

Waikato River water quality monitoring programme: data report 2013

Prepared by:
Asaeli Tulagi

For:
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

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Peer reviewed by:
Bill Vant

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Approved for release by:
Chris McKinnon

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Hydrological flow data were provided by Mighty River Power (Hydro Lakes, Waiotapu stream and Waikato River at Reids Farm), Contact Energy (Ohaaki Bridge) and Genesis Power (Huntly) through agents Opus and NIWA. The Environmental Monitoring Programme, Waikato Regional Council, Hamilton provided hydrological flow data for the two sites.

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1 Introduction

1.1 Background

The year 2013 report follows the format of the previous data report (Tulagi, 2013).

To effectively manage water quality, the Waikato River monitoring programme addresses the following questions:

1. What is the quality of the water now?
2. Why is the water of the observed level of quality?
3. Is water quality getting better or worse? If so - what makes it change?
4. How can we improve the quality, ecological health and integrity of the Waikato River?

The monitoring information allows the Council to:

- determine compliance with classification standards
- define the suitability of the resource for various beneficial uses and values of the water
- monitor the impact of major discrete point source discharges on water quality
- monitor the impacts of diffuse discharges on water quality
- provide a basis for evaluating the effectiveness of resource management measures.

This dataset is invaluable for the evaluation of the Waikato River: its state, the pressures on it and its response to these pressures. We need to continue to gather comprehensive, reliable, and good quality data on the Waikato River to protect and enhance its values into the future.

This report is the 23rd since the re-design of the Waikato River Monitoring Programme (WARIMP) implemented in 1989. Copies of reports can be obtained via the Waikato Regional Council Internet site <http://www.waikatoregion.govt.nz/Publications/> or by contacting Waikato Regional Council (the Library) on 0800 800 401, e-mail: infreq@waikatoregion.govt.nz.

1.2 Report content

The report provides information on:

1. Routine monthly monitoring of water quality at 10 sites:
 - Year 2013 summary data tabulated by parameter for each location and reported with the median of the previous 5 years.
 - Key parameter graphs showing the average water quality for 2013 at each location, compared to results of the previous 5 years.
 - Summary tables identifying the number of samples meeting 'satisfactory' and 'excellent' water quality standards and guidelines.
 - Raw data for 2013.
 - Five-yearly pesticide survey at six sites.
2. Additional information is provided in the appendices on:
 - Flow (*Appendix I*).
 - The effect of flow is important to assessing water quality and making comparisons between years. Appendix I provide information on annual median flow at some locations for the previous 10 years.
 - Datasonde deployments
 - Plots of deployments undertaken during 2013 showing the level of diurnal and seasonal variation at five Waikato River sites (*Appendix II*).

1.3 Water quality guidelines and standards

Table 1 lists the physical and chemical water quality standards and guidelines used to assess the condition of the Waikato River in 2013. The standards mainly relate to either the protection of the ecological health of rivers and streams or to whether they are suitable for water-based recreation, especially swimming.

Some water quality guidelines and standards are relevant to the use of the Waikato River for both general water supply (industrial/cooling water, irrigation, stock water etc.) and as a source of municipal drinking water. In most cases two criteria are shown. The less stringent criteria define water that is “satisfactory” for the desired use; these are mostly based on existing national and other guidelines and standards (Appendix III). The more stringent criteria identify “excellent” water, and reflect expert opinion. Samples gathered in 2013 whose results do not comply with the “satisfactory” criteria (Table 1) are underlined in raw data summaries.

Table 1: Guidelines and standards for physicochemical water quality for ecological health and for human uses of water

Water Quality Measure	Relevance ¹	Satisfactory	Excellent
Ecological health			
Dissolved oxygen (% saturation)	aquatic life (breathing)	>80	>90
pH	aquatic life (acidity)	6.5–9	7–8
Turbidity (NTU)	plant growth (clarity)	<5	<2
Ammoniacal-N (g/m ³)	aquatic life (toxicity)	<0.88	<0.1
Temperature (°C)	fish (spawning)	<12 (May-Sep) <20 (Oct-Apr)	<10 <16
Total phosphorus (g/m ³)	nuisance plant growth	<0.04	<0.01
Total nitrogen (g/m ³)	nuisance plant growth	<0.5	<0.1
Human uses - recreation			
Baseflow water clarity (m)	visibility	>1.6	>4
Escherichia coli (no./100 mL)	human health	<550	<55
Median Escherichia coli (no./100 mL)	human health	<126	<23
Human uses - water supply			
Phytoplankton chlorophyll a (g/m ³)	filter blockage	<0.02	<0.005
Human uses - drinking water			
Arsenic (g/m ³)	human health (toxicity)	<0.01	–
Boron (g/m ³)	human health (toxicity)	<1.4	–

¹ Refer to Appendix III for description of guideline and standards values used. These guidelines and standards are also defined on the Waikato Regional Council Internet site; www.waikatoregion.govt.nz

2 The Waikato River monitoring programme design

2.1 Sampling collection

Sample collection occurs monthly, as two sampling runs. Locations in the upper catchment from Taupo to Waipapa are visited as part of the first run, and locations in the middle and lower catchments from Hamilton (at the Narrows) to Tuakau are visited on the next. Each location is sampled at a similar time on each occasion (coefficient of variation $\approx 2-6\%$) to minimise the effect of diurnal variation on the measurement of water quality parameters. Sample times are recorded in New Zealand Standard Time (NZST). Because of the controlled nature of the river, our daytime samples are generally collected at higher than median flows.

2.2 Sample locations

Routine water quality monitoring locations of the Waikato River Monitoring Programme and additional locations used during the summer microbiological surveys are illustrated in *Figure 1* and summarised in *Table 2*.

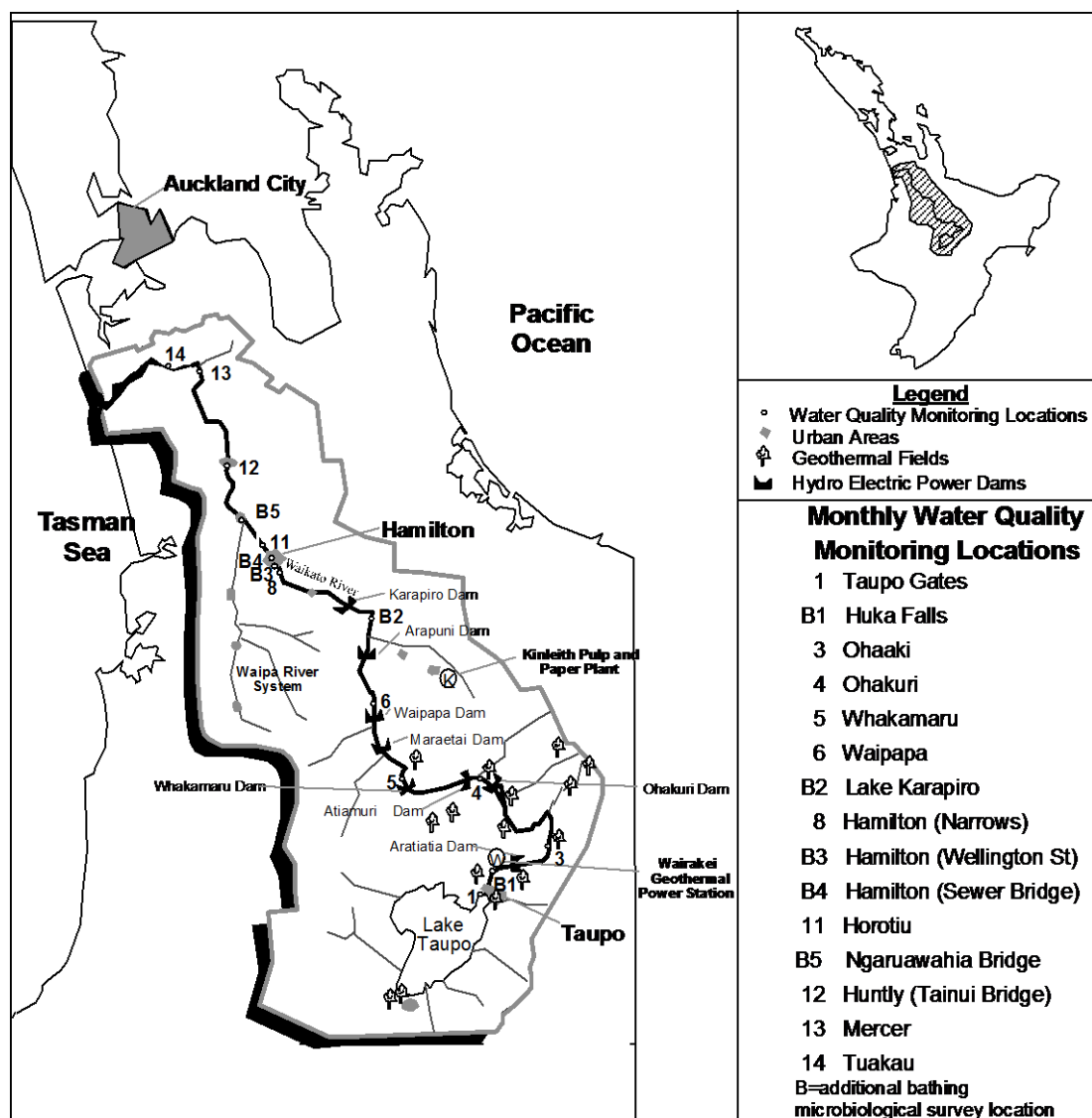


Figure 1: Waikato River water quality monitoring locations

Ten locations along the river are visited monthly (Taupo, Ohaaki, Ohakuri, Whakamaru, Waipapa, Hamilton-Narrows, Hamilton-Horotiu, Huntly, Mercer and Tuakau), and an additional four locations are included for the summer intensive microbiological survey (see Table 2, Figure 1). The major tributaries that enter the Waikato River are also monitored monthly as part of the Regional River Monitoring Programme (RERIMP) initiated in 1993 (Huser and Wilson, 1996b). Three locations (Taupo at Reids Farm, Hamilton at Wellington Street, and Rangiriri) are sampled by NIWA as part of the 'National River Water Quality Network' (Table 2).

Table 2: Routine sampling and bathing water monitoring locations

Location Number	Distance ¹ (km)	Location name	Map Ref.	Field ^Y Measurements
1131.127	0.1	Taupo Gates	U18:772-757	–
1131.119* ^d	1.2	Taupo – Reids Farm	U18:778:763	true left bank
1131.70 ^b	6.0	Huka Falls	U18:789-792	–
1131.244 ^d	7.8	Downstream Huka Falls	U18:797-809	river boat jetty ²
1131.105 ^d	36.5	Ohaaki Bridge	U17:981-914	at bridge, true right bank
1131.107	75.8	Ohakuri Tailrace Bridge	U17:796-061	boat ramp ³
1131.147	105.0	Whakamaru Tailrace	T17:552-056	boat ramp ⁴
1131.143	126.1	Waipapa Tailrace	T16:448-200	boat ramp ⁵
1131.81 ^b	166.7	Lake Karapiro Boat Ramp	T15:436-570	Horahora domain
1131.328	202.2	Hamilton – Narrows	S14:168-710	boat ramp ⁶
1131.145* ^b	210.8	Hamilton – Wellington St Bch	S14:117-757	at jetty, true right bank
1131.64 ^d	211.5	Hamilton – Traffic Bridge	S14:118-764	true right bank
1131.121 ^b	219.8	Hamilton – Sewer Bridge	S14:082-823	true left bank
1131.69	225.6	Horotiu Bridge	S14:048-871	d/s of bridge
1131.102 ^b	232.3	Ngaruawahia Bridge	S14:997-912	u/s of confluence ⁷
1131.77	246.5	Huntly – Tainui Bridge	S13:003-018	true left bank
1131.117* ^d	262.3	Rangiriri Bridge	S13:989-167	true right bank
1131.91	286.3	Mercer Bridge	S12:919-336	–
1131.133	296.8	Tuakau Bridge	R12:828-320	boat ramp ⁸
1131.131 ^d	306.5	Tuakau – Elbows Landing	R12:745-352	NZ Steel Ltd pumping station

¹ approximate distance (in kilometres) from Lake Taupo's outlet.

² river boat jetty and boat ramp, true left bank, about 1.8 km downstream of Huka Falls

³ boat ramp in recreation reserve immediately upstream from dam (true left bank).

⁴ boat ramp at Whakamaru Power Station.

⁵ river access d/s of Lake Waipapa, about 500 m off S.H. 32 along a gravel road (true left bank).

⁶ boat ramp accessed via Narrows Lane (true right bank)

⁷ road bridge upstream of Waipa River confluence.

⁸ immediately d/s of bridge, at Reserve (true right bank).

^b bathing season intensive microbiological survey locations only – survey conducted over the 2012/13 summer.

* Locations at **Taupo (Reids Farm)**, 1.1 km d/s from Taupo Gates), at **Hamilton** (Wellington Street jetty) and at **Rangiriri** (Rangiriri Bridge) are sampled and reported as part of the National River Water Quality Network undertaken by NIWA. Contact person: Graham Bryers, NIWA, Hamilton.

^Y Logistic considerations mean field measurements are often made at slightly different locations from sample collection (e.g. sampling from bridges).

^d Datasonde deployment sites.

2.3 Water quality parameters

Water quality of the Waikato River is assessed by measuring up to 40 parameters (27 routinely). Some parameters are measured in the field, but the majority of parameters are analysed in a laboratory using standard analytical methods. Details of field measurements and analytical methods used are appended (*Appendix III*).

2.4 Quality control, data storage and analysis

Quality control measures are undertaken in accordance with Waikato Regional Council's ISO 9001:2008 standards including procedures for the collection, transport, storage of samples, and methods for data verification and quality assurance to ensure the consistency of data across the programme. Samples are sent to IANZ registered laboratories for analysis. Back-up samples are held for two months until results have been verified by routine quality assurance procedures. All data from field measurements and laboratory analyses are stored in Waikato Regional Council's new database called WISKI.

Data analysis was performed using Statistica (version 11.0) and DataDesk (version 6.0.1). For the purpose of data analysis, non-detect results (i.e. results with "less than" values) were assumed to be equal to half the corresponding limit of detection (i.e. $<x = x/2$), and results greater than the value reported were taken as equal to the value reported (i.e. $>x = x$).

2.5 Reports

Waikato Regional Council's State of the Environment Report summarises the state of the Waikato River, other rivers in the region, and common pressures (Environment Waikato, 1999).

Waikato Regional Council Technical Report 2013/20, Trends in River Water Quality in the Waikato Region, 1993–2012 (Vant, 2013) outlines the trends in the Waikato River and other rivers in the region. Copies are available in electronic format from the publications page of the Waikato Regional Council website:

<http://www.waikatoregion.govt.nz/Publications/Technical-Reports>

The data contained in these Waikato River reports is updated to the Waikato Regional Council "Waikato River" Internet page:

<http://www.waikatoregion.govt.nz/Fresh-water-quality>

The "How healthy are our rivers?" link provides details of the guidelines and standards used to assess the condition of the Waikato River and other rivers in the region. A link to water quality at other regional river monitoring sites is also available from this page.

