.5	<2	<2	<2
Nickel (Ni)	µg/L		<1	<3	<3	<3
Phosphorus (P)	µg/L		<100	<50		<0.05
Potassium (K)	µg/L		2,600	2,500	2,460	2450
Silver (Ag)	µg/L		<0.1	<2	<2	<2
Sodium (Na)	µg/L	(**)	10,000	8,590	10,700	10900
Strontium (Sr)	µg/L		230	305	271	323
Vanadium (V)	µg/L		<0.5	<2	<2	<2
Zinc (Zn)	µg/L	5,000 (AO)	280	449	379	226

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. ug/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE B-4
GROUNDWATER QUALITY RESULTS -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	
DATE			21-Sep-15
TDS	mg/L	500 (AO)	410
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	428
Total Ammonia-N	mg/L		<0.02
Conductivity	umho/cm		774
Dissolved Organic Carbon	mg/L	5 (AO)	2.3
Orthophosphate (P)	mg/L		<0.50
pH	pH	6.5 - 8.5 (OG)	7.95
Sulphate (SO ₄)	mg/L	500 (AO)	4.98
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	402
Chloride (Cl)	mg/L	250 (AO)	1.95
Nitrite (N)	mg/L	1.0 (*)	<0.25
Nitrate (N)	mg/L	10.0 (*)	<0.25
Nitrate + Nitrite	mg/L		<0.07
Microbiological			
Total Coliforms	CFU/100mL	NOT DETECTED	85
Fecal Streptococcus/Enterococci	CFU/100mL		<1
Heterotrophic Plate Count	CFU/1mL		70
Coliform Background Count	CFU/100mL		45
Escherichia coli	CFU/100mL	NOT DETECTED	ND
Metals			
Aluminum (Al)	µg/L	100 (OG)	7
Barium (Ba)	µg/L	1,000 (MAC)*	60
Beryllium (Be)	µg/L		<1
Boron (B)	µg/L	5,000 (IMAC)	14
Cadmium (Cd)	µg/L	5 (MAC)*	<1
Calcium (Ca)	µg/L		154000
Chromium (Cr)	µg/L	50 (MAC)*	<3
Cobalt (Co)	µg/L		<1
Copper (Cu)	µg/L	1,000 (AO)	11
Iron (Fe)	µg/L	300 (AO)	493
Lead (Pb)	µg/L	10 (MAC)*	3
Magnesium (Mg)	µg/L		10600
Manganese (Mn)	µg/L	50 (MAC)*	167
Molybdenum (Mo)	µg/L		<2
Nickel (Ni)	µg/L		<3
Phosphorus (P)	µg/L		<0.05
Potassium (K)	µg/L		1550
Silver (Ag)	µg/L		<2
Sodium (Na)	µg/L	(**)	3840
Strontium (Sr)	µg/L		342
Vanadium (V)	µg/L		<2
Zinc (Zn)	µg/L	5,000 (AO)	46

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. µg/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE B-5
GROUNDWATER QUALITY RESULTS -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	
DATE			21-Sep-15
TDS	mg/L	500 (AO)	480
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	342
Total Ammonia-N	mg/L		<0.02
Conductivity	umho/cm		977
Dissolved Organic Carbon	mg/L	5 (AO)	1.1
Orthophosphate (P)	mg/L		<0.50
pH	pH	6.5 - 8.5 (OG)	7.82
Sulphate (SO ₄)	mg/L	500 (AO)	17
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	297
Chloride (Cl)	mg/L	250 (AO)	116
Nitrite (N)	mg/L	1.0 (*)	<0.25
Nitrate (N)	mg/L	10.0 (*)	0.78
Nitrate + Nitrite	mg/L		0.78
Microbiological			
Total Coliforms	CFU/100mL	NOT DETECTED	102
Fecal Streptococcus/enterococci	CFU/100mL		<1
Heterotrophic Plate Count	CFU/1mL		840
Coliform Background Count	CFU/100mL		ND
Escherichia coli	CFU/100mL	NOT DETECTED	ND
Metals			
Aluminum (Al)	µg/L	100 (OG)	57
Barium (Ba)	µg/L	1,000 (MAC)*	127
Beryllium (Be)	µg/L		<1
Boron (B)	µg/L	5,000 (IMAC)	36
Cadmium (Cd)	µg/L	5 (MAC)*	<1
Calcium (Ca)	µg/L		113000
Chromium (Cr)	µg/L	50 (MAC)*	5
Cobalt (Co)	µg/L		<1
Copper (Cu)	µg/L	1,000 (AO)	620
Iron (Fe)	µg/L	300 (AO)	132
Lead (Pb)	µg/L	10 (MAC)*	2
Magnesium (Mg)	µg/L		14600
Manganese (Mn)	µg/L	50 (MAC)*	6
Molybdenum (Mo)	µg/L		<2
Nickel (Ni)	µg/L		<3
Phosphorus (P)	µg/L		<0.05
Potassium (K)	µg/L		1580
Silver (Ag)	µg/L		<2
Sodium (Na)	µg/L	(**)	69800
Strontium (Sr)	µg/L		293
Vanadium (V)	µg/L		2
Zinc (Zn)	µg/L	5,000 (AO)	62

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. ug/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE B-6
GROUNDWATER QUALITY RESULTS
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG			
			18-Aug-11	11-Apr-13	21-Sep-15
TDS	mg/L	500 (AO)	357	300	356
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	300	272	340
Total Ammonia-N	mg/L		0.06	0.09	<0.02
Conductivity	umho/cm		628	566	670
Dissolved Organic Carbon	mg/L	5 (AO)	0.9	1.2	1.1
Orthophosphate (P)	mg/L		<0.01	<0.10	<0.50
pH	pH	6.5 - 8.5 (OG)	7.78	8.24	7.96
Dissolved Sulphate (SO ₄)	mg/L	500 (AO)	12	6.57	11.7
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	299	269	308
Dissolved Chloride (Cl)	mg/L	250 (AO)	16	8.94	10
Nitrite (N)	mg/L	1.0 (*)	<0.01	<0.05	<0.25
Nitrate (N)	mg/L	10.0 (*)	0.4	0.14	2.99
Nitrate + Nitrite	mg/L	10.0 (*)	0.4	0.14	2.99
Microbiological					
Background	CFU/100mL			ND	ND
Heterotrophic Plate Count	CFU/1mL			340	1230
Total Coliforms	CFU/100mL	NOT DETECTED	100 (1)	27	Overgrowth
Fecal Streptococcus/Enterococci	CFU/100mL			3	9
Escherichia coli	CFU/100mL	NOT DETECTED	0 (1)	ND	ND
Metals					
Aluminum (Al)	mg/L	0.100 (OG)	<0.005	0.005	0.006
Barium (Ba)	mg/L	1.0 (MAC)*	0.058	0.044	0.065
Beryllium (Be)	mg/L		<0.0005	<0.001	<0.001
Boron (B)	mg/L	5.0 (IMAC)	0.028	0.035	0.037
Cadmium (Cd)	mg/L	0.005 (MAC)*	<0.0001	<0.002	<0.001
Calcium (Ca)	mg/L		110	97.7	120
Chromium (Cr)	mg/L	0.050 (MAC)*	<0.005	<0.003	<0.003
Cobalt (Co)	mg/L		<0.0005	<0.001	<0.001
Copper (Cu)	mg/L	1.0 (AO)	0.027	0.56	0.033
Iron (Fe)	mg/L	0.300 (AO)	<0.100	0.051	<0.010
Lead (Pb)	mg/L	0.010 (MAC)*	0.0007	<0.002	<0.002
Magnesium (Mg)	mg/L		9.4	6.91	9.77
Manganese (Mn)	mg/L	0.050 (MAC)*	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.0005	<0.002	<0.002
Nickel (Ni)	mg/L		<0.001	<0.003	<0.003
Phosphorus (P)	mg/L		<0.100	<0.05	<0.05
Potassium (K)	mg/L		1.3	0.89	1.47
Silver (Ag)	mg/L		<0.0001	<0.002	<0.002
Sodium (Na)	mg/L		17	9.71	123
Strontium (Sr)	mg/L		0.27	0.228	0.312
Vanadium (V)	mg/L		0.0011	<0.002	<0.002
Zinc (Zn)	mg/L	5.0 (AO)	0.01	0.018	0.009

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L denotes milligrams per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