3 Results

3.1 Waikato River Monitoring Programme

Routine Water Quality Monitoring

Summary Statistics

Key Parameter Graphs

Comparison with Water Quality Standards

Raw Data

Absorbance of filtered sample at 340 nm (units: /cm)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Ohaaki Bridge	12	0.003	0.004	0.001	0.004	0.003	-0.40	0.003
Ohakuri Tailrace Bridge	12	0.005	0.005	0.001	0.007	0.003	-0.52	0.005
Whakamaru Tailrace	12	0.006	0.007	0.003	0.009	0.003	-0.05	0.007
Waipapa Tailrace	12	0.010	0.010	0.004	0.015	0.002	-0.35	0.010
Narrow s	12	0.012	0.011	0.007	0.021	0.006	0.93	0.011
Horotiu Bridge	12	0.013	0.012	0.007	0.021	0.007	0.52	0.012
Huntly-Tainui Bridge	12	0.019	0.020	0.010	0.031	0.009	0.31	0.018
Mercer Bridge	12	0.023	0.021	0.008	0.047	0.017	0.61	0.021
Tuakau Bridge	12	0.026	0.025	0.009	0.048	0.021	0.26	0.024

Absorbance of filtered sample at 440 nm (units: /cm)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Ohaaki Bridge	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Ohakuri Tailrace Bridge	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Whakamaru Tailrace	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Waipapa Tailrace	12	0.002	0.001	0.001	0.003	0.001	0.93	0.001
Narrow s	12	0.002	0.002	0.001	0.005	0.002	0.93	0.002
Horotiu Bridge	12	0.002	0.002	0.001	0.004	0.002	0.49	0.002
Huntly-Tainui Bridge	12	0.003	0.003	0.001	0.005	0.003	-0.28	0.003
Mercer Bridge	12	0.004	0.004	0.001	0.008	0.003	0.34	0.004
Tuakau Bridge	12	0.004	0.005	0.001	0.009	0.004	0.23	0.004

Arsenic - Total (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.011	0.012	0.010	0.013	0.001	-0.40	0.011
Ohaaki Bridge	12	0.029	0.027	0.021	0.044	0.008	0.97	0.027
Ohakuri Tailrace Bridge	12	0.033	0.034	0.027	0.038	0.005	-0.17	0.032
Whakamaru Tailrace	12	0.032	0.032	0.024	0.035	0.004	-1.31	0.031
Waipapa Tailrace	12	0.027	0.027	0.022	0.030	0.004	-0.21	0.026
Narrow s	12	0.024	0.025	0.017	0.030	0.006	-0.30	0.023
Horotiu Bridge	12	0.024	0.024	0.018	0.030	0.007	0.26	0.023
Huntly-Tainui Bridge	12	0.017	0.018	0.009	0.024	0.009	-0.31	0.018
Mercer Bridge	12	0.017	0.017	0.011	0.024	0.007	-0.01	0.017
Tuakau Bridge	12	0.017	0.016	0.009	0.025	0.009	0.25	0.017

Boron (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.17	0.17	0.16	0.18	0.01	0.41	0.17
Ohaaki Bridge	12	0.32	0.29	0.23	0.43	0.15	0.45	0.28
Ohakuri Tailrace Bridge	12	0.36	0.36	0.28	0.41	0.07	-0.32	0.33
Whakamaru Tailrace	12	0.34	0.35	0.30	0.39	0.05	-0.17	0.33
Waipapa Tailrace	12	0.30	0.30	0.25	0.34	0.03	-0.18	0.28
Narrow s	12	0.25	0.26	0.20	0.30	0.04	-0.29	0.25
Horotiu Bridge	12	0.27	0.28	0.22	0.31	0.03	-0.31	0.26
Huntly-Tainui Bridge	12	0.21	0.22	0.12	0.29	0.07	-0.15	0.20
Mercer Bridge	12	0.22	0.22	0.16	0.30	0.06	0.25	0.20
Tuakau Bridge	12	0.21	0.21	0.15	0.30	0.07	0.32	0.20

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Black Disk (m)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	12	4.2	4.3	1.9	5.8	1.6	-0.48	3.6
Ohakuri Tailrace Bridge	12	2.4	2.2	1.2	4.5	1.1	0.95	2.2
Whakamaru Tailrace	12	2.3	2.1	1.0	4.1	1.2	0.59	1.8
Waipapa Tailrace	12	2.1	1.9	1.1	3.0	1.0	0.13	1.8
Narrow s	12	1.8	1.8	1.2	2.4	0.6	0.01	1.5
Horotiu Bridge	12	1.6	1.6	0.9	1.9	0.3	-1.20	1.2
Huntly-Tainui Bridge	12	0.9	1.0	0.3	1.4	0.4	-0.29	0.9
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	0.7	0.7	0.4	1.0	0.3	0.08	0.6

Biochemical Oxygen Demand - 5 day (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.7	0.6	0.2	2.7	0.5	<u>2.46</u>	0.7
Ohaaki Bridge	12	0.8	0.7	0.2	2.5	0.3	<u>2.35</u>	0.7
Ohakuri Tailrace Bridge	12	1.0	0.9	0.4	3.0	0.5	<u>2.13</u>	0.8
Whakamaru Tailrace	12	1.0	1.0	0.5	1.5	0.5	0.11	1.0
Waipapa Tailrace	12	0.9	0.9	0.4	1.8	0.7	0.54	0.8
Narrow s	12	0.9	0.9	0.5	1.2	0.4	-0.29	1.0
Horotiu Bridge	12	0.9	1.0	0.4	1.3	0.4	-0.64	1.0
Huntly-Tainui Bridge	12	1.3	1.2	0.6	3.0	0.5	1.40	1.0
Mercer Bridge	12	1.3	1.3	0.8	2.3	0.6	0.70	1.2
Tuakau Bridge	12	1.3	1.2	0.8	2.1	0.5	0.69	1.2

Carbon - Dissolved Organic (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	1.23	1.25	0.60	1.80	0.45	-0.09	0.90
Ohaaki Bridge	12	1.29	1.20	0.80	1.90	0.25	0.64	1.00
Ohakuri Tailrace Bridge	12	1.41	1.30	1.00	2.80	0.25	<u>2.48</u>	1.10
Whakamaru Tailrace	12	1.50	1.45	1.00	1.90	0.50	0.02	1.20
Waipapa Tailrace	12	1.73	1.75	1.30	2.00	0.55	-0.34	1.40
Narrow s	12	1.92	1.85	1.50	2.40	0.50	0.31	1.50
Horotiu Bridge	12	2.00	2.00	1.50	2.50	0.60	0.12	1.60
Huntly-Tainui Bridge	12	2.44	2.45	1.60	3.60	0.75	0.24	2.00
Mercer Bridge	12	2.83	2.90	1.60	5.10	1.45	0.61	2.25
Tuakau Bridge	12	3.08	3.10	1.70	4.90	1.85	0.31	2.40

Carbon - Total Organic (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	1.37	1.40	0.90	2.20	0.60	0.54	1.20
Ohaaki Bridge	12	1.40	1.30	1.10	1.90	0.40	0.85	1.17
Ohakuri Tailrace Bridge	12	1.68	1.60	1.30	2.90	0.35	<u>2.06</u>	1.40
Whakamaru Tailrace	12	1.81	1.75	1.50	2.50	0.25	1.25	1.50
Waipapa Tailrace	12	2.01	2.00	1.70	2.40	0.20	0.59	1.70
Narrow s	12	2.20	2.25	1.80	2.70	0.55	0.11	1.90
Horotiu Bridge	12	2.28	2.10	1.80	2.80	0.75	0.37	2.10
Huntly-Tainui Bridge	12	3.10	2.90	1.80	6.40	1.00	<u>1.84</u>	2.70
Mercer Bridge	12	3.88	3.65	2.00	8.00	2.10	1.00	3.50
Tuakau Bridge	12	4.21	4.20	2.30	6.10	1.80	0.04	3.50

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Chloride (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	8	8	8	9	0	-0.10	8
Ohaaki Bridge	12	18	16	14	28	7	0.97	17
Ohakuri Tailrace Bridge	12	21	22	17	26	3	-0.06	20
Whakamaru Tailrace	12	21	21	17	27	3	1.04	20
Waipapa Tailrace	12	19	19	17	22	3	-0.03	19
Narrow s	12	19	19	16	21	4	0.09	18
Horotiu Bridge	12	19	19	16	21	3	-0.06	18
Huntly-Tainui Bridge	12	17	17	15	20	3	0.17	17
Mercer Bridge	12	18	18	16	20	3	-0.08	17
Tuakau Bridge	12	18	18	16	20	3	-0.02	17

Chlorophyll a (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.002	0.002	0.002	0.002	0.000	1.00	0.002
Ohaaki Bridge	12	0.002	0.002	0.002	0.002	0.000	1.00	0.002
Ohakuri Tailrace Bridge	12	0.004	0.004	0.002	0.007	0.005	0.07	0.003
Whakamaru Tailrace	12	0.019	0.006	0.002	0.148	0.008	<u>2.92</u>	0.006
Waipapa Tailrace	12	0.006	0.004	0.002	0.013	0.006	0.91	0.004
Narrow s	12	0.006	0.005	0.002	0.015	0.005	0.97	0.007
Horotiu Bridge	12	0.006	0.004	0.002	0.014	0.009	0.68	0.008
Huntly-Tainui Bridge	12	0.006	0.005	0.002	0.011	0.005	0.35	0.006
Mercer Bridge	12	0.010	0.009	0.002	0.025	0.005	1.23	0.010
Tuakau Bridge	12	0.013	0.011	0.002	0.033	0.007	1.23	0.012

Colour (Munsell Colour Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	12	51.0	50.0	42.5	62.5	7.5	0.26	50.0
Ohakuri Tailrace Bridge	12	41.2	41.0	32.5	55.0	8.8	0.67	40.0
Whakamaru Tailrace	12	38.5	40.0	22.5	47.5	6.0	-1.34	40.0
Waipapa Tailrace	12	37.7	37.5	32.5	42.5	5.0	0.10	37.5
Narrow s	12	37.1	37.5	32.5	42.5	3.8	0.34	35.0
Horotiu Bridge	12	36.0	36.3	30.0	42.5	7.5	0.09	35.0
Huntly-Tainui Bridge	12	34.0	33.8	27.5	45.0	10.0	0.39	35.0
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	32.1	32.5	22.5	42.5	11.3	-0.07	30.0

Conductivity at 25 °C (ms/m)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	11.9	11.9	11.7	12.0	0.2	-0.27	11.9
Ohaaki Bridge	12	15.9	14.9	13.8	20.0	2.8	0.87	15.2
Ohakuri Tailrace Bridge	12	17.8	18.1	15.6	19.7	1.7	-0.35	17.2
Whakamaru Tailrace	12	17.4	17.4	16.2	19.2	1.2	0.44	17.0
Waipapa Tailrace	12	16.7	16.8	15.5	17.7	1.3	-0.23	16.2
Narrow s	12	16.3	16.6	15.0	17.3	1.7	-0.39	15.8
Horotiu Bridge	12	16.5	16.8	15.2	17.5	1.5	-0.34	15.9
Huntly-Tainui Bridge	12	15.5	15.5	13.4	17.4	1.8	-0.08	15.0
Mercer Bridge	12	16.1	16.3	14.6	17.5	1.8	-0.11	15.7
Tuakau Bridge	12	16.3	16.3	14.9	18.6	1.8	0.46	15.7

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Dissolved Oxygen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	9.6	9.4	9.0	10.3	0.9	0.36	9.7
Ohaaki Bridge	12	9.4	9.1	8.1	11.4	1.7	0.68	9.6
Ohakuri Tailrace Bridge	12	9.3	9.1	8.2	10.7	1.3	0.27	9.8
Whakamaru Tailrace	12	9.6	9.3	8.2	11.2	1.7	0.42	10.3
Waipapa Tailrace	12	9.5	9.1	8.4	10.8	1.8	0.24	9.8
Narrow s	12	9.5	9.0	8.1	11.2	2.3	0.36	9.9
Horotiu Bridge	12	9.3	9.1	7.9	10.9	2.4	0.14	9.7
Huntly-Tainui Bridge	12	9.2	8.8	8.2	10.5	2.0	0.31	9.5
Mercer Bridge	12	9.2	9.0	8.2	10.2	1.4	0.22	9.5
Tuakau Bridge	12	9.3	9.4	8.3	10.4	0.9	0.07	9.5

Dissolved Oxygen (% Saturation)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	98.7	98.7	91.8	103.7	8.3	-0.12	99.7
Ohaaki Bridge	12	98.0	96.9	93.3	105.3	7.1	0.59	102.6
Ohakuri Tailrace Bridge	12	98.3	98.7	86.9	112.5	7.8	0.17	101.3
Whakamaru Tailrace	12	100.5	99.5	87.1	117.5	11.5	0.27	103.8
Waipapa Tailrace	12	98.1	98.7	87.2	107.0	6.8	-0.33	101.4
Narrow s	12	95.3	93.5	89.2	107.0	6.7	1.01	97.6
Horotiu Bridge	12	94.2	92.9	87.4	106.3	9.5	0.68	97.1
Huntly-Tainui Bridge	12	93.3	93.1	81.2	103.2	4.6	-0.47	96.0
Mercer Bridge	12	94.1	94.4	83.5	100.6	4.6	-0.67	95.9
Tuakau Bridge	12	96.5	97.0	81.5	111.7	9.2	0.07	97.2

Enterococci (cfu/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	5	1	1	24	5	<u>1.8</u>	1
Ohaaki Bridge	12	25	10	1	110	23	<u>1.7</u>	8
Ohakuri Tailrace Bridge	12	3	1	1	13	3	<u>2.2</u>	2
Whakamaru Tailrace	12	43	8	1	270	13	<u>2.0</u>	6
Waipapa Tailrace	12	21	4	1	100	32	1.6	4
Narrow s	12	44	33	3	120	38	1.0	31
Horotiu Bridge	12	62	40	2	230	75	1.5	54
Huntly-Tainui Bridge	12	201	27	9	1700	103	<u>2.9</u>	48
Mercer Bridge	12	49	16	5	390	17	<u>3.0</u>	27
Tuakau Bridge	12	86	14	2	510	33	<u>1.9</u>	27

Escherichia coli (cfu/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	6	3	1	22	8	1.3	2
Ohaaki Bridge	12	24	20	4	59	27	0.6	13
Ohakuri Tailrace Bridge	12	4	3	1	15	4	<u>1.7</u>	3
Whakamaru Tailrace	12	58	11	4	500	29	<u>2.9</u>	7
Waipapa Tailrace	12	14	8	1	47	19	1.1	8
Narrow s	12	65	52	21	180	52	1.5	40
Horotiu Bridge	12	149	85	10	800	150	<u>2.4</u>	105
Huntly-Tainui Bridge	12	366	80	36	1900	395	<u>2.0</u>	105
Mercer Bridge	12	217	55	20	1500	116	<u>2.7</u>	95
Tuakau Bridge	12	294	110	40	1600	275	<u>2.4</u>	100

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Faecal Coliforms (cfu/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	7	3	1	22	12	1.0	2
Ohaaki Bridge	12	28	22	4	73	33	0.7	14
Ohakuri Tailrace Bridge	12	5	3	1	22	4	<u>2.4</u>	3
Whakamaru Tailrace	12	117	11	4	1200	34	<u>3.0</u>	7
Waipapa Tailrace	12	15	9	1	47	21	0.9	9
Narrow s	12	76	59	26	200	61	1.3	51
Horotiu Bridge	12	160	105	20	800	150	<u>2.4</u>	135
Huntly-Tainui Bridge	12	420	95	45	2300	410	<u>2.2</u>	120
Mercer Bridge	12	231	71	35	1500	125	<u>2.6</u>	120
Tuakau Bridge	12	580	125	50	3300	370	<u>2.0</u>	105

Lithium (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.040	0.040	0.037	0.043	0.002	0.280	0.040
Ohaaki Bridge	12	0.096	0.089	0.072	0.150	0.036	0.887	0.089
Ohakuri Tailrace Bridge	12	0.124	0.125	0.091	0.155	0.025	-0.209	0.119
Whakamaru Tailrace	12	0.122	0.122	0.100	0.161	0.019	0.893	0.120
Waipapa Tailrace	12	0.104	0.110	0.085	0.119	0.016	-0.583	0.100
Narrow s	12	0.092	0.092	0.069	0.109	0.016	-0.206	0.090
Horotiu Bridge	12	0.096	0.098	0.078	0.109	0.012	-0.345	0.092
Huntly-Tainui Bridge	12	0.070	0.072	0.041	0.100	0.025	-0.058	0.067
Mercer Bridge	12	0.071	0.072	0.052	0.100	0.024	0.342	0.064
Tuakau Bridge	12	0.069	0.066	0.044	0.101	0.022	0.306	0.065

Nitrate/Nitrite Nitrogen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.002	0.001	0.001	0.007	0.002	1.41	0.001
Ohaaki Bridge	12	0.063	0.048	0.018	0.290	0.025	<u>2.79</u>	0.039
Ohakuri Tailrace Bridge	12	0.090	0.119	0.001	0.174	0.104	-0.23	0.086
Whakamaru Tailrace	12	0.115	0.094	0.021	0.270	0.119	0.62	0.101
Waipapa Tailrace	12	0.204	0.196	0.119	0.340	0.120	0.34	0.164
Narrow s	12	0.282	0.270	0.126	0.500	0.143	0.29	0.240
Horotiu Bridge	12	0.301	0.285	0.151	0.530	0.146	0.46	0.260
Huntly-Tainui Bridge	12	0.504	0.425	0.250	1.240	0.300	1.43	0.360
Mercer Bridge	12	0.446	0.395	0.147	0.850	0.335	0.47	0.355
Tuakau Bridge	12	0.401	0.370	0.059	0.830	0.369	0.30	0.330

Nitrogen - Ammoniacal (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.005	0.005	0.005	0.005	0.000	1.00	0.005
Ohaaki Bridge	12	0.009	0.005	0.005	0.020	0.009	0.82	0.005
Ohakuri Tailrace Bridge	12	0.008	0.005	0.005	0.017	0.007	1.02	0.005
Whakamaru Tailrace	12	0.008	0.005	0.005	0.023	0.003	<u>1.84</u>	0.005
Waipapa Tailrace	12	0.019	0.021	0.005	0.040	0.025	0.16	0.015
Narrow s	12	0.018	0.018	0.005	0.035	0.020	0.25	0.016
Horotiu Bridge	12	0.014	0.013	0.005	0.030	0.017	0.48	0.012
Huntly-Tainui Bridge	12	0.020	0.018	0.005	0.055	0.010	1.40	0.013
Mercer Bridge	12	0.008	0.005	0.005	0.037	0.000	<u>3.02</u>	0.005
Tuakau Bridge	12	0.008	0.005	0.005	0.018	0.006	1.16	0.005

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Nitrogen - Total Kjeldahl (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.086	0.060	0.025	0.340	0.058	<u>2.32</u>	0.070
Ohaaki Bridge	12	0.086	0.080	0.025	0.130	0.040	-0.36	0.083
Ohakuri Tailrace Bridge	12	0.118	0.100	0.060	0.320	0.060	<u>2.22</u>	0.110
Whakamaru Tailrace	12	0.168	0.150	0.080	0.280	0.090	0.64	0.150
Waipapa Tailrace	12	0.128	0.130	0.070	0.170	0.080	-0.16	0.140
Narrow s	12	0.166	0.155	0.130	0.250	0.045	1.12	0.170
Horotiu Bridge	12	0.171	0.160	0.120	0.240	0.050	0.55	0.190
Huntly-Tainui Bridge	12	0.262	0.220	0.140	0.530	0.155	1.11	0.225
Mercer Bridge	12	0.302	0.330	0.080	0.540	0.165	0.04	0.315
Tuakau Bridge	12	0.289	0.265	0.180	0.490	0.130	0.82	0.300