Appendix C

Surface Water Data

- Surface Water Quality – Local Stations – Table C-1
 - Surface Water Flow Rates – Figure C-1
 - Time-Concentration Graphs – Figures C-2 to C-4
 - Surface Water Quality – Codrington Fish Research Centre – Table C-2
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TABLE C-1
SURFACE WATER QUALITY - LOCAL STATIONS
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS								
			Pond North of Pit	SWB	SWB	SWB	SWB	SWB	SWB	SWB	SWB
DATE			19-Aug-11	11-Apr-13	4-Jul-13	19-Sep-13	4-Dec-13	15-Apr-14	16-Sep-14	31-Mar-15	21-Sep-15
Field Parameters											
pH	pH	6.5 - 8.5	8.22	7.75	EF	7.91	8.54	8.23	7.79	8.91	7.41
Temperature	t°C		21.6	5.6	11	11	6.5	5.7	10	1.9	11.1
Conductivity	(µS/cm)		2287	407	415	346	437	429	376	223	369
Dissolved Oxygen	mg/L			10	12.31	9.8*	11.4	12.2		10.1	9.6
Turbidity	NTU			4.09	<1	1.9*	4.1	7.3		31.3	10.8
Flow Rate	L/s			0.35	1.67	0.87	1.13	1.3	1	0.7	0.2
Inorganics											
TDS	mg/L		165	238	220	232	232	266		108	216
Hardness (CaCO ₃)	mg/L		140	233	218	232	232	218		111	228
Total Ammonia-N	mg/L		<0.05	0.063	0.143	<0.02	<0.02	0.13		0.06	<0.02
Ammonia (unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02
Conductivity	umho/cm		321	454	443	439	440	447		229	428
Dissolved Organic Carbon	mg/L		4.2	0.9	1	1.2	1.4	2.5		10.9	0.9
Orthophosphate (P)	mg/L		<0.01	<0.100	<0.100	<0.10	<0.10	<0.10		<0.10	<0.10
pH	pH	6.5 - 8.5	8.16	8.04	8.41	7.78	8.28	8.3		8.08	8.22
Sulphate (SO ₄)	mg/L		5	6.24	5.2	4.73	5.07	5.36		2.48	4.61
Alkalinity (Total as CaCO ₃)	mg/L		169	222	230	250	239	219		111	219
Chloride (Cl)	mg/L		<1	1.02	0.967	0.99	1.02	1.06		1.18	0.96
Nitrite (N)	mg/L		<0.01	<0.050	<0.050	<0.05	<0.05	<0.05		<0.05	<0.05
Nitrate (N)	mg/L		<0.1	0.104	0.082	0.08	0.08	0.16		0.38	0.05
Nitrate + Nitrite	mg/L		<0.1	0.104	0.082	0.08	0.08	0.16		0.38	<0.07
Metals											
Aluminum (Al)	µg/L	75	110	4.2	14	10	<4	22		12	<4
Barium (Ba)	µg/L		33	69.1	57.1	62	64	51		25	66
Beryllium (Be)	µg/L	1100	<0.5	<2.0	<2.0	<1	<1	<1		<1	<1
Boron (B)	µg/L	200	<10	<10	<10	<10	13	<10		10	<10
Cadmium (Cd)	µg/L	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<1
Calcium (Ca)	µg/L		49000	81700	76600	81800	81100	77300		39700	80500
Chromium (Cr)	µg/L	8.9	<5	<3.0	<3.0	<3	<3	<3		<3	<3
Cobalt (Co)	µg/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
Copper (Cu)	µg/L	5	<1	<2.0	<2.0	<2	<2	<2		1	<2
Iron (Fe)	µg/L	300	160	<10	28	<10	230	<10		170	10
Lead (Pb)	µg/L	25.0	<0.5	<1.0	<1.0	<1	1	<1		<1	<1
Magnesium (Mg)	µg/L		4700	6960	6430	6790	1050	6170		2880	6600
Manganese (Mn)	µg/L		23	3.9	13.7	15	40	6		29	11
Molybdenum (Mo)	µg/L	40	0.5	<2.0	<2.0	<2	<2	<2		<2	<2
Nickel (Ni)	µg/L	25	<1	<3.0	<3.0	<3	<3	<3		<3	<3
Phosphorus (P)	µg/L	30	<100	36	48	<20	80	30		44	<10
Potassium (K)	µg/L		950	1130	1030	1110	1200	1240		4820	1190
Silver (Ag)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1
Sodium (Na)	µg/L		1100	1130	1070	1210	1150	1010		950	1190
Strontium (Sr)	µg/L		92	132	115	117	127	125		61	125
Vanadium (V)	µg/L	6	1.7	<2.0	<2.0	<2	<2	<2		<2	<2
Zinc (Zn)	µg/L	20	<5	<5.0	7	6	8	<5		<5	5

- NOTES:
1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
 2. Bolding and shading denotes concentration exceeds PWQO.
 3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
 4. Blank denotes no PWQO or parameter not tested.
 5. EF indicates equipment failure.

TABLE C-1
SURFACE WATER QUALITY - LOCAL STATIONS
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS							
			SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC
DATE			11-Apr-13	4-Jul-13	19-Sep-13	4-Dec-13	15-Apr-14	16-Sep-14	31-Mar-15	21-Sep-15
Field Parameters										
pH	pH	6.5 - 8.5	8.33	EF	8.02	8.42	7.79	8.02	7.63	7.84
Temperature	t°C		3.6	22.6	17.2	3.1	6	14.1	1.4	16.4
Conductivity	(µS/cm)		370	355	316	452	420	329	365	32.7
Dissolved Oxygen	mg/L		9.8	9.49	9.5*	11.6	9.9		9.9	8.0
Turbidity	NTU		17.9	1.4	8.8*	6.4		16.6		25.2
Flow Rate	L/s		50	2.8	<1	10.5	51.9	5.6	12.8	1
Inorganics										
TDS	mg/L		234	198	220	246	280	280	196	196
Hardness (CaCO3)	mg/L		190	178	172	242	197	197	173	193
Total Ammonia-N	mg/L		0.047	0.275	<0.02	0.03	0.82	0.82	0.6	<0.02
Ammonia (unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	umho/cm		412	372	335	458	452	452	368	371
Dissolved Organic Carbon	mg/L		6.7	4.2	4.2	2.8	11.4	11.4	13.1	6.9
Orthophosphate (P)	mg/L		<0.100	<0.100	0.22	<0.10	0.51	0.51	0.19	<0.10
pH	pH	6.5 - 8.5	7.87	8.34	7.78	8.28	8.17	8.17	8.12	8.26
Sulphate (SO4)	mg/L		7.15	4.35	5.94	7.84	6.97	6.97	6.55	6.39
Alkalinity (Total as CaCO3)	mg/L		176	189	185	231	197	197	173	184
Chloride (Cl)	mg/L		8.36	1.84	1.52	1.88	9.95	9.95	5.26	1.36
Nitrite (N)	mg/L		<0.050	<0.050	<0.05	<0.05	0.08	0.08	<0.05	<0.05
Nitrate (N)	mg/L		2.08	<0.050	0.16	0.09	0.58	0.58	0.26	<0.05
Nitrate + Nitrite	mg/L		2.08	<0.070	0.16	0.09	0.66	0.66	0.26	<0.07
Metals										
Aluminum (Al)	µg/L	75	10.4	15.5	13	<4	13	13	28	<4
Barium (Ba)	µg/L		43.9	38.7	62	53	32	32	56	57
Beryllium (Be)	µg/L	1100	<2.0	<2.0	<1	<1	<1	<1	<1	<1
Boron (B)	µg/L	200	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium (Cd)	µg/L	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
Calcium (Ca)	µg/L		64400	58400	56300	82000	67500	67500	57800	64100
Chromium (Cr)	µg/L	8.9	<3.0	<3.0	<3	<3	3	3	<3	<3
Cobalt (Co)	µg/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper (Cu)	µg/L	5	<2.0	<2.0	<2	<2	<2	<2	2	<2
Iron (Fe)	µg/L	300	240	372	630	140	200	200	450	270
Lead (Pb)	µg/L	25.0	<1.0	<1.0	<1	<1	<1	<1	<1	<1
Magnesium (Mg)	µg/L		6990	7770	7530	9070	6980	6980	6950	8100
Manganese (Mn)	µg/L		20	65.7	98	46	39	39	49	44
Molybdenum (Mo)	µg/L	40	<2.0	<2.0	<2	<2	<2	<2	<2	<2
Nickel (Ni)	µg/L	25	<3.0	<3.0	<3	<3	<3	<3	<3	<3
Phosphorus (P)	µg/L	30	267	70	80	40	270	270	720	60
Potassium (K)	µg/L		6190	<500	960	910	6190	6190	9730	1330
Silver (Ag)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium (Na)	µg/L		3900	1930	1970	1980	4460	4460	2730	1940
Strontium (Sr)	µg/L		120	124	127	130	131	131	98	129
Vanadium (V)	µg/L	6	<2.0	<2.0	<2	<2	<2	<2	<2	<2
Zinc (Zn)	µg/L	20	6.7	<5.0	<5	<5	5	5	5	7

NOTES:

1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
2. Bolding and shading denotes concentration exceeds PWQO.
3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
4. Blank denotes no PWQO or parameter not tested.
5. EF indicates equipment failure.