Nitrogen - Total (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.089	0.062	0.026	0.347	0.059	<u>2.33</u>	0.075
Ohaaki Bridge	12	0.150	0.138	0.045	0.410	0.041	<u>2.21</u>	0.122
Ohakuri Tailrace Bridge	12	0.208	0.214	0.090	0.352	0.129	0.01	0.225
Whakamaru Tailrace	12	0.284	0.276	0.142	0.444	0.139	0.12	0.271
Waipapa Tailrace	12	0.331	0.341	0.217	0.470	0.100	0.10	0.331
Narrow s	12	0.448	0.430	0.277	0.640	0.208	0.21	0.430
Horotiu Bridge	12	0.472	0.455	0.312	0.700	0.160	0.52	0.446
Huntly-Tainui Bridge	12	0.766	0.660	0.410	1.770	0.450	1.46	0.585
Mercer Bridge	12	0.747	0.745	0.330	1.340	0.437	0.34	0.692
Tuakau Bridge	12	0.690	0.600	0.339	1.190	0.573	0.40	0.635

pH (pH Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	7.6	7.7	6.8	7.9	0.3	-1.57	7.7
Ohaaki Bridge	12	7.2	7.2	6.9	7.6	0.3	0.48	7.3
Ohakuri Tailrace Bridge	12	7.3	7.3	6.9	7.6	0.3	-0.13	7.3
Whakamaru Tailrace	12	7.4	7.4	7.2	7.7	0.2	0.34	7.5
Waipapa Tailrace	12	7.4	7.4	7.2	7.5	0.2	-0.22	7.4
Narrow s	12	7.5	7.4	7.1	8.0	0.2	0.78	7.5
Horotiu Bridge	12	7.4	7.4	7.2	7.8	0.4	0.37	7.5
Huntly-Tainui Bridge	12	7.4	7.5	7.0	7.8	0.4	-0.14	7.5
Mercer Bridge	12	7.5	7.6	7.1	7.7	0.4	-0.55	7.5
Tuakau Bridge	12	7.4	7.4	7.0	8.0	0.5	0.25	7.4

Phosphorus - Dissolved Reactive (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.002	0.002	0.002	0.002	0.000	-1.00	0.002
Ohaaki Bridge	12	0.008	0.008	0.004	0.014	0.004	0.51	0.006
Ohakuri Tailrace Bridge	12	0.010	0.011	0.002	0.020	0.005	0.15	0.009
Whakamaru Tailrace	12	0.009	0.009	0.002	0.015	0.007	-0.12	0.009
Waipapa Tailrace	12	0.016	0.017	0.009	0.022	0.005	-0.56	0.016
Narrow s	12	0.016	0.017	0.008	0.023	0.011	-0.19	0.016
Horotiu Bridge	12	0.018	0.019	0.011	0.025	0.010	-0.22	0.021
Huntly-Tainui Bridge	12	0.019	0.020	0.013	0.025	0.006	-0.19	0.021
Mercer Bridge	12	0.016	0.017	0.006	0.025	0.010	-0.01	0.018
Tuakau Bridge	12	0.011	0.012	0.004	0.018	0.006	-0.25	0.015

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Phosphorus - Total (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.004	0.003	0.002	0.009	0.004	0.66	0.003
Ohaaki Bridge	12	0.013	0.012	0.008	0.022	0.008	0.70	0.010
Ohakuri Tailrace Bridge	12	0.017	0.018	0.007	0.025	0.006	-0.29	0.019
Whakamaru Tailrace	12	0.020	0.020	0.012	0.030	0.006	0.44	0.021
Waipapa Tailrace	12	0.025	0.024	0.020	0.035	0.005	1.04	0.026
Narrow s	12	0.028	0.029	0.018	0.043	0.006	0.92	0.029
Horotiu Bridge	12	0.032	0.031	0.024	0.047	0.011	0.65	0.038
Huntly-Tainui Bridge	12	0.045	0.038	0.033	0.107	0.008	<u>2.60</u>	0.049
Mercer Bridge	12	0.047	0.043	0.031	0.089	0.022	1.42	0.056
Tuakau Bridge	12	0.093	0.051	0.034	0.480	0.035	<u>2.83</u>	0.057

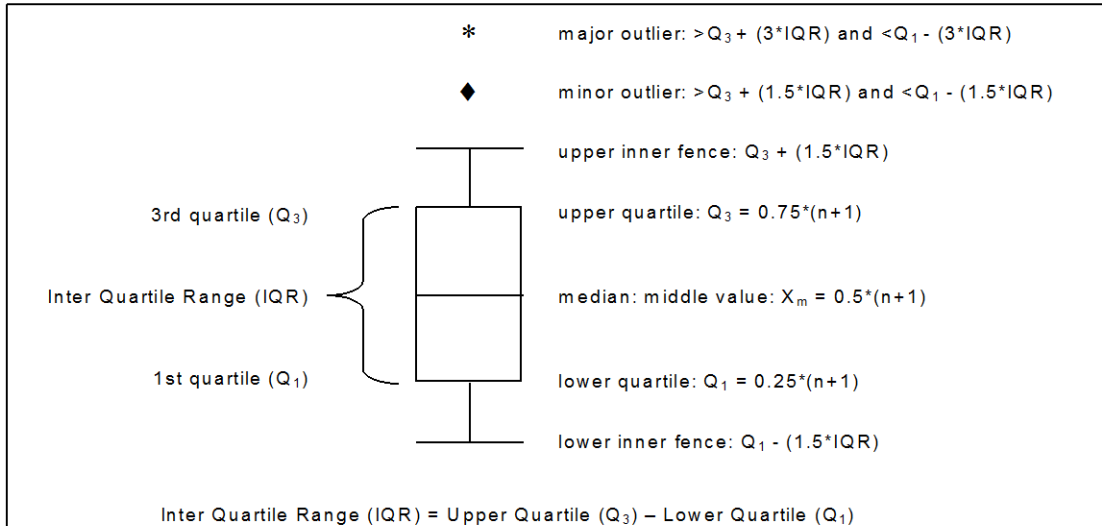
Temperature (°C)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	15.1	14.8	10.7	19.2	6.5	-0.01	14.7
Ohaaki Bridge	12	16.4	17.0	11.2	20.8	6.3	-0.15	15.9
Ohakuri Tailrace Bridge	12	16.7	16.8	12.3	20.7	7.2	-0.08	16.4
Whakamaru Tailrace	12	16.9	16.8	11.9	21.5	7.2	-0.04	16.5
Waipapa Tailrace	12	16.6	16.4	11.6	21.7	7.3	0.02	16.1
Narrow s	12	16.4	17.1	11.1	21.3	7.5	-0.18	16.2
Horotiu Bridge	12	16.5	16.5	11.0	21.2	7.7	-0.07	15.8
Huntly-Tainui Bridge	12	16.7	16.0	10.6	22	7.4	0.03	15.5
Mercer Bridge	12	17.0	16.4	10.7	21	7.4	-0.09	16.6
Tuakau Bridge	12	17.3	16.7	10.8	23.0	8.4	-0.01	16.6

Dissolved Solids - Total (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	87.2	87.0	77.0	96.0	6.5	-0.27	87.0
Ohaaki Bridge	12	116.5	110.5	92.0	151.0	21.5	0.59	110.0
Ohakuri Tailrace Bridge	12	129.2	128.5	113.0	143.0	13.0	-0.20	125.5
Whakamaru Tailrace	12	130.8	130.0	119.0	146.0	6.0	0.67	129.0
Waipapa Tailrace	12	127.2	126.5	121.0	137.0	7.0	0.64	123.5
Narrow s	12	126.3	126.0	116.0	143.0	9.5	0.66	120.5
Horotiu Bridge	12	123.5	124.0	104.0	139.0	7.5	-0.59	121.0
Huntly-Tainui Bridge	12	117.4	117.5	103.0	139	14.0	0.53	113.5
Mercer Bridge	12	124.2	124.5	115.0	139	11.0	0.51	118.5
Tuakau Bridge	12	124.3	125.0	113.0	132.0	11.5	-0.30	119.0

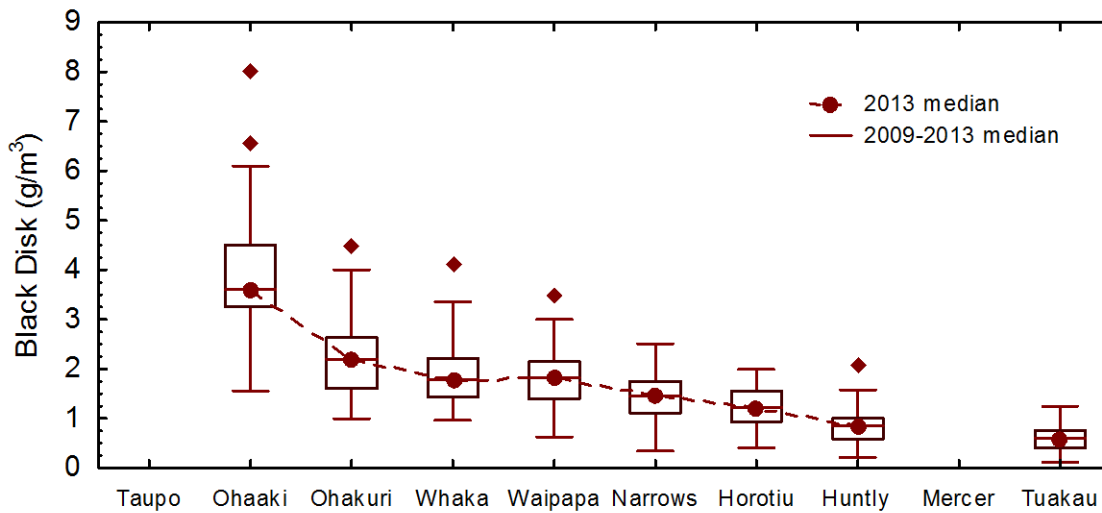
Turbidity (NTU)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.6	0.4	0.3	1.6	0.6	1.09	0.5
Ohaaki Bridge	12	1.0	0.7	0.4	3.5	0.4	<u>2.32</u>	0.7
Ohakuri Tailrace Bridge	12	0.9	0.9	0.7	1.7	0.2	<u>2.14</u>	1.0
Whakamaru Tailrace	12	1.2	1.1	0.8	2.2	0.6	1.00	1.2
Waipapa Tailrace	12	1.3	1.3	0.8	2.2	0.5	0.94	1.3
Narrow s	12	2.1	1.9	1.6	4.4	0.5	<u>2.34</u>	2.1
Horotiu Bridge	12	2.5	2.3	1.7	4.3	1.0	1.06	2.6
Huntly-Tainui Bridge	12	8.2	4.9	1.9	41	4.5	<u>2.70</u>	5.9
Mercer Bridge	12	9.9	7.2	3.3	37	7.3	<u>2.27</u>	10.0
Tuakau Bridge	12	10.8	8.9	2.7	38.0	6.3	<u>2.14</u>	8.9

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

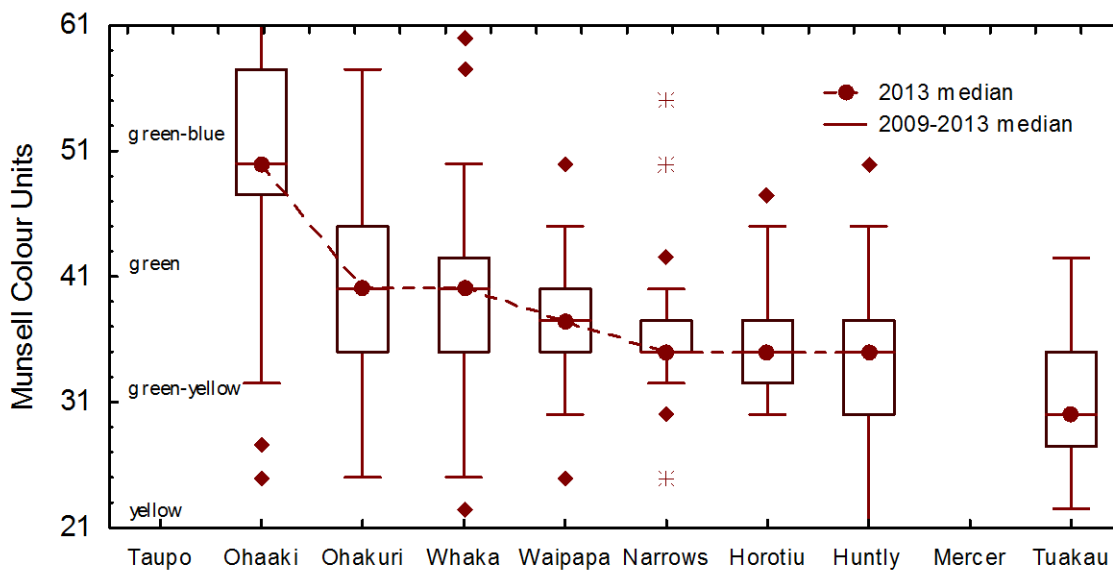
Boxplots are used to present data



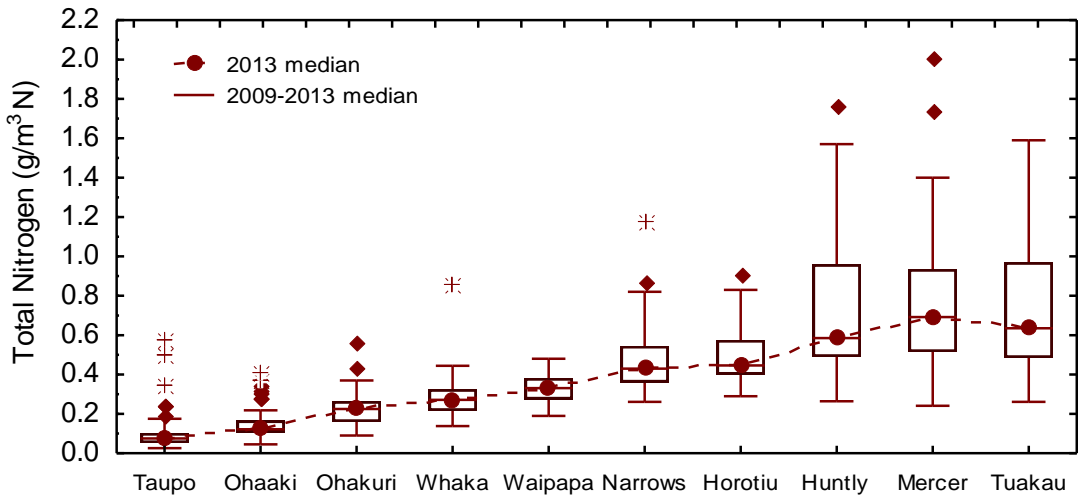
Black Disk, 2009-2013 Data



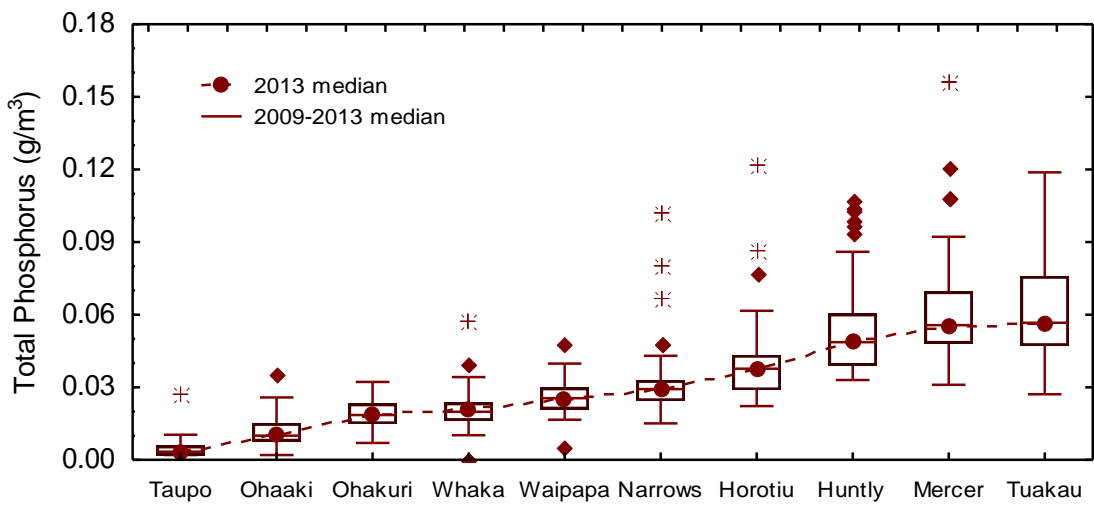
Colour, 2009-2013 Data



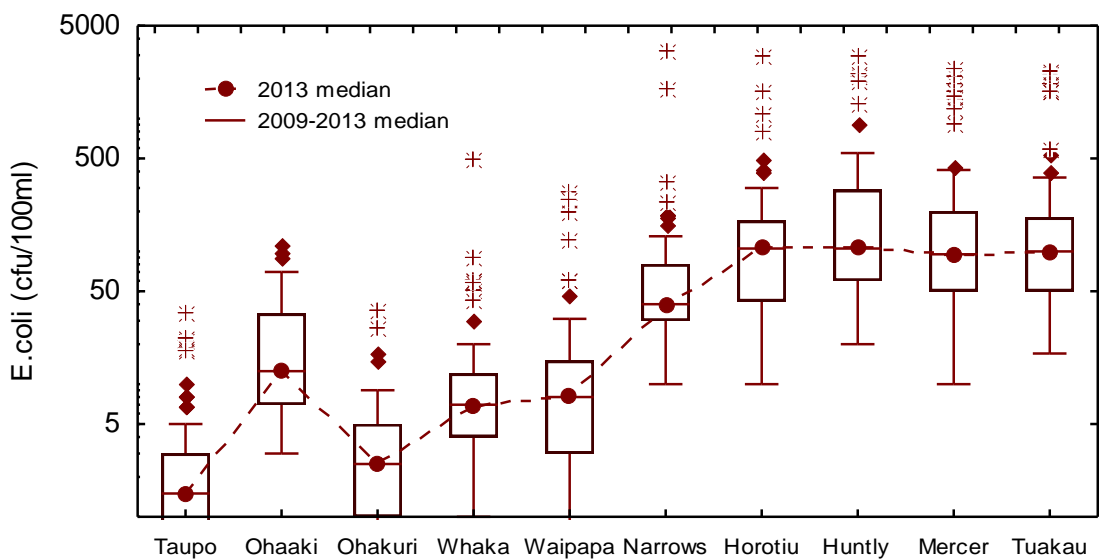
Total Nitrogen, 2009-2013 Data



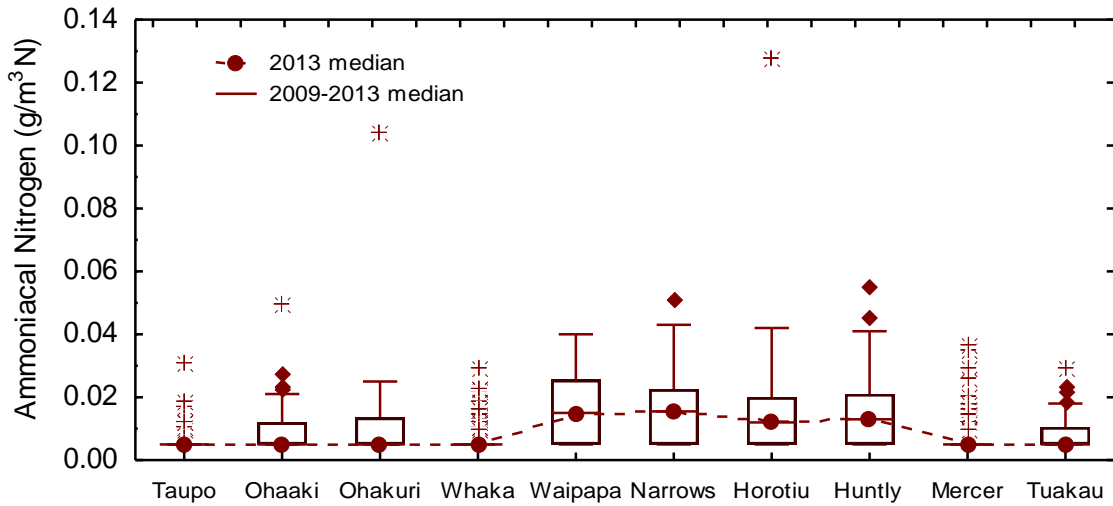
Total Phosphorus, 2009-2013 Data



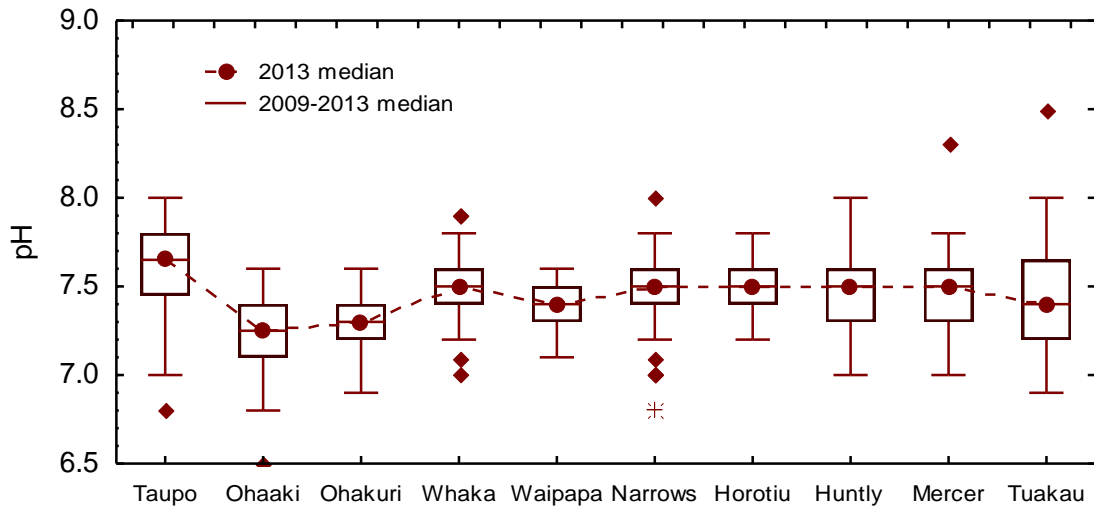
E.coli, 2009-2013 Data



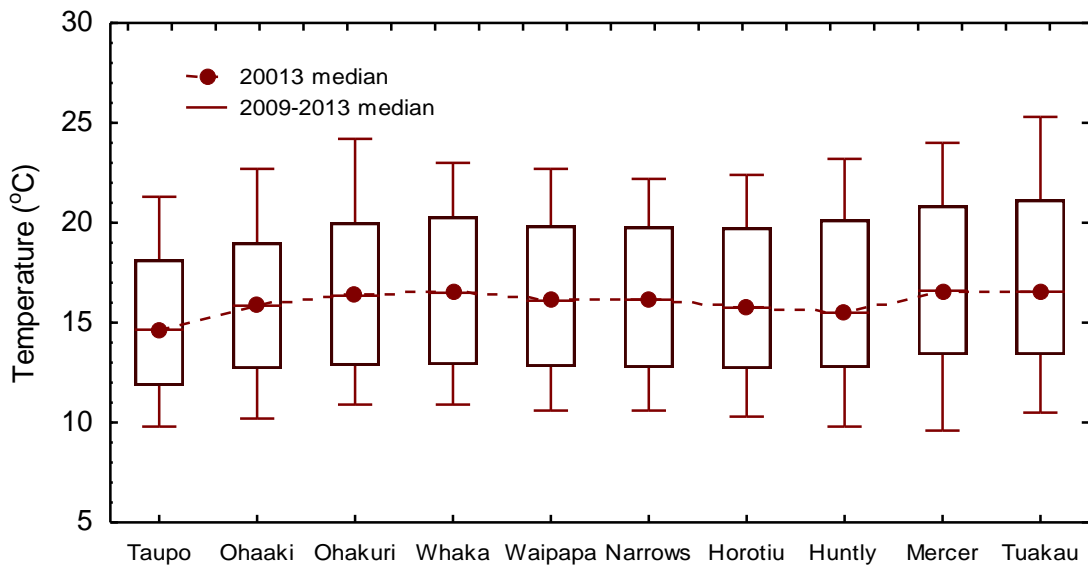
Ammoniacal Nitrogen, 2009-2013 Data



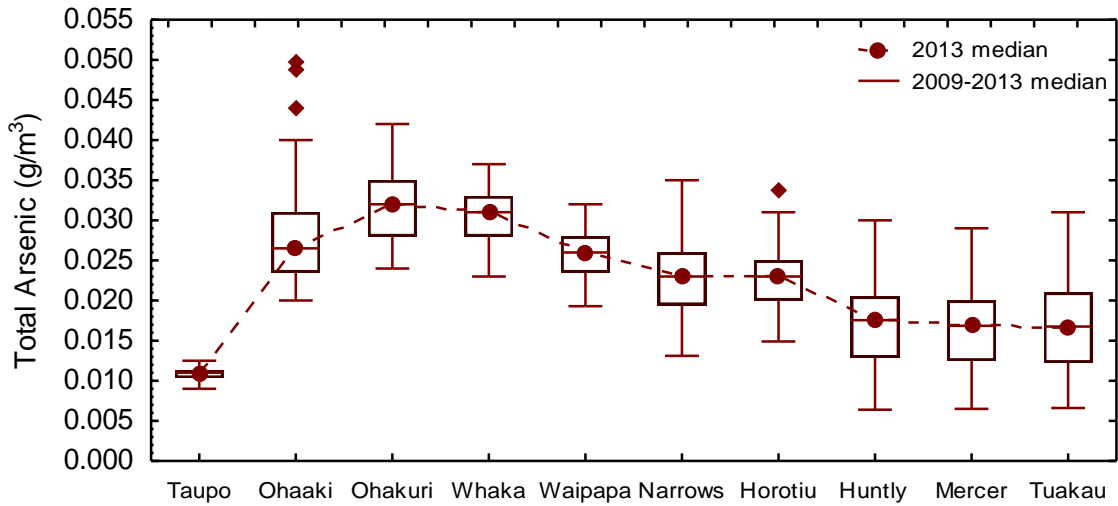
pH, 2009-2013 Data



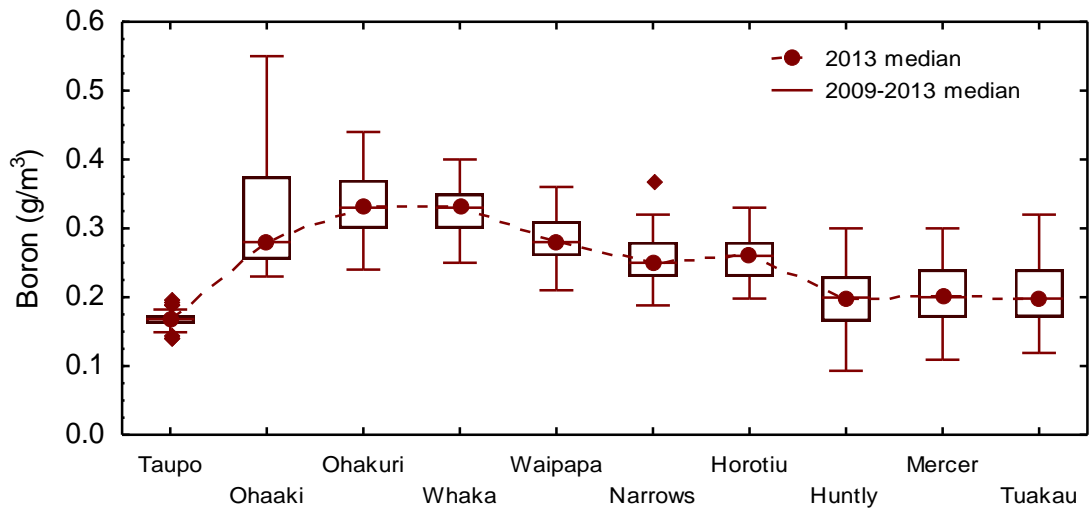
Temperature, 2009-2013 Data



Total Arsenic, 2009-2013 Data



Boron, 2009-2013 Data



Dissolved Oxygen, 2009-2013 Data

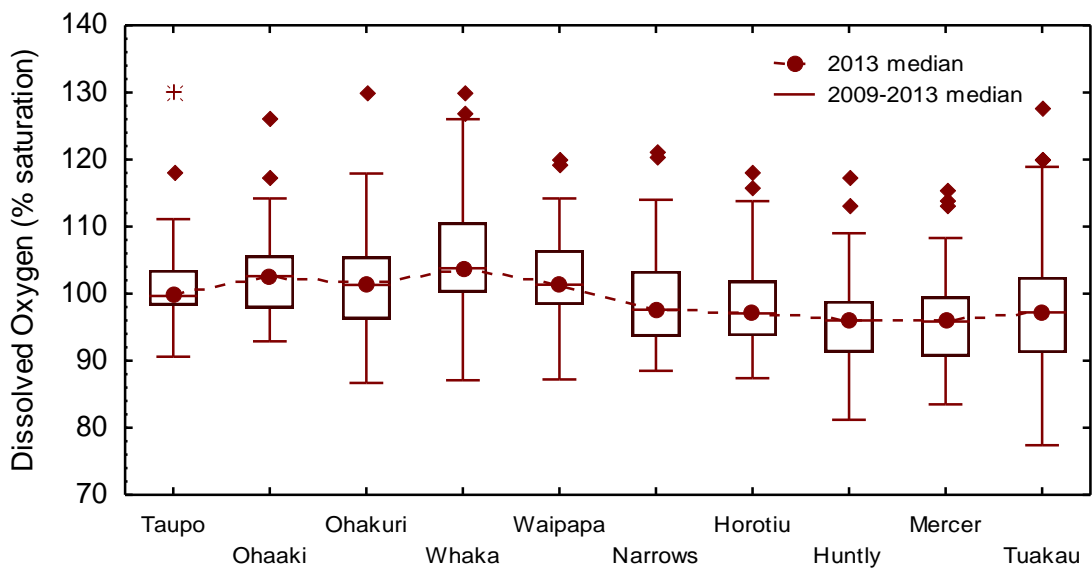


Table 3: Samples (year 2013) complying with the 'satisfactory' water quality guidelines and standards. n = 12 (except * where n = 11).

Location	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			water supply	drinking water	
	DO	pH	Turb	NH ₄ N	Temp	TP	TN	Bk ¹ Disk	E coli	Median E coli	CHLa	As	B
Taupo Gates	12	12	12	12	10	12	12	-	12	Y	12	0	12
Ohaaki Bridge	12	12	12	12	6	12	12	12/12	12	Y	12	0	12
Ohakuri Tailrace Br	12	12	12	12	3	12	12	11/12	12	Y	12	0	12
Whakamaru Tailrace	12	12	12	12	3	12	12	10/12	12	Y	10	0	12
Waipapa Tailrace	12	12	12	12	4	12	12	9/12	12	Y	12	0	12
Hamilton – Narrows	12	12	12	12	7	12	8	8/12	12	Y	12	0	12
Horotiu Bridge	12	12	12	12	5	12	7	7/12	11	Y	12	0	12
Huntly – Tainui Br	12	12	6	12	4	8	4	0/12	9	Y	12	0	12
Mercer Bridge	12	12	5	12	3	5	3	-	11	Y	11	0	12
Tuakau Bridge	12	12	3	12	3	2	5	0/12	10	Y	10	0	12

¹ samples complying with the baseflow water clarity guideline from the number of samples measured when flow was below the upper decile of all flows

Table 4: Samples (year 2013) complying with the 'excellent' water quality guidelines and standards.

Location	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			water supply	Drinking water	
	DO	pH	Turb	NH ₄ N	Temp	TP	TN	Bk ¹ Disk	E coli	Median E coli	CHLa	As	B
Taupo Gates	12	11	12	12	2	12	9	-	12	Y	12	n/a	n/a
Ohaaki Bridge	12	10	11	12	1	5	2	7/12	11	Y	12	n/a	n/a
Ohakuri Tailrace Br	10	11	12	12	1	1	1	1/12	12	Y	8	n/a	n/a
Whakamaru Tailrace	10	12	11	12	1	0	0	1/12	9	Y	5	n/a	n/a
Waipapa Tailrace	11	12	11	12	1	0	0	0/12	12	Y	8	n/a	n/a
Hamilton – Narrows	11	12	9	12	1	0	0	0/12	6	N	8	n/a	n/a
Horotiu Bridge	8	12	6	12	1	0	0	0/12	5	N	7	n/a	n/a
Huntly – Tainui Br	12	12	1	12	1	0	0	0/12	1	N	7	n/a	n/a
Mercer Bridge	10	12	0	12	1	0	0	-	6	N	4	n/a	n/a
Tuakau Bridge	10	12	0	12	1	0	0	0/12	2	N	2	n/a	n/a

¹ samples complying with the baseflow water clarity guideline from the number of samples measured when flow was below the upper decile of all flows

DATE	TIME*	FLOW	BDISK	COLOR	COND	pH	TEMP	DO	PCDO	BOD5	TURB	TDS	NNN	NO3-N	NH4-N
dd/mm/yy	hh:mm	m ³ /s	m	units	m S/m	units	°C	g/m ³	%Sat	g/m ³	NTU	g/m ³	g/m ³	g/m ³	g/m ³
Satisfactory Water Quality			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
Guideline/Standard							<20 (Oct-Apr)								

1131-127 UD = 580 m³/s (Flows from "Reids Farm")

Waikato River at Taupo Control Gates

8/01/2013	8:30 a.m.	90	-	-	11.8	7.8	18.0	9.3	103.6	0.4	1.38	96	0.006	0.005	<0.01
5/02/2013	9:15 a.m.	109	-	-	11.8	6.8	18.4	9.0	101.4	<0.4	0.25	81	<0.002	<0.002	<0.01
5/03/2013	8:55 a.m.	196	-	-	11.9	7.9	19.2	9.1	103.0	<0.4	0.31	84	<0.002	<0.002	<0.01
2/04/2013	8:50 a.m.	54	-	-	12.0	7.8	18.9	9.3	103.7	2.7	1.12	87	0.007	0.007	<0.01
7/05/2013	9:20 a.m.	78	-	-	12.0	7.6	<u>15.8</u>	9.1	95.7	0.8	0.34	87	<0.002	<0.002	<0.01
4/06/2013	9:20 a.m.	205	-	-	11.8	7.7	<u>13.4</u>	9.1	91.8	0.5	0.50	91	<0.002	<0.002	<0.01
2/07/2013	9:33 a.m.	96	-	-	11.7	7.6	11.7	10.0	94.1	<0.4	0.27	85	0.003	0.003	<0.01
9/08/2013	9:20 a.m.	185	-	-	11.9	7.6	11.3	10.0	94.3	<0.4	0.34	91	<0.002	<0.002	<0.01
3/09/2013	8:58 a.m.	244	-	-	11.9	7.4	10.7	10.3	95.6	0.7	0.47	77	<0.002	<0.002	<0.01
1/10/2013	8:00 a.m.	200	-	-	12.0	7.3	11.8	10.3	98.8	0.6	0.67	90	0.003	0.003	<0.01
5/11/2013	8:10 a.m.	75	-	-	12.0	7.7	13.7	9.8	98.5	0.7	1.55	92	<0.002	<0.002	<0.01
2/12/2013	8:42 a.m.	286	-	-	11.7	7.7	17.7	9.5	103.4	0.6	0.33	85	<0.002	<0.002	<0.01