FIGURE C-1
SURFACE WATER FLOW RATES

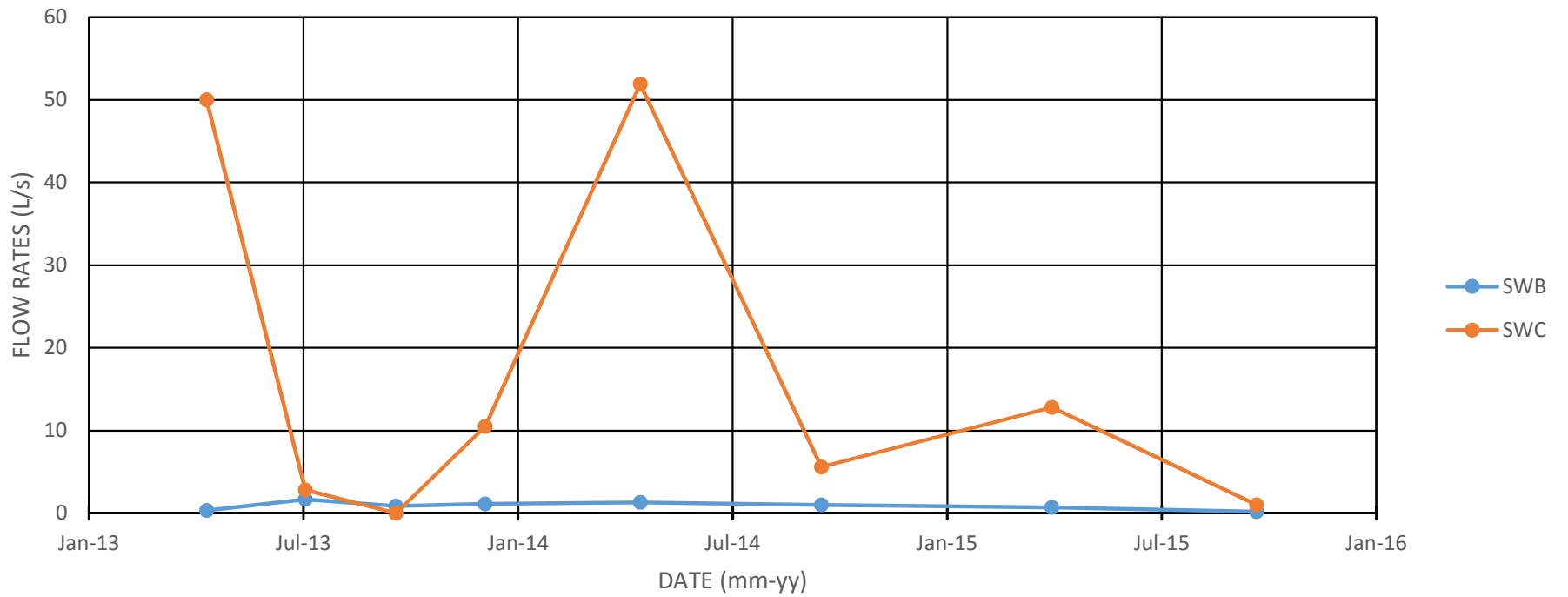


FIGURE C-2
TDS CONCENTRATIONS VS TIME

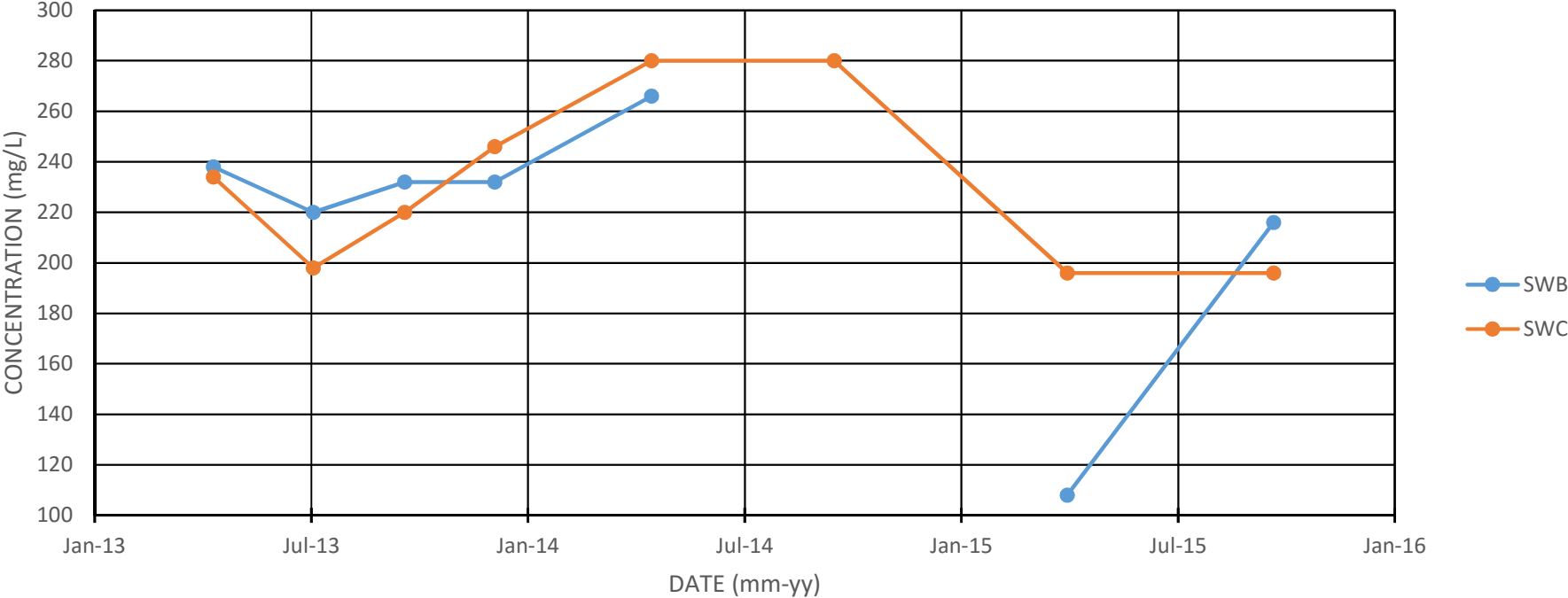


FIGURE C-3
NITRATE CONCENTRATIONS VS TIME

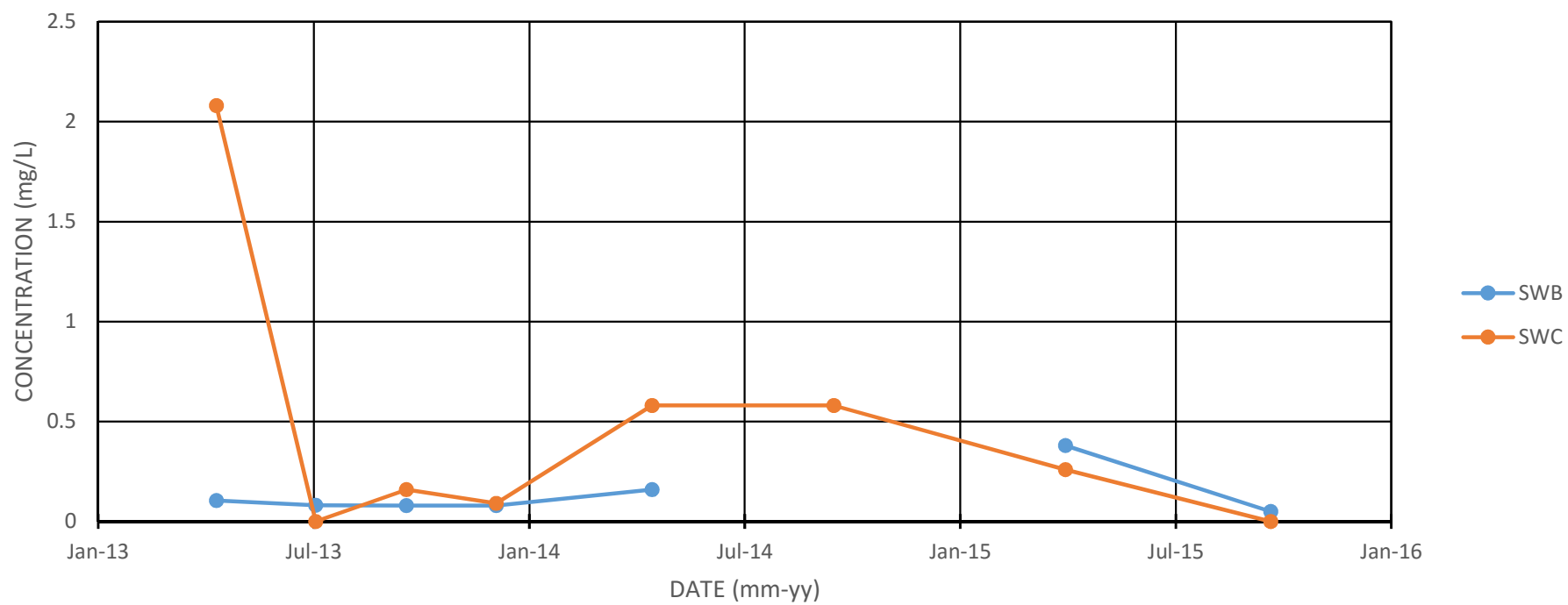


FIGURE C-4
TOTAL PHOSPHORUS CONCENTRATIONS VS TIME

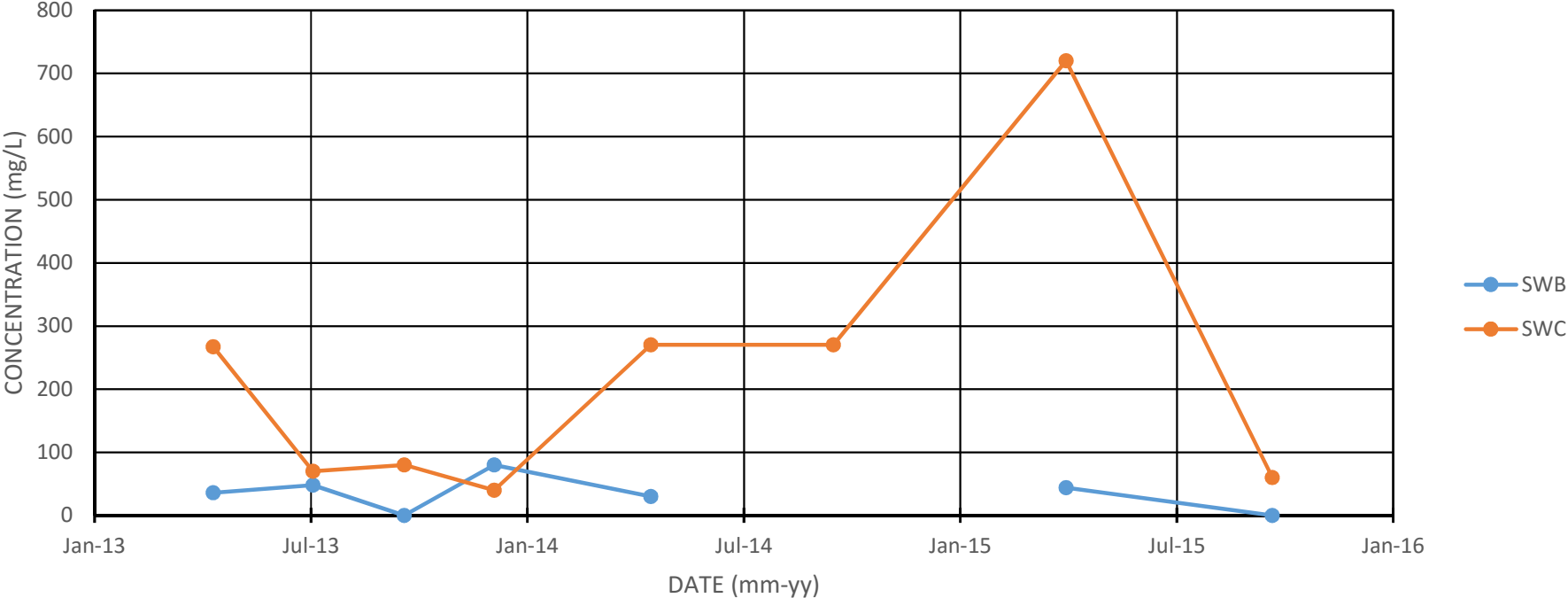


TABLE C-2
SURFACE WATER QUALITY - CODRINGTON FISH RESEARCH CENTRE
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS								
			Fish Hatchery Head Pond	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1
DATE			28-Sep-11	15-Apr-13	4-Jul-13	19-Sep-13	4-Dec-13	16-Apr-14	17-Sep-14	1-Apr-15	21-Sep-15
Field Parameters											
pH	pH	6.5 - 8.5	7.92	7.54	EF	6.9	7.55	7.78	7.54	8.36	7.19
Temperature	°C		11.1	8.5	9.6	9.7	7.9	8.3	9	8.6	8.5
Conductivity	(µS/cm)		507	475	576	483	613	600	531	610	524
Dissolved Oxygen	mg/L			6.3	5.88	9.7*	4.7	4.69	4.72	5	4.88