1131-105 UD = 276 m³/s (Flows from Ohaaki Bridge Recorder, +/- 20%)

Waikato River at Ohaaki Br

8/01/2013	9:15 a.m.	141	5.8	47.5	16.3	6.9	19.0	8.6	98.5	0.7	0.65	132	0.054	0.052	0.01
5/02/2013	10:02 a.m.	149	5.0	50.0	14.8	7.0	19.8	8.1	93.3	0.6	0.63	111	0.050	0.048	<0.01
5/03/2013	10:09 a.m.	151	4.0	47.5	14.5	7.6	<u>20.2</u>	8.5	97.2	0.5	0.43	107	0.039	0.039	<0.01
2/04/2013	9:45 a.m.	91	3.5	42.5	20.0	7.3	<u>20.8</u>	8.2	95.2	2.5	3.50	142	0.290	0.290	0.02
7/05/2013	10:10 a.m.	92	3.5	62.5	17.1	7.2	<u>17.2</u>	8.8	94.1	0.7	1.74	122	0.061	0.061	0.02
4/06/2013	10:25 a.m.	146	4.5	55.0	15.0	7.0	<u>13.6</u>	9.3	93.6	0.8	0.93	110	0.051	0.050	<0.01
2/07/2013	10:16 a.m.	164	5.0	55.0	14.7	7.3	<u>12.6</u>	10.6	101.3	<0.4	0.70	108	0.046	0.045	<0.01
9/08/2013	10:04 a.m.	113	5.1	50.0	18.2	6.9	<u>13.6</u>	9.8	96.5	0.4	0.53	151	0.062	0.061	0.02
3/09/2013	9:45 a.m.	242	5.0	50.0	14.5	7.3	11.2	11.4	105.1	0.5	0.82	97	0.018	0.018	<0.01
1/10/2013	8:35 a.m.	208	1.9	42.5	14.1	7.1	12.7	10.8	105.3	0.8	0.51	104	0.026	0.026	<0.01
5/11/2013	9:15 a.m.	133	3.4	57.5	17.4	7.2	16.8	8.9	94.6	0.8	0.94	122	0.043	0.041	0.01
2/12/2013	9:42 a.m.	198	3.3	52.5	13.8	7.2	19.0	9.2	101.5	0.9	0.66	92	0.020	0.020	<0.01

1131-107 UD = 330 m³/s (Flows from Ohakuri Dam - Total)

Waikato River at Ohakuri Tailrace Br

8/01/2013	10:45 a.m.	221	2.0	32.5	18.2	7.4	19.8	8.5	97.9	0.9	1.04	143	0.115	0.114	0.01
5/02/2013	10:50 a.m.	196	1.8	42.0	16.4	7.2	<u>20.4</u>	8.6	99.4	0.6	0.72	124	0.034	0.031	<0.01
5/03/2013	10:55 a.m.	151	1.9	42.5	17.2	7.6	<u>20.6</u>	9.2	104.6	0.6	0.80	122	0.020	0.020	<0.01
2/04/2013	10:47 a.m.	187	2.6	37.5	18.5	7.3	<u>20.7</u>	8.9	102.0	3.0	0.77	134	0.032	0.032	0.02
7/05/2013	10:50 a.m.	225	1.8	35.0	19.7	7.2	<u>17.1</u>	8.2	86.9	0.8	0.92	136	0.142	0.138	0.02
4/06/2013	11:15 a.m.	302	3.5	55.0	17.6	6.9	<u>13.4</u>	8.9	88.6	0.7	0.77	127	0.128	0.125	<0.01
2/07/2013	11:21 a.m.	201	4.5	40.0	17.9	7.2	<u>12.3</u>	9.8	91.9	0.4	0.78	129	0.174	0.172	0.01
9/08/2013	10:50 a.m.	229	2.8	47.5	18.4	7.6	<u>12.8</u>	10.0	97.2	0.4	0.77	139	0.123	0.122	<0.01
3/09/2013	10:35 a.m.	257	3.0	47.5	18.5	7.3	<u>12.5</u>	10.1	96.1	1.0	0.91	128	0.131	0.128	<0.01
1/10/2013	9:15 a.m.	311	1.8	42.5	18.7	7.1	14.6	10.0	101.6	1.1	1.02	136	0.143	0.142	<0.01
5/11/2013	10:00 a.m.	215	<u>1.2</u>	35.0	16.3	7.5	16.5	10.7	112.5	1.4	1.69	119	<.002	<.002	<0.01
2/12/2013	10:35 a.m.	319	2.2	37.5	15.6	7.3	<u>20.2</u>	8.9	100.3	1.0	0.99	113	0.040	0.038	<0.01

1131-147 UD = 306 m³/s (Flows from Whakamaru Dam - Total)

Waikato River at Whakamaru Tailrace

8/01/2013	11:20 a.m.	238	1.8	35.0	17.0	7.4	<u>20.3</u>	9.2	105.6	0.7	1.4	132	0.057	0.055	0.02
5/02/2013	11:42 a.m.	165	1.8	40.0	16.8	7.3	<u>21.3</u>	8.2	95.8	0.7	1.0	130	0.074	0.073	<0.01
5/03/2013	11:47 a.m.	223	2.0	42.0	17.3	7.5	<u>21.5</u>	9.2	106.4	0.9	1.3	128	0.032	0.032	<0.01
2/04/2013	11:37 a.m.	204	2.2	35.0	17.5	7.3	<u>20.4</u>	8.6	98.2	1.5	1.1	133	0.072	0.071	0.02
7/05/2013	11:30 a.m.	255	2.5	37.5	19.2	7.4	<u>16.7</u>	8.9	93.2	1.0	0.8	146	0.185	0.183	<0.01
4/06/2013	12:05 p.m.	262	3.2	40.0	18.2	7.2	<u>13.7</u>	8.8	87.1	0.9	0.8	127	0.200	0.200	<0.01
2/07/2013	12:16 p.m.	258	4.1	40.0	16.8	7.2	11.9	9.6	89.3	0.5	0.9	126	0.270	0.270	<0.01
9/08/2013	11:35 a.m.	229	3.2	47.5	18.1	7.4	<u>12.6</u>	10.4	98.6	1.0	0.8	144	0.174	0.173	<0.01
3/09/2013	11:10 a.m.	207	2.6	42.5	17.9	7.5	<u>12.4</u>	10.7	100.4	1.3	2.2	132	0.121	0.119	<0.01
1/10/2013	10:00 a.m.	289	<u>1.5</u>	42.5	17.5	7.5	14.4	11.1	110.6	1.5	2.0	130	0.114	0.113	<0.01
5/11/2013	11:30 a.m.	198	<u>1.0</u>	22.5	16.2	7.7	16.8	11.2	117.5	1.3	1.6	119	0.021	0.019	<0.01
2/12/2013	11:34 a.m.	261	1.7	37.5	16.2	7.7	<u>20.3</u>	9.3	103.7	1.0	1.0	122	0.065	0.063	0.01

Note: < = less than the value stated

UD = upper decile flow (long-term record 1994-2013 inclusive)

*New Zealand Standard Time

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards - Table 1

() black disk measurements taken in flows above upper decile values –don't assess for compliance

TKN g/m ³	TN g/m ³	DRP g/m ³	TP g/m ³	CL g/m ³	AS g/m ³	B g/m ³	LI g/m ³	A340F /cm	A440F /cm	ENT cfu/100mL	FC cfu/100mL	E.coli cfu/100mL	CHLA g/m ³	DOC g/m ³	TOC g/m ³
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<550	<0.02		
0.08	0.09	<0.004	<0.004	8.3	<u>0.012</u>	0.17	0.040	<0.002	<0.002	15	22	22	<0.003	1.0	1.3
0.06	0.06	<0.004	<0.004	8.4	<u>0.011</u>	0.16	0.037	<0.002	<0.002	24	7	7	<0.003	0.6	1.0
<0.05	0.05	<0.004	<0.004	8.2	<u>0.011</u>	0.16	0.039	<0.002	<0.002	3	20	10	<0.003	1.1	1.5
0.34	0.35	<0.004	<0.004	8.4	<u>0.011</u>	0.17	0.040	<0.002	<0.002	<1	4	4	<0.003	1.8	2.2
<0.05	0.05	<0.004	0.006	9.0	<u>0.010</u>	0.16	0.040	<0.002	<0.002	3	4	4	<0.003	1.0	0.9
0.13	0.13	<0.004	0.009	8.1	<u>0.012</u>	0.16	0.040	<0.002	<0.002	1	<1	<1	<0.003	1.2	1.6
0.05	0.05	<0.004	<0.004	8.2	<u>0.011</u>	0.18	0.043	<0.002	<0.002	<1	<1	<1	<0.003	1.4	1.5
0.06	0.06	<0.004	0.004	8.7	<u>0.012</u>	0.17	0.038	<0.002	<0.002	<1	<1	<1	<0.003	1.5	1.7
0.11	0.11	<0.004	<0.004	8.4	<u>0.012</u>	0.17	0.041	<0.002	<0.002	1	1	1	<0.003	1.3	1.2
0.06	0.06	<0.004	0.006	8.7	<u>0.012</u>	0.18	0.041	<0.002	<0.002	<1	1	1	<0.003	1.3	1.0
0.07	0.07	<0.004	0.007	7.6	<u>0.013</u>	0.17	0.039	<0.002	<0.002	8	18	18	<0.003	0.9	0.9
<0.05	0.05	<0.004	0.005	8.0	<u>0.010</u>	0.16	0.039	<0.002	<0.002	1	1	<1	<0.003	1.6	1.6
0.08	0.13	0.008	0.009	18.5	<u>0.031</u>	<u>0.32</u>	0.101	0.004	<0.002	7	57	34	<0.003	1.1	1.2
0.10	0.15	0.008	0.008	15.1	<u>0.025</u>	0.27	0.080	0.004	<0.002	<u>110</u>	46	46	<0.003	0.8	1.3
0.06	0.10	0.006	0.008	14.2	<u>0.024</u>	0.25	0.075	<0.002	<0.002	<u>80</u>	40	40	<0.003	1.3	1.2
0.12	0.41	0.014	0.022	28.0	<u>0.044</u>	<u>0.43</u>	0.150	0.004	<0.002	10	22	18	<0.003	1.9	1.9
0.12	0.18	0.011	0.020	22.0	<u>0.032</u>	<u>0.39</u>	0.114	0.004	<0.002	10	21	21	<0.003	1.2	1.1
0.06	0.11	0.007	0.013	15.7	<u>0.027</u>	0.25	0.083	0.002	<0.002	11	14	14	<0.003	1.1	1.2
0.08	0.13	0.006	0.009	15.5	<u>0.025</u>	<u>0.31</u>	0.094	<0.002	<0.002	<1	9	9	<0.003	1.3	1.3
0.08	0.14	0.010	0.016	26.0	<u>0.039</u>	<u>0.40</u>	0.123	0.002	<0.002	1	4	4	<0.003	1.7	1.5
0.13	0.15	0.004	0.008	14.7	<u>0.026</u>	0.26	0.079	<0.002	<0.002	8	12	12	<0.003	1.2	1.3
0.08	0.11	0.007	0.010	14.1	<u>0.023</u>	0.25	0.072	0.003	<0.002	29	73	59	<0.003	1.2	1.7
0.10	0.14	0.010	0.016	20.0	<u>0.032</u>	<u>0.42</u>	0.111	0.004	<0.002	3	7	5	<0.003	1.2	1.3
<0.05	0.07	0.004	0.013	13.6	<u>0.021</u>	0.23	0.072	0.004	<0.002	26	35	29	<0.003	1.5	1.8
0.11	0.23	0.013	0.020	22.0	<u>0.038</u>	<u>0.34</u>	0.123	0.007	<0.002	<1	4	4	0.004	1.1	1.4
0.09	0.12	0.008	0.012	18.5	<u>0.030</u>	<u>0.32</u>	0.112	0.005	<0.002	2	6	6	<0.003	1.2	1.4
0.07	0.09	0.005	0.014	20.0	<u>0.028</u>	<u>0.33</u>	0.113	0.003	<0.002	4	2	2	0.007	1.3	1.5
0.32	0.35	0.008	0.007	23.0	<u>0.034</u>	<u>0.41</u>	0.142	0.004	<0.002	2	2	2	0.003	2.8	2.9
0.11	0.25	0.020	0.025	26.0	<u>0.037</u>	<u>0.39</u>	0.155	0.007	<0.002	2	5	5	<0.003	1.3	1.4
0.13	0.26	0.013	0.019	21.0	<u>0.034</u>	<u>0.34</u>	0.120	0.005	<0.002	<1	5	5	<0.003	1.3	1.8
0.09	0.26	0.013	0.017	21.0	<u>0.030</u>	<u>0.40</u>	0.139	0.004	<0.002	<1	1	1	<0.003	1.5	1.5
0.08	0.20	0.012	0.020	23.0	<u>0.034</u>	<u>0.39</u>	0.126	<0.002	<0.002	<1	2	2	0.006	1.5	1.7
0.07	0.20	0.011	0.014	22.0	<u>0.035</u>	<u>0.37</u>	0.135	0.005	<0.002	<1	<1	<1	0.006	1.3	1.3
0.14	0.28	0.011	0.020	22.0	<u>0.033</u>	<u>0.38</u>	0.133	0.007	<0.002	<1	<1	<1	0.005	1.4	1.7
0.14	0.14	<0.004	0.025	17.2	<u>0.032</u>	<u>0.32</u>	0.099	0.004	<0.002	13	22	15	0.007	1.2	1.9
0.06	0.10	0.009	0.016	16.8	<u>0.027</u>	0.28	0.091	0.006	<0.002	5	6	6	0.004	1.0	1.7
0.18	0.24	0.010	0.014	19.7	<u>0.034</u>	<u>0.33</u>	0.112	0.005	<0.002	10	13	11	0.009	1.3	1.6
0.14	0.21	0.007	0.017	19.2	<u>0.032</u>	0.34	0.124	0.006	<0.002	270	60	60	<0.003	1.0	1.5
0.11	0.14	0.005	0.020	21.0	<u>0.033</u>	<u>0.30</u>	0.112	0.004	<0.002	10	7	7	0.006	1.8	1.7
0.28	0.35	0.007	0.012	21.0	<u>0.034</u>	<u>0.36</u>	0.130	0.005	<0.002	6	8	8	0.005	1.9	2.5
0.14	0.33	0.014	0.024	27.0	<u>0.032</u>	<u>0.39</u>	0.161	0.009	<0.002	20	12	12	<0.003	1.3	1.7
0.08	0.28	0.015	0.023	22.0	<u>0.035</u>	<u>0.34</u>	0.132	0.007	<0.002	<1	7	7	0.006	1.5	1.8
0.11	0.38	0.014	0.016	18.7	<u>0.024</u>	<u>0.36</u>	0.122	0.008	<0.002	<1	6	6	<0.003	1.8	1.8
0.27	0.44	0.013	0.021	23.0	<u>0.032</u>	<u>0.38</u>	0.120	0.003	<0.002	6	10	10	0.013	1.6	2.1
0.15	0.27	0.008	0.030	21.0	<u>0.033</u>	<u>0.37</u>	0.131	0.007	<0.002	2	4	4	0.148	1.4	1.8
0.25	0.36	0.007	0.022	21.0	<u>0.029</u>	<u>0.35</u>	0.122	0.009	<0.002	4	23	13	<u>0.021</u>	1.2	1.5
0.15	0.17	<0.004	0.019	17.1	<u>0.031</u>	<u>0.31</u>	0.100	0.005	<0.002	180	1200	500	0.007	1.3	1.7
0.16	0.23	0.010	0.018	18.8	<u>0.029</u>	<u>0.30</u>	0.103	0.007	<0.002	11	58	58	0.006	1.9	2.0

Note: < = less than the value stated

UD = upper decile flow (long-term record 1994-2013 inclusive)

*New Zealand Standard Time

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards - Table 1

() black disk measurements taken in flows above upper decile values –don't assess for compliance

DATE	TIME*	FLOW	BDISK	COLOR	COND	PH	TEMP	DO	PCDO	BOD5	TURB	TDS	NNN	NO3-N	NH4-N
dd/m/yy	hh:mm	m ³ /s	m	units	mS/m	units	'C	g/m ³	%Sat	g/m ³	NTU	g/m ³	g/m ³	g/m ³	g/m ³
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
							<20 (Oct-Apr)								

1131-143 UD = 371 m³/s (Flows from Waipapa Dam - Total)

Waikato River at Waipapa Tailrace

8/01/2013	11:45 a.m.	235	<u>1.6</u>	35.0	16.2	7.2	<u>20.9</u>	9.0	103.0	0.8	1.30	129	0.162	0.155	0.04
5/02/2013	12:30 p.m.	172	3.0	35.0	16.6	7.4	<u>21.7</u>	8.6	99.8	0.8	1.40	127	0.119	0.115	0.03
5/03/2013	12:27 p.m.	221	3.0	37.5	17.7	7.3	<u>20.3</u>	8.4	94.9	0.5	0.92	123	0.133	0.123	0.03
2/04/2013	12:21 p.m.	234	2.4	35.0	17.0	7.3	<u>20.3</u>	8.8	98.6	1.4	0.94	128	0.152	0.148	0.03
7/05/2013	12:10 p.m.	255	2.0	32.5	17.3	7.4	<u>16.4</u>	9.2	94.3	0.9	1.62	137	0.250	0.250	0.02
4/06/2013	12:40 p.m.	330	1.8	40.0	17.3	7.2	<u>13.5</u>	8.7	87.2	0.6	1.32	131	0.270	0.270	<0.01
2/07/2013	12:51 p.m.	248	3.0	40.0	15.5	7.4	11.6	10.8	98.8	0.4	1.24	122	0.340	0.330	<0.01
9/08/2013	12:05 p.m.	218	2.5	42.5	17.5	7.5	<u>12.4</u>	10.4	98.1	0.5	0.80	134	0.260	0.260	<0.01
3/09/2013	11:45 a.m.	271	1.9	40.0	17.5	7.4	<u>12.6</u>	10.6	99.2	1.8	1.07	123	0.230	0.220	<0.01
1/10/2013	10:25 a.m.	362	<u>1.1</u>	42.5	16.0	7.2	14.1	10.6	103.9	1.4	1.56	126	0.260	0.250	<0.01
5/11/2013	12:55 p.m.	274	<u>1.5</u>	35.0	16.3	7.5	16.4	10.4	107.0	1.1	2.20	125	0.122	0.119	0.02
2/12/2013	12:02 p.m.	243	1.9	37.5	15.7	7.4	19.5	8.9	92.6	1.1	1.25	121	0.147	0.143	0.03

1131-328 UD = 377 m³/s (Flows from Karapiro Dam - Total)

Waikato River at Narrows Boat Ramp

9/01/2013	7:45 a.m.	167	<u>1.6</u>	37.5	16.0	7.4	<u>20.5</u>	8.3	91.3	0.9	2.40	143	0.260	0.250	0.04
7/02/2013	7:23 a.m.	161	1.7	40.0	16.6	7.5	<u>20.6</u>	8.4	93.0	0.9	1.85	121	0.126	0.121	0.01
6/03/2013	7:50 a.m.	150	1.8	40.0	16.5	7.4	<u>21.3</u>	8.1	91.2	1.1	1.65	126	0.127	0.123	0.02
3/04/2013	8:00 a.m.	148	1.9	37.5	17.2	7.4	19.8	8.3	90.9	0.8	1.91	132	0.230	0.220	0.03
8/05/2013	9:15 a.m.	205	2.4	35.0	17.3	7.1	<u>16.6</u>	8.8	89.2	1.2	1.82	137	0.330	0.330	0.02
5/06/2013	9:00 a.m.	234	<u>1.2</u>	32.5	17.2	7.4	<u>13.5</u>	10.9	107.0	0.5	4.40	127	0.390	0.380	0.02
3/07/2013	8:51 a.m.	184	2.1	35.0	15.0	7.4	11.1	10.4	92.5	0.5	1.85	116	0.500	0.500	<0.01
7/08/2013	9:00 a.m.	214	<u>1.4</u>	35.0	16.8	7.8	11.1	11.1	99.5	0.8	1.88	127	0.340	0.340	<0.01
4/09/2013	9:30 a.m.	209	1.7	42.5	16.9	7.7	11.8	11.2	102.4	0.9	1.55	126	0.280	0.280	<0.01
2/10/2013	7:35 a.m.	246	<u>1.5</u>	37.5	15.1	8.0	13.7	10.1	96.3	1.1	2.50	117	0.370	0.370	0.01
8/11/2013	8:00 a.m.	285	2.2	35.0	15.7	7.4	17.5	9.1	95.8	1.0	1.71	125	0.240	0.240	0.02
3/12/2013	7:55 a.m.	284	2.1	37.5	15.0	7.3	19.8	8.7	93.9	0.6	1.57	119	0.195	0.189	0.03

1131-69 UD = 384 m³/s (Flows from Hamilton - Bridge Street Bridge)

Waikato River at Horotiu Br

9/01/2013	8:40 a.m.	170	<u>1.6</u>	37.5	16.0	7.4	<u>20.8</u>	7.9	87.4	1.0	2.40	121	0.250	0.240	0.02
7/02/2013	8:30 a.m.	159	<u>1.3</u>	30.0	16.9	7.6	<u>20.8</u>	8.4	93.4	1.2	1.75	127	0.151	0.147	<0.01
6/03/2013	9:00 a.m.	150	1.8	42.5	16.7	7.5	<u>21.2</u>	8.0	89.0	1.0	1.66	128	0.162	0.158	0.02
3/04/2013	8:45 a.m.	143	1.6	37.5	17.4	7.2	<u>20.2</u>	8.0	88.5	0.8	4.00	128	0.250	0.250	0.03
8/05/2013	10:05 a.m.	191	1.6	32.5	17.5	7.2	<u>16.3</u>	8.9	89.5	1.2	2.70	139	0.380	0.380	0.01
5/06/2013	9:48 a.m.	216	<u>0.9</u>	32.5	17.2	7.2	<u>13.7</u>	10.8	106.3	0.4	4.30	121	0.410	0.400	0.01
3/07/2013	9:40 a.m.	182	1.9	30.0	15.2	7.4	11.0	10.3	92.4	0.6	2.40	118	0.530	0.530	<0.01
7/08/2013	10:20 a.m.	169	<u>1.6</u>	40.0	17.1	7.5	11.8	10.6	97.2	0.8	1.82	128	0.360	0.350	0.01
4/09/2013	10:30 a.m.	169	1.8	42.5	17.2	7.6	<u>12.3</u>	10.9	100.9	1.0	1.88	127	0.310	0.290	<0.01
2/10/2013	8:40 a.m.	185	<u>1.3</u>	32.5	15.3	7.8	13.4	10.5	100.2	1.1	3.00	121	0.350	0.340	<0.01
8/11/2013	8:50 a.m.	184	1.8	35.0	15.8	7.4	16.7	9.2	95.5	0.9	2.20	120	0.260	0.250	0.01
3/12/2013	8:45 a.m.	176	1.7	40.0	15.6	7.2	19.6	8.4	90.2	1.3	1.81	104	0.198	0.192	0.03

1131-77 UD = 580 m³/s (Flows from Huntly Power Station Recorder)

Waikato River at Huntly-Tainui Br

9/01/2013	9:15 a.m.	209	<u>1.0</u>	37.5	15.5	7.6	<u>21.1</u>	8.2	92.0	0.7	3.00	124	0.310	0.300	0.02
7/02/2013	9:25 a.m.	216	<u>1.0</u>	30.0	16.2	7.6	<u>22.3</u>	8.3	92.9	3.0	4.10	119	0.260	0.250	0.02
6/03/2013	10:10 a.m.	182	<u>1.3</u>	45.0	16.7	7.5	<u>21.0</u>	8.2	91.3	1.3	2.70	124	0.250	0.240	0.02
3/04/2013	9:15 a.m.	173	<u>1.4</u>	37.5	17.4	7.4	<u>20.5</u>	8.5	94.2	1.0	1.86	139	0.340	0.340	0.01
8/05/2013	10:45 a.m.	368	<u>0.3</u>	27.5	15.0	7.0	<u>14.8</u>	8.4	81.2	1.4	<u>41.00</u>	116	1.240	1.230	0.06
5/06/2013	10:40 a.m.	387	<u>0.6</u>	27.5	16.0	7.3	<u>13.5</u>	10.5	103.2	2.2	<u>8.90</u>	122	0.530	0.520	0.04
3/07/2013	10:20 a.m.	320	<u>1.0</u>	27.5	14.2	7.2	10.6	10.3	91.1	0.6	<u>6.80</u>	112	0.850	0.850	0.02
7/08/2013	11:25 a.m.	234	<u>1.0</u>	35.0	16.7	7.8	<u>13.3</u>	10.3	97.0	1.5	3.70	124	0.480	0.470	0.02
4/09/2013	11:10 a.m.	287	<u>0.7</u>	42.5	15.4	7.5	<u>12.3</u>	10.5	97.8	1.2	<u>5.60</u>	103	0.570	0.560	<0.01
2/10/2013	9:20 a.m.	467	<u>0.5</u>	27.5	13.4	7.7	13.9	9.7	93.3	1.1	<u>10.80</u>	106	0.600	0.600	<0.01
8/11/2013	9:30 a.m.	309	<u>1.0</u>	32.5	14.6	7.3	17.1	9.1	94.6	0.9	<u>5.90</u>	110	0.370	0.360	0.02
3/12/2013	9:30 a.m.	299	<u>1.1</u>	37.5	14.7	7.2	19.8	8.4	91.1	1.2	3.70	110	0.250	0.240	0.02

Note: < = less than the value stated

UD = upper decile flow (long-term record 1994-2013 inclusive)

*New Zealand Standard Time

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards - Table 1

() black disk measurements taken in flows above upper decile values –don't assess for compliance

TKN g/m ³	TN g/m ³	DRP g/m ³	TP g/m ³	CL g/m ³	AS g/m ³	B g/m ³	LI g/m ³	A340F /cm	A440F /cm	ENT cfu/100mL	FC cfu/100mL	E coli cfu/100mL	CHLA g/m ³	DOC g/m ³	TOC g/m ³
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<550	<0.02		
0.17	0.33	0.014	0.022	18.3	<u>0.029</u>	0.26	0.085	0.009	<0.002	3	3	3	0.003	1.4	2.0
0.13	0.25	0.017	0.026	18.7	<u>0.028</u>	0.31	0.111	0.010	0.002	100	47	47	0.003	1.3	1.9
0.09	0.22	0.017	0.026	21.0	<u>0.030</u>	0.30	0.110	0.011	0.002	25	12	12	0.004	1.8	2.0
0.17	0.32	0.019	0.020	19.4	<u>0.026</u>	0.31	0.111	0.008	<0.002	4	2	2	0.006	2.0	2.1
0.14	0.39	0.022	0.035	22.0	<u>0.024</u>	0.29	0.111	0.015	0.003	50	30	30	<0.003	2.0	2.4
0.08	0.35	0.019	0.023	21.0	<u>0.030</u>	0.32	0.115	0.010	<0.002	40	33	25	0.005	2.0	2.1
0.13	0.47	0.018	0.022	17.2	<u>0.022</u>	0.30	0.102	0.011	<0.002	1	5	4	0.003	2.0	1.9
0.09	0.35	0.017	0.023	21.0	<u>0.026</u>	0.34	0.109	0.004	<0.002	<1	1	1	0.011	1.7	1.9
0.12	0.35	0.014	0.020	21.0	<u>0.027</u>	0.34	0.119	0.009	<0.002	<1	4	4	0.013	1.7	2.0
0.17	0.43	0.013	0.024	19.1	<u>0.024</u>	0.29	0.099	0.013	0.002	4	19	19	0.013	1.4	1.7
0.17	0.29	0.009	0.028	17.1	<u>0.028</u>	0.28	0.092	0.009	<0.002	<1	5	3	0.004	1.5	2.1
0.07	0.22	0.017	0.029	17.4	<u>0.025</u>	0.25	0.087	0.011	0.002	25	18	15	<0.003	2.0	2.0
0.19	0.45	0.015	0.028	17.1	<u>0.027</u>	0.27	0.092	0.007	<0.002	44	80	60	<0.003	1.6	2.4
0.16	0.29	0.008	0.018	18.6	<u>0.030</u>	0.27	0.092	0.010	0.002	26	38	32	0.005	1.6	1.9
0.15	0.28	0.008	0.026	18.6	<u>0.026</u>	0.24	0.091	0.008	<0.002	45	80	80	0.005	1.5	1.8
0.13	0.36	0.022	0.030	20.0	<u>0.024</u>	0.28	0.100	0.009	<0.002	34	41	36	<0.003	1.8	1.9
0.13	0.46	0.023	0.025	21.0	<u>0.026</u>	0.29	0.108	0.012	0.002	100	63	55	<0.003	1.7	1.8
0.17	0.56	0.023	0.043	21.0	<u>0.028</u>	0.30	0.109	0.016	0.003	120	200	180	0.012	2.2	2.6
0.14	0.64	0.019	0.029	16.9	<u>0.018</u>	0.25	0.089	0.015	0.003	12	26	21	0.004	2.4	2.7
0.23	0.57	0.016	0.029	21.0	<u>0.022</u>	0.27	0.101	0.007	<0.002	70	53	34	0.008	1.9	2.5
0.13	0.41	0.010	0.024	19.7	<u>0.017</u>	0.23	0.081	0.010	<0.002	3	54	48	0.015	1.7	2.0
0.25	0.62	0.020	0.030	16.7	<u>0.019</u>	0.20	0.069	0.021	0.005	13	120	90	0.008	2.4	2.2
0.15	0.39	0.010	0.024	16.1	<u>0.025</u>	0.22	0.086	0.011	<0.002	31	130	110	0.004	2.1	2.3
0.16	0.36	0.017	0.032	17.0	<u>0.022</u>	0.24	0.084	0.013	0.004	29	32	30	0.004	2.1	2.3
0.15	0.40	0.017	0.033	17.3	<u>0.026</u>	0.26	0.094	0.007	<0.002	67	80	70	<0.003	1.5	1.9
0.20	0.35	0.011	0.024	18.9	<u>0.030</u>	0.27	0.093	0.011	0.002	80	150	130	0.006	1.6	1.9
0.15	0.31	0.012	0.030	18.6	<u>0.028</u>	0.27	0.099	0.008	<0.002	12	40	30	0.004	1.7	1.8
0.20	0.45	0.023	0.038	19.6	<u>0.024</u>	0.31	0.109	0.009	<0.002	30	20	20	<0.003	1.7	2.1
0.12	0.50	0.025	0.031	21.0	<u>0.024</u>	0.28	0.102	0.015	0.003	100	150	130	<0.003	1.9	2.1
0.24	0.65	0.023	0.047	20.0	<u>0.028</u>	0.31	0.109	0.018	0.004	230	230	220	0.013	2.5	2.8
0.17	0.70	0.021	0.026	17.0	<u>0.018</u>	0.28	0.096	0.016	0.003	18	42	42	0.004	2.5	2.6
0.15	0.51	0.019	0.036	20.0	<u>0.021</u>	0.28	0.100	0.008	<0.002	30	30	10	0.008	2.2	2.8
0.15	0.46	0.015	0.024	19.9	<u>0.020</u>	0.28	0.099	0.012	0.002	2	30	20	0.014	1.7	2.0
0.21	0.56	0.024	0.041	17.1	<u>0.020</u>	0.23	0.078	0.021	0.004	9	220	220	0.012	2.1	2.4
0.17	0.43	0.011	0.026	16.2	<u>0.023</u>	0.22	0.086	0.013	0.002	120	800	800	<0.003	2.4	2.8
0.14	0.34	0.018	0.031	16.4	<u>0.022</u>	0.25	0.085	0.012	0.002	49	130	100	0.004	2.2	2.1
0.18	0.49	0.022	0.038	16.7	<u>0.020</u>	0.22	0.076	0.010	<0.002	16	45	36	<0.003	1.6	2.2
0.29	0.55	0.013	0.033	18.5	<u>0.021</u>	0.22	0.073	0.020	0.004	30	90	80	0.007	2.5	2.8
0.16	0.41	0.018	0.037	18.8	<u>0.024</u>	0.24	0.082	0.010	<0.002	18	100	80	0.004	1.7	2.1
0.14	0.48	0.023	0.035	19.6	<u>0.023</u>	0.29	0.100	0.012	0.002	24	50	40	0.003	1.7	1.8
0.53	1.77	0.017	0.107	16.1	0.009	0.12	0.041	0.031	0.005	1700	2300	1900	<0.003	3.6	6.4
0.22	0.75	0.025	0.046	18.4	<u>0.021</u>	0.25	0.086	0.021	0.004	280	400	370	0.011	2.4	3.6
0.24	1.09	0.020	0.039	15.7	<u>0.012</u>	0.19	0.059	0.021	0.003	21	70	70	0.004	2.9	3.2
0.37	0.85	0.021	0.040	20.0	<u>0.018</u>	0.24	0.085	0.013	<0.002	15	60	60	0.008	3.1	3.4
0.22	0.79	0.015	0.034	16.9	<u>0.013</u>	0.19	0.059	0.020	0.003	9	90	80	0.011	2.3	2.6
0.42	1.02	0.020	0.055	14.6	<u>0.012</u>	0.15	0.046	0.028	0.004	80	1000	900	0.008	2.4	2.7
0.20	0.57	0.013	0.037	15.0	<u>0.017</u>	0.16	0.059	0.020	0.004	160	550	550	0.005	2.6	3.4
0.17	0.42	0.019	0.036	15.8	<u>0.019</u>	0.21	0.071	0.018	0.003	55	280	230	0.005	2.5	3.0

Note: < = less than the value stated

UD = upper decile flow (long-term record 1994-2013 inclusive)

*New Zealand Standard Time

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards - Table 1

() black disk measurements taken in flows above upper decile values –don't assess for compliance

DATE	TIME*	FLOW	BDISK	COLOR	COND	PH	TEMP	DO	PCDO	BOD5	TURB	TDS	NNN	NO3-N	NH4-N
dd/mm/yy	hh:mm	m ³ /s	m	units	m S/m	units	°C	g/m ³	%Sat	g/m ³	NTU	g/m ³	g/m ³	g/m ³	g/m ³
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep) <20 (Oct-Apr)	>80	-	<5	-	-	-	<0.88	

1131-91 UD = 670 m³/s (Flows from Mercer Bridge Recorder)