Turbidity	NTU			1	<1	<0.5*	0.31	4.8	4.5	4	6.24
Flow Rate	L/s			No Flow	3.2	3.9	7.2	7.4	2.9	6.8	2.3
Inorganics											
TDS	mg/L		302		332	350	316				
Hardness (CaCO3)	mg/L		260		273	318	298				
Total Ammonia-N	mg/L		<0.05		<0.020	<0.02	<0.02				
Ammonia (unionized)	mg/L	0.02	<0.02		<0.02	<0.02	<0.02				
Conductivity	umho/cm		524		612	621	625				
Dissolved Organic Carbon	mg/L		1		1	0.9	<0.5				
Orthophosphate (P)	mg/L		<0.01		<0.100	<0.20	<0.20				
pH	pH	6.5 - 8.5	8.15		8.41	7.76	8.22				
Sulphate (SO4)	mg/L		17		20.8	20.0	20.6				
Alkalinity (Total as CaCO3)	mg/L		241		249	271	253				
Chloride (Cl)	mg/L		12		30	27.9	27.8				
Nitrite (N)	mg/L		<0.01		<0.050	<0.10	<0.10				
Nitrate (N)	mg/L		2.6		1.5	1.54	1.36				
Nitrate + Nitrite	mg/L		2.6		1.5	1.54	1.36				
Metals											
Aluminum (Al)	µg/L	75	5		11.6	9	<4				
Barium (Ba)	µg/L		110		134	142	135				