Waikato River at Mercer Br

9/01/2013	9:50 a.m.	247	-	-	15.8	7.7	<u>21.4</u>	8.2	92.1	1.0	4.40	129	0.250	0.240	<0.01
7/02/2013	10:05 a.m.	228	-	-	16.8	7.7	<u>21.4</u>	8.9	100.2	2.3	4.40	119	0.147	0.144	<0.01
6/03/2013	11:00 a.m.	176	-	-	16.8	7.7	<u>21.0</u>	8.7	96.5	1.5	3.60	126	0.210	0.200	<0.01
3/04/2013	10:00 a.m.	178	-	-	17.5	7.6	<u>21.2</u>	8.6	96.8	0.8	3.30	139	0.250	0.250	<0.01
8/05/2013	11:50 a.m.	388	-	-	14.9	7.1	<u>15.2</u>	8.5	83.5	1.4	<u>37.00</u>	118	0.800	0.790	0.04
5/06/2013	11:34 a.m.	405	-	-	17.0	7.2	<u>13.9</u>	10.2	100.6	1.1	<u>10.10</u>	126	0.570	0.560	<0.01
3/07/2013	11:17 a.m.	351	-	-	15.5	7.3	<u>10.7</u>	10.1	89.9	0.8	<u>8.80</u>	123	0.850	0.850	<0.01
7/08/2013	12:15 p.m.	251	-	-	17.4	7.6	<u>13.6</u>	10.1	96.0	1.8	<u>6.60</u>	130	0.600	0.590	<0.01
4/09/2013	12:10 p.m.	343	-	-	17.0	7.4	<u>12.8</u>	9.8	92.4	1.8	<u>14.20</u>	130	0.410	0.410	<0.01
2/10/2013	10:27 a.m.	494	-	-	14.6	7.5	<u>14.8</u>	9.5	93.2	1.1	<u>13.20</u>	116	0.570	0.560	<0.01
8/11/2013	10:40 a.m.	299	-	-	15.3	7.7	<u>17.6</u>	9.1	95.6	1.1	<u>7.70</u>	119	0.380	0.380	<0.01
3/12/2013	10:40 a.m.	262	-	-	15.1	7.4	<u>20.1</u>	8.4	92.1	1.4	<u>5.10</u>	115	0.310	0.310	<0.01

1131-133 UD = 670 m³/s (Flows from Mercer Bridge Recorder)

Waikato River at Tuakau Br

9/01/2013	11:15 a.m.	241	<u>0.6</u>	37.5	15.8	8.0	<u>23.0</u>	9.5	109.8	2.1	<u>7.60</u>	131	0.134	0.131	<0.01
7/02/2013	10:25 a.m.	229	<u>0.6</u>	27.5	16.8	7.9	<u>22.0</u>	9.9	111.7	1.9	<u>8.90</u>	120	0.059	0.056	<0.01
6/03/2013	11:35 a.m.	172	<u>0.9</u>	40.0	16.8	7.7	<u>21.6</u>	8.9	100.6	1.4	2.70	132	0.172	0.169	<0.01
3/04/2013	10:30 a.m.	173	<u>0.9</u>	37.5	17.4	7.6	<u>21.8</u>	8.9	101.4	1.2	3.50	130	0.210	0.210	<0.01
8/05/2013	12:20 p.m.	389	<u>0.4</u>	22.5	15.3	7.0	<u>15.5</u>	8.3	81.5	1.2	<u>38.00</u>	121	0.740	0.730	0.02
5/06/2013	12:09 p.m.	406	<u>0.5</u>	30.0	17.4	7.1	<u>13.3</u>	9.6	93.7	0.8	<u>12.20</u>	129	0.580	0.570	0.02
3/07/2013	11:47 a.m.	352	<u>0.8</u>	25.0	15.9	7.2	<u>10.8</u>	9.5	84.2	1.0	<u>10.20</u>	121	0.830	0.830	0.01
7/08/2013	12:45 p.m.	260	<u>0.8</u>	35.0	18.6	7.0	<u>13.4</u>	10.3	97.7	1.0	4.60	130	0.540	0.540	0.01
4/09/2013	12:40 p.m.	343	<u>0.6</u>	42.5	16.6	7.5	<u>12.7</u>	10.4	97.2	1.5	<u>8.90</u>	132	0.440	0.440	<0.01
2/10/2013	11:13 a.m.	497	<u>0.5</u>	22.5	14.9	7.4	<u>15.1</u>	9.2	91.4	1.6	<u>17.00</u>	114	0.530	0.530	<0.01
8/11/2013	11:15 a.m.	299	<u>0.7</u>	30.0	15.3	7.4	<u>17.8</u>	9.1	96.8	1.1	<u>10.30</u>	118	0.280	0.270	<0.01
3/12/2013	11:15 a.m.	275	<u>1.0</u>	35.0	15.0	7.4	<u>20.4</u>	8.4	92.3	1.2	<u>5.40</u>	113	0.300	0.290	<0.01

Note: < = less than the value stated

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*New Zealand Standard Time

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() black disk measurements taken in flows above upper decile values –don't assess for compliance

TKN g/m ³	TN g/m ³	DRP g/m ³	TP g/m ³	CL g/m ³	AS g/m ³	B g/m ³	LI g/m ³	A340F /cm	A440F /cm	ENT cfu/100mL	FC	E coli	CHLA g/m ³	DOC g/m ³	TOC g/m ³
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<550	<0.02		

0.17	0.42	0.012	0.038	17.2	<u>0.020</u>	0.25	0.081	0.008	<0.002	10	62	39	0.007	1.7	2.4
0.40	<u>0.55</u>	0.009	0.036	18.7	<u>0.021</u>	0.24	0.079	0.016	0.003	11	80	70	0.020	1.9	2.0
0.15	0.36	0.010	0.031	18.7	<u>0.024</u>	0.25	0.085	0.009	<0.002	10	40	20	0.006	1.6	2.0
0.08	0.33	0.018	0.033	20.0	<u>0.022</u>	<u>0.30</u>	0.100	0.011	<0.002	21	110	110	0.006	1.6	2.0
0.54	<u>1.34</u>	0.015	<u>0.089</u>	17.3	<u>0.011</u>	0.16	0.054	0.028	0.005	390	1500	1500	<0.003	3.2	6.6
0.34	<u>0.91</u>	0.025	<u>0.059</u>	19.3	<u>0.019</u>	0.24	0.079	0.026	0.005	40	220	200	0.012	3.2	4.2
0.33	<u>1.18</u>	0.018	<u>0.041</u>	16.7	<u>0.011</u>	0.19	0.057	0.033	0.005	13	40	40	0.005	3.9	4.4
0.33	<u>0.93</u>	0.019	<u>0.046</u>	20.0	<u>0.016</u>	0.24	0.079	0.018	0.003	5	35	27	0.010	3.3	4.2
0.45	<u>0.86</u>	0.006	<u>0.054</u>	19.0	<u>0.013</u>	0.19	0.056	0.047	0.008	24	60	40	<u>0.025</u>	5.1	8.0
0.34	<u>0.91</u>	0.021	<u>0.058</u>	15.7	<u>0.014</u>	0.16	0.052	0.032	0.005	19	490	430	0.009	2.6	3.5
0.25	<u>0.63</u>	0.011	<u>0.045</u>	15.6	<u>0.017</u>	0.18	0.064	0.020	0.003	30	90	90	0.009	2.8	3.8
0.24	<u>0.55</u>	0.023	0.033	16.1	<u>0.017</u>	0.20	0.064	0.022	0.004	9	40	40	0.008	3.0	3.4
0.29	0.42	0.005	<u>0.053</u>	17.3	<u>0.022</u>	0.25	0.078	0.010	<0.002	<u>510</u>	3300	400	0.017	2.0	3.6
0.28	0.34	0.004	<u>0.048</u>	18.6	<u>0.021</u>	0.23	0.076	0.017	0.003	13	80	70	<u>0.033</u>	2.0	3.0
0.18	0.35	0.008	<u>0.044</u>	18.5	<u>0.024</u>	0.25	0.086	0.009	<0.002	10	60	50	0.009	1.7	2.3
0.20	0.41	0.014	0.037	19.9	<u>0.025</u>	<u>0.30</u>	0.101	0.011	<0.002	34	120	100	0.008	2.0	3.0
0.45	<u>1.19</u>	0.012	<u>0.093</u>	18.0	<u>0.010</u>	0.16	0.051	0.031	0.005	350	2000	1600	<0.003	3.4	5.3
0.38	<u>0.96</u>	0.012	<u>0.064</u>	19.7	<u>0.016</u>	0.21	0.066	0.038	0.006	50	320	290	0.014	4.6	5.7
0.31	<u>1.14</u>	0.013	<u>0.112</u>	17.0	0.009	0.18	0.049	0.045	0.008	15	580	<u>580</u>	0.007	4.9	6.1
0.23	<u>0.77</u>	0.018	<u>0.480</u>	19.9	<u>0.015</u>	0.24	0.079	0.023	0.004	6	50	40	0.010	2.5	3.8
0.25	<u>0.69</u>	0.008	0.034	18.4	<u>0.013</u>	0.21	0.065	0.030	0.005	2	80	70	<u>0.021</u>	3.6	4.8
0.49	<u>1.02</u>	0.013	<u>0.064</u>	16.1	<u>0.011</u>	0.15	0.044	0.048	0.009	8	160	120	0.013	4.1	4.8
0.23	<u>0.51</u>	0.012	<u>0.045</u>	16.2	<u>0.017</u>	0.17	0.064	0.023	0.004	19	130	130	0.012	3.1	4.6
0.18	0.48	0.017	<u>0.043</u>	16.0	<u>0.015</u>	0.20	0.063	0.027	0.005	12	80	80	0.009	3.1	3.5

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*New Zealand Standard Time

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Table 5: Results for the 4 detectable pesticides (values shown in bold). All other pesticides analysed were below detection level.

DATE dd/mm/yy	TIME* hh:mm	Acetochl g/m ³	Atrazine g/m ³	Hexazinone g/m ³	Terbuthylazine g/m ³
1131-127 Waikato River at Taupo Control Gates					
5/03/2013	08:55	< 0.00001	< 0.00001	< 0.000005	< 0.000005
4/06/2013	09:20	< 0.00001	< 0.00001	< 0.000005	0.000005
3/09/2013	08:58	< 0.00001	< 0.00001	< 0.000005	< 0.000005
2/12/2013	08:42	< 0.00001	< 0.00001	< 0.000005	< 0.000005
1131-107 Waikato River at Ohakuri Tailrace Br					
5/03/2013	10:55	< 0.00001	< 0.00001	< 0.000005	< 0.000005
4/06/2013	11:15	< 0.00001	< 0.00001	< 0.000005	0.000005
3/09/2013	10:35	< 0.00001	< 0.00001	< 0.000005	< 0.000005
2/12/2013	10:35	< 0.00001	< 0.00001	< 0.000005	< 0.000005
1131-143 Waikato River at Waipapa Tailrace					
5/03/2013	12:27	< 0.00001	< 0.00001	< 0.000005	< 0.000005
4/06/2013	12:40	< 0.00001	< 0.00001	< 0.000005	< 0.000005
3/09/2013	11:45	< 0.00001	< 0.00001	< 0.000005	< 0.000005
2/12/2013	12:02	< 0.00001	< 0.00001	< 0.000005	< 0.000005
1131-328 Waikato River at Narrows Boat Ramp					
6/03/2013	07:50	< 0.00001	< 0.00001	0.000005	< 0.000005
5/06/2013	09:00	< 0.00001	< 0.00001	< 0.000005	< 0.000005
4/09/2013	09:30	< 0.00001	< 0.00001	< 0.000005	< 0.000005
3/12/2013	07:55	< 0.00001	< 0.00001	< 0.000005	< 0.000005
1131-69 Waikato River at Horotiu Br					
6/03/2013	09:00	< 0.00001	< 0.00001	0.000006	< 0.000005
5/06/2013	09:48	< 0.00001	< 0.00001	< 0.000005	0.000006
4/09/2013	10:30	< 0.00001	< 0.00001	< 0.000005	< 0.000005
3/12/2013	08:45	< 0.00001	< 0.00001	< 0.000005	< 0.000005
1131-133 Waikato River at Tuakau Br					
6/03/2013	11:35	< 0.00001	< 0.00001	0.000005	< 0.000005
5/06/2013	12:09	< 0.00001	< 0.00001	< 0.000005	0.000006
4/09/2013	12:40	< 0.00001	< 0.00001	< 0.000005	< 0.000005
3/12/2013	11:15	0.000026	0.000022	< 0.000005	0.000006

< = less than the value stated

*Time = New Zealand Standard Time

Table 6: Organochlorine, organonitrogen and organophosphorus pesticides analysed including methods and detection limits (DL).

Code	Parameter	#DL	*Method	Code	Parameter	#DL	*Method	Code	Parameter	#DL	*Method	Detection limits (g/m ³)	
2,4"-DDD	2,4"-DDD	b	GC-ECD	Dicloran	Dicloran	c	GC-MS	Oxadiazol	Oxadiazon	a	GC-MS	a	0.00001
2,4"-DDE	2,4"-DDE	b	GC-ECD	Dieldrin	Dieldrin	b	GC-ECD	Oxyfluof	Oxyfluofen	a	GC-MS	b	0.0000005
2,4"-DDT	2,4"-DDT	b	GC-ECD	Difenoco	Difenoconazole	c	GC-MS	Paclobut	Paclobutrazol	a	GC-MS	c	0.00002
4,4"-DDD	4,4"-DDD	b	GC-ECD	Dimethoa	Dimethoate	c	GC-MS	Parathie	Parathion-ethyl	a	GC-MS	d	0.00005
4,4"-DDE	4,4"-DDE	b	GC-ECD	Diphenyl	Diphenylamine	c	GC-MS	Parathim	Parathion-methyl	a	GC-MS	e	0.000002
4,4"-DDT	4,4"-DDT	b	GC-ECD	Diuron	Diuron	a	GC-MS	Pendimet	Pendimethalin	a	GC-MS	f	0.000005
Acetochl	Acetochlor	a	GC-MS	Endosul	Endosulfan I	b	GC-ECD	Permethr	Permethrin	a	GC-MS		
Alachlor	Alachlor	a	GC-MS	Endosull	Endosulfan II	b	GC-ECD	Pirimica	Pirimicarb	a	GC-MS		
Aldrin	Aldrin	b	GC-ECD	Endosulp	Endosulfan sulphate	b	GC-ECD	Pirimiph	Pirimiphos Methyl	a	GC-MS		
Alpha-BH	Alpha-BHC	b	GC-ECD	Endrin	Endrin	b	GC-ECD	Prochlor	Prochloraz	d	GC-MS		
Atrazind	Atrazine-desethyl	a	GC-MS	Endrin a	Endrin aldehyde	b	GC-ECD	Procymid	Procymidone	a	GC-MS		
Atrazine	Atrazine	a	GC-MS	Endrin K	Endrin Ketone	b	GC-ECD	Prometry	Prometryn	a	GC-MS		
Atrazini	Atrazine-deisopropyl	a	GC-MS	Fenpropi	Fenpropimorph	a	GC-MS	Propachl	Propachlor	a	GC-MS		
Azaconaz	Azaconazole	a	GC-MS	Fluazifo	Fluazifop-p-butyl	a	GC-MS	Propanil	Propanil	c	GC-MS		
Azinphos	Azinphos-methyl	c	GC-MS	Fluometu	Fluometuron	a	GC-MS	Propazin	Propazine	a	GC-MS		
Benalaxy	Benalaxyl	a	GC-MS	Flusilaz	Flusilazole	a	GC-MS	Propicon	Propiconazole	a	GC-MS		
Beta-BHC	Beta-BHC	b	GC-ECD	Fluvalin	Fluvalinate	a	GC-MS	Pyriprox	Pyriproxifen	a	GC-MS		
Bitertan	Bitertanol	c	GC-MS	Furalaxy	Furalaxyl	a	GC-MS	Quizalet	Quizaletop-ethyl	a	GC-MS		
Bromacil	Bromacil	a	GC-MS	Gamma-BH	Gamma-BHC (Lindane)	b	GC-ECD	Simazine	Simazine	a	GC-MS		
Bromopro	Bromopropylate	a	GC-MS	Haloxypm	Haloxypop-methyl	a	GC-MS	Simetryn	Simetryn	a	GC-MS		
Butachlo	Butachlor	a	GC-MS	Heptachl	Heptachlor	b	GC-ECD	Sulfentr	Sulfentrazone	d	GC-MS		
Captan	Captan	c	GC-MS	Heptaepo	Heptachlor epoxide	b	GC-ECD	TCMTB	TCMTB	c	GC-MS		
Carbaryl	Carbaryl	a	GC-MS	Hexachlo	Hexachlorobenzene	b	GC-ECD	Tebucona	Tebuconazole	a	GC-MS		
Carbofur	Carbofuran	a	GC-MS	Hexacona	Hexaconazole	a	GC-MS	Terbacil	Terbacil	a	GC-MS		
Chlorflu	Chlorfluazuron	a	GC-MS	Hexazino	Hexazinone	f	GC-MS	Terbufos	Terbufos	a	GC-MS		
Chloroth	Chlorothalonil	a	GC-MS	IPBC	IPBC (3-Iodo-2-propynyl -n-butylcarbamate)	d	GC-MS	Terbumet	Terbumeton	a	GC-MS		
Chlorpyf	Chlorpyrifos	a	GC-MS	lprodion	lprodione*	d	GC-MS	Terbutde	Terbutylazine desethyl	a	GC-MS		
Chlorpym	Chlorpyrifos-methyl	a	GC-MS	Kresoxim	Kresoxim-methyl	a	GC-MS	Terbuty	Terbutylazine	f	GC-MS		
Chlortol	Chlortoluron	c	GC-MS	Linuron	Linuron	a	GC-MS	Terbutry	Terbutryn	a	GC-MS		
cis-Chlo	cis-Chlordane	b	GC-ECD	Malathio	Malathion	a	GC-MS	Thiabend	Thiabendazole	d	GC-MS		
Cyfluthr	Cyfluthrin	a	GC-MS	Metalaxy	Metalaxyl	a	GC-MS	Thiobenc	Thiobencarb	a	GC-MS		
Cyhaloth	Cyhalothrin	a	GC-MS	Methoxyc	Methoxychlor	b	GC-ECD	Tolyflua	Tolyfluamid	a	GC-MS		
Cynanazi	Cynanazine	a	GC-MS	Metolach	Metolachlor	a	GC-MS	Total Ch	Total Chlordane (cis+trans)*100/42	e	GC-ECD		
Cypermet	Cypermethrin	c	GC-MS	Metribuz	Metribuzin	a	GC-MS	trans-Ch	trans-Chlordane	b	GC-ECD		
Delta-BH	Delta-BHC	b	GC-ECD	Molinate	Molinate	c	GC-MS	Triazoph	Triazophos	a	GC-MS		
Deltamet	Deltamethrin	a	GC-MS	Myclobut	Myclobutanil	a	GC-MS	Triflura	Trifluralin	a	GC-MS		
Diazinon	Diazinon	a	GC-MS	Naled	Naled	d	GC-MS	Vinclozo	Vinclozolin	a	GC-MS		
Dichlofl	Dichlofluanid	a	GC-MS	Norflura	Norflurazon	c	GC-MS						
Dichlorv	Dichlorvos	c	GC-MS										