Beryllium (Be)	µg/L	1100	<0.5		<2.0	<1	<1				
Boron (B)	µg/L	200	11		14	<10	10				
Cadmium (Cd)	µg/L	0.5	<0.1		<0.1	<0.1	<0.1				
Calcium (Ca)	µg/L		81000		83100	98200	91300				
Chromium (Cr)	µg/L	8.9	<5		<3.0	<3	<3				
Cobalt (Co)	µg/L	0.9	<0.5		<0.5	<0.5	<0.5				
Copper (Cu)	µg/L	5	<1		<2.0	<2	<2				
Iron (Fe)	µg/L	300	<100		<10	<10	<10				
Lead (Pb)	µg/L	25.0	<0.5		<1.0	<1	<1				
Magnesium (Mg)	µg/L		13000		15900	17600	17000				
Manganese (Mn)	µg/L		9		<2.0	3	<2				
Molybdenum (Mo)	µg/L	40	<0.5		<2.0	<2	<2				
Nickel (Ni)	µg/L	25	<1		<3.0	<3	<3				
Phosphorus (P)	µg/L	30	<100		<20	<20	20				
Potassium (K)	µg/L		1300		1530	1590	1620				
Silver (Ag)	µg/L	0.1	<0.1		<0.1	<0.1	<0.1				
Sodium (Na)	µg/L		5700		10500	11900	11100				
Strontium (Sr)	µg/L		190		293	316	301				
Vanadium (V)	µg/L	6	<0.5		<2.0	<2	<2				
Zinc (Zn)	µg/L	20	<5		<5.0	57	<5				

- NOTES:
1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
 2. Bolding and shading denotes concentration exceeds PWQO.
 3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
 4. Blank denotes no PWQO or parameter not tested..
 5. EF indicates equipment failure.

TABLE C-2
SURFACE WATER QUALITY - CODRINGTON FISH RESEARCH CENTRE
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS							
			FH-SW2 15-Apr-13	FH-SW2 4-Jul-13	FH-SW2 19-Sep-13	FH-SW2 4-Dec-13	FH-SW2 16-Apr-14	FH-SW2 17-Sep-14	FH-SW2 1-Apr-15	FH-SW2 21-Sep-15
Field Parameters										
pH	pH	6.5 - 8.5	7.89	EF	8.02	8.06	8.2	8.11	9.1	7.75
Temperature	°C		6	12.4	10	4	3.7	8.4	1.6	8.4
Conductivity	(µS/cm)		411	462	383	525	373	417	442	404
Dissolved Oxygen	mg/L		10.2	12.58	9.9*	10.5	12.55	11.85	12	11.62
Turbidity	NTU		2.6	<1	<0.5*	0.86	3.8	3	4	5.33
Flow Rate	L/s		27.4	12.6	4.9	6.9	69.4	6.3	36.9	6.4
Inorganics										
TDS	mg/L			242	280	266				
Hardness (CaCO3)	mg/L			247	261	259				
Total Ammonia-N	mg/L			0.102	<0.02	<0.02				
Ammonia (unionized)	mg/L	0.02		<0.02	<0.02	<0.02				
Conductivity	umho/cm			491	490	499				
Dissolved Organic Carbon	mg/L			1.2	1.4	1.3				
Orthophosphate (P)	mg/L			<0.100	<0.10	<0.20				
pH	pH	6.5 - 8.5		8.53	7.98	8.31				
Sulphate (SO4)	mg/L			13.8	14.0	13.5				
Alkalinity (Total as CaCO3)	mg/L			244	261	242				
Chloride (Cl)	mg/L			3.3	3.63	3.42				
Nitrite (N)	mg/L			<0.050	<0.05	<0.10				
Nitrate (N)	mg/L			0.964	1.08	0.84				
Nitrate + Nitrite	mg/L			0.964	1.08	0.84				
Metals										
Aluminum (Al)	µg/L	75		13.2	10	<4				
Barium (Ba)	µg/L			79.6	87	76				
Beryllium (Be)	µg/L	1100		<2.0	<1	<1				
Boron (B)	µg/L	200		<10	<10	<10				
Cadmium (Cd)	µg/L	0.5		<0.1	<0.1	<0.1				
Calcium (Ca)	µg/L			79300	84100	83800				
Chromium (Cr)	µg/L	8.9		<3.0	<3	<3				
Cobalt (Co)	µg/L	0.9		<0.5	<0.5	<0.5				
Copper (Cu)	µg/L	5		<2.0	<2	<2				
Iron (Fe)	µg/L	300		<10	<10	<10				
Lead (Pb)	µg/L	25.0		<1.0	<1	<1				
Magnesium (Mg)	µg/L			11800	12400	12200				
Manganese (Mn)	µg/L			11.1	3.0	10				
Molybdenum (Mo)	µg/L	40		<2.0	<2	<2				
Nickel (Ni)	µg/L	25		<3.0	<3	<3				
Phosphorus (P)	µg/L	30		<20	<20	<20				
Potassium (K)	µg/L			1110	1130	1140				
Silver (Ag)	µg/L	0.1		<0.1	<0.1	<0.1				
Sodium (Na)	µg/L			2390	2480	2500				
Strontium (Sr)	µg/L			168	167	167				
Vanadium (V)	µg/L	6		<2.0	<2	<2				
Zinc (Zn)	µg/L	20		<5.0	<5	<5				

- NOTES:
1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
 2. Bolding and shading denotes concentration exceeds PWQO.
 3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
 4. Blank denotes no PWQO or parameter not tested..
 5. EF indicates equipment failure.