* there was no results for this pesticide for samples collected in December 2013 because the method performance was unacceptable

Method

GC-MS: Solid phase extraction, GPC (if required), GC-MS analysis

GC-ECD: Solid phase extraction, SPE cleanup (if required), dual column GC-ECD analysis

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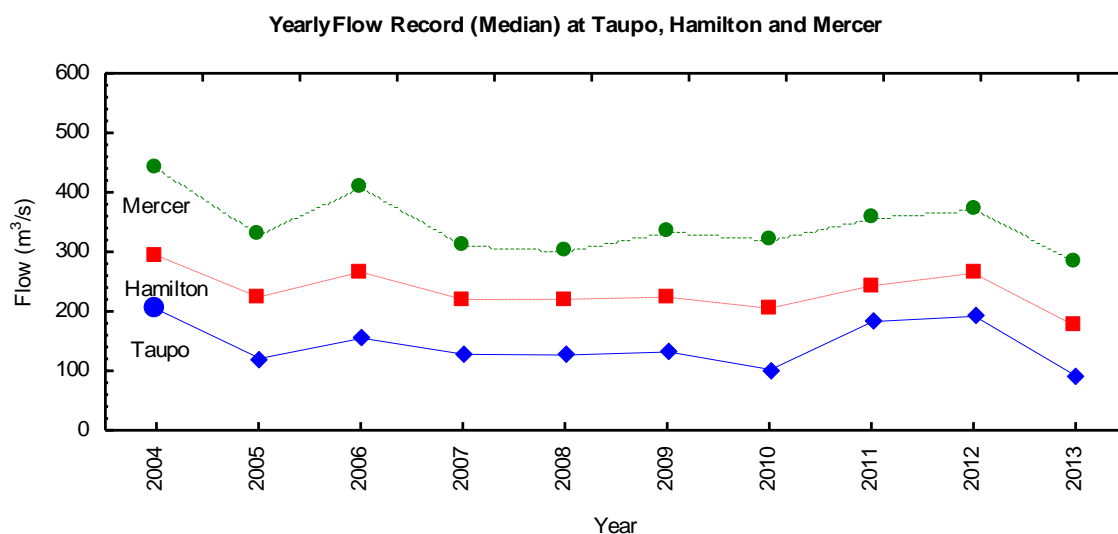
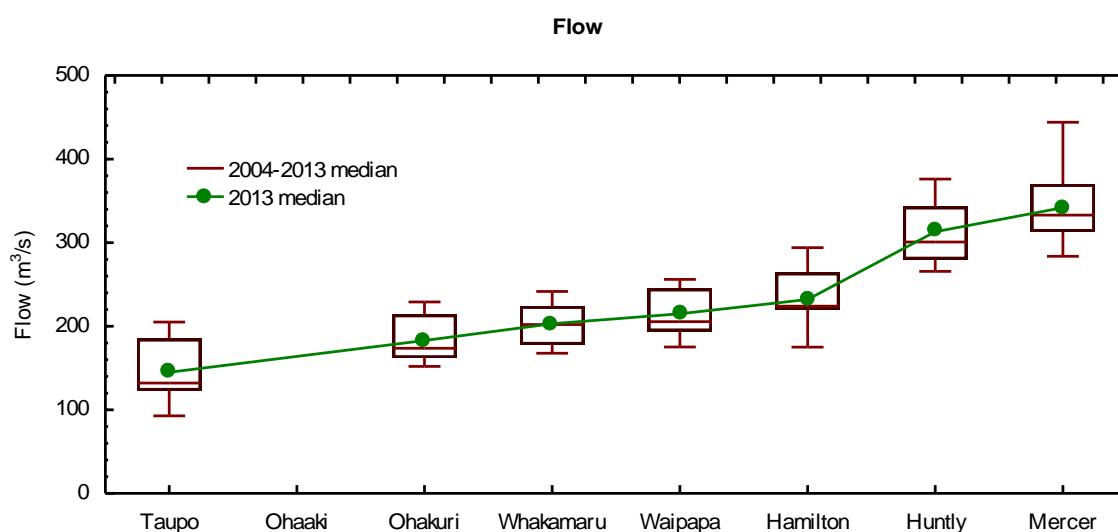
Appendix I:

Flow Information

Location	DISTANCE		FLOW RATE+ (m ³ /s)										10 YEAR
	km		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Median
Taupo	4.2		205	123	157	130	129	134	104	185	194	93	145
Ohakuri	75.8		214	152	184	157	163	162	192	225	229	163	183
Whakamaru	105.0		224	175	208	178	186	196	209	242	232	168	203
Waipapa	126.1		256	200	237	190	211	194	198	250	245	175	215
Hamilton	211.5		294	224	266	220	220	224	205	243	264	175	232
Huntly	246.5		376	290	343	280	274	306	296	339	345	266	313
Mercer	286.3		444	332	409	313	302	334	323*	356*	370*	284	342
Waiotapu Stm	46.6		3.7	3.6	3.8	2.8	3.0	2.7	3.3	3.8	3.5	2.5	3
Waipa River	232.7			56	58	34	52	52	32	57	53	36	48

+Rating curve errors mean estimates of flow are ± 8%

*Historical flow data updated due to rating changes from updated data received

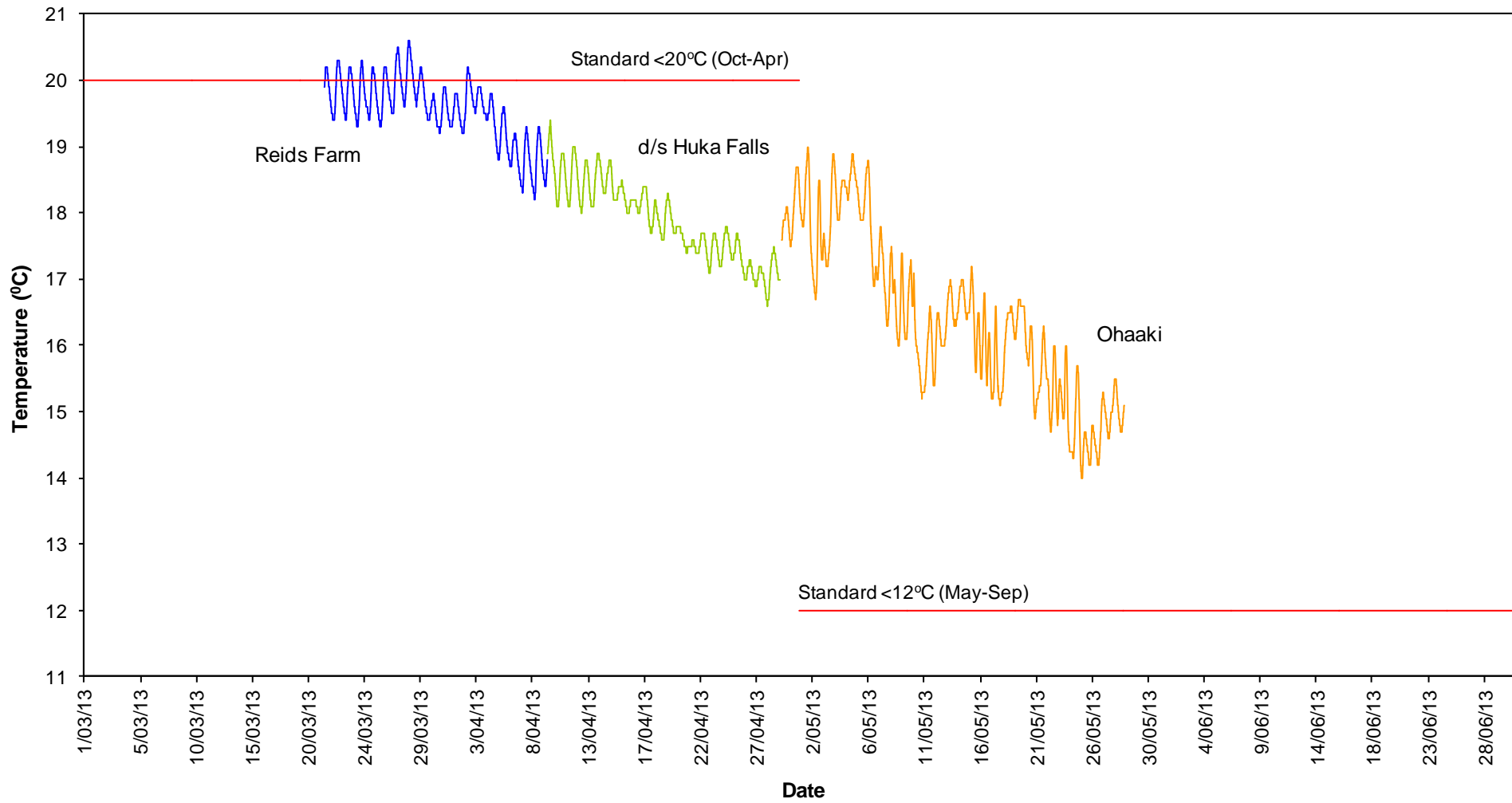


Appendix II

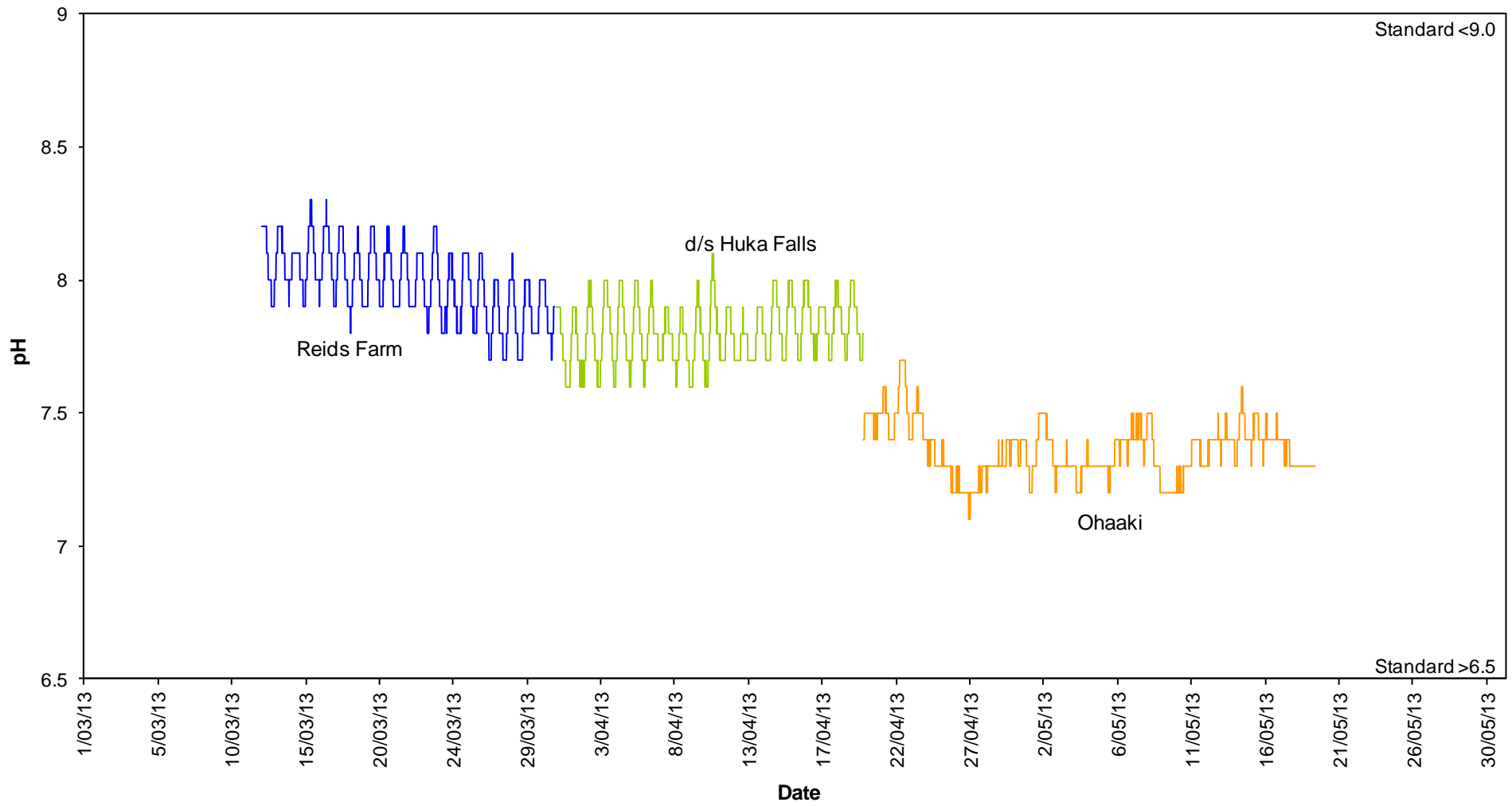
Datasonde deployments

Diurnal variation of selected water quality parameters

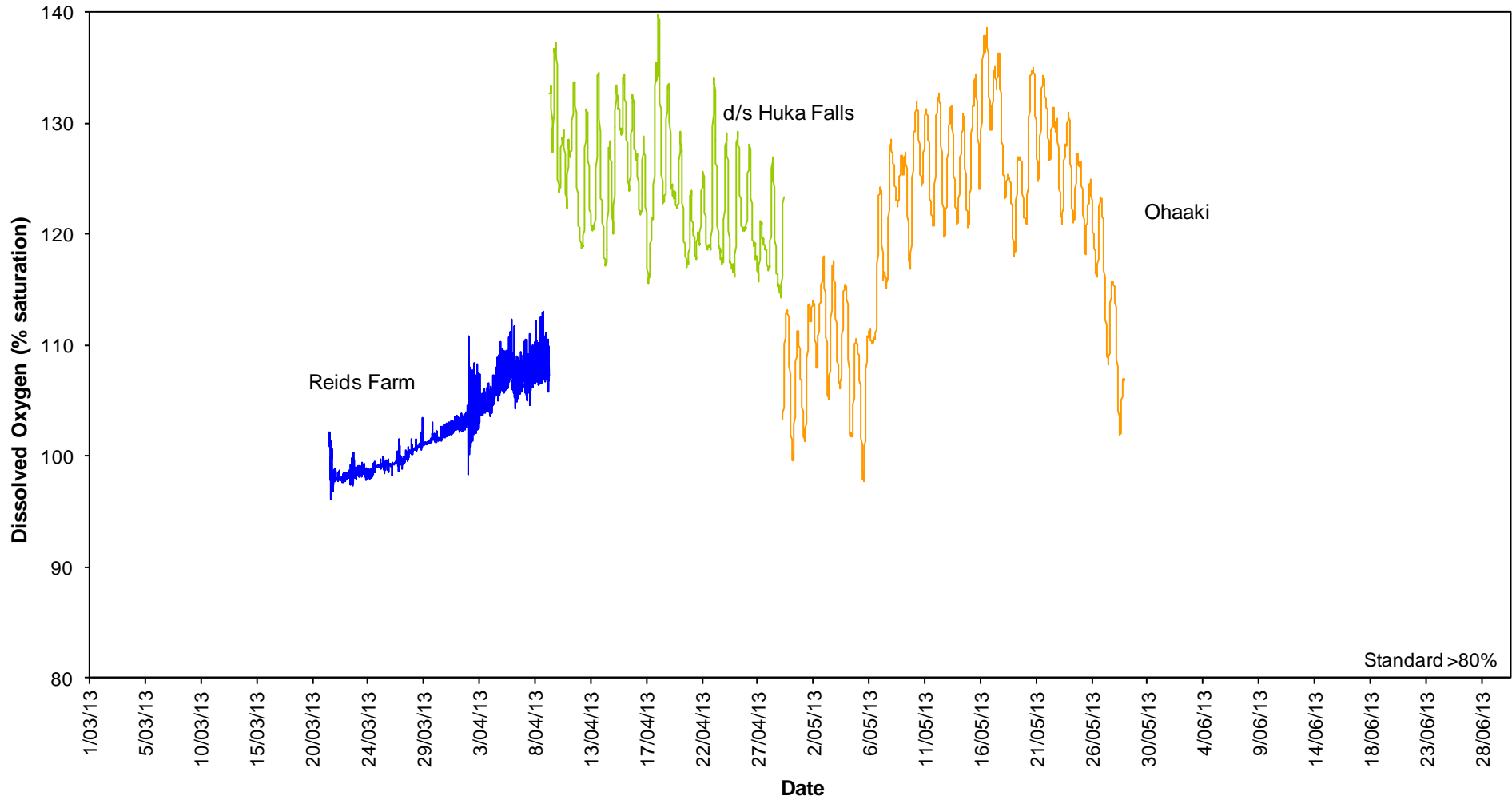
Temperature: Upper Waikato (March - June)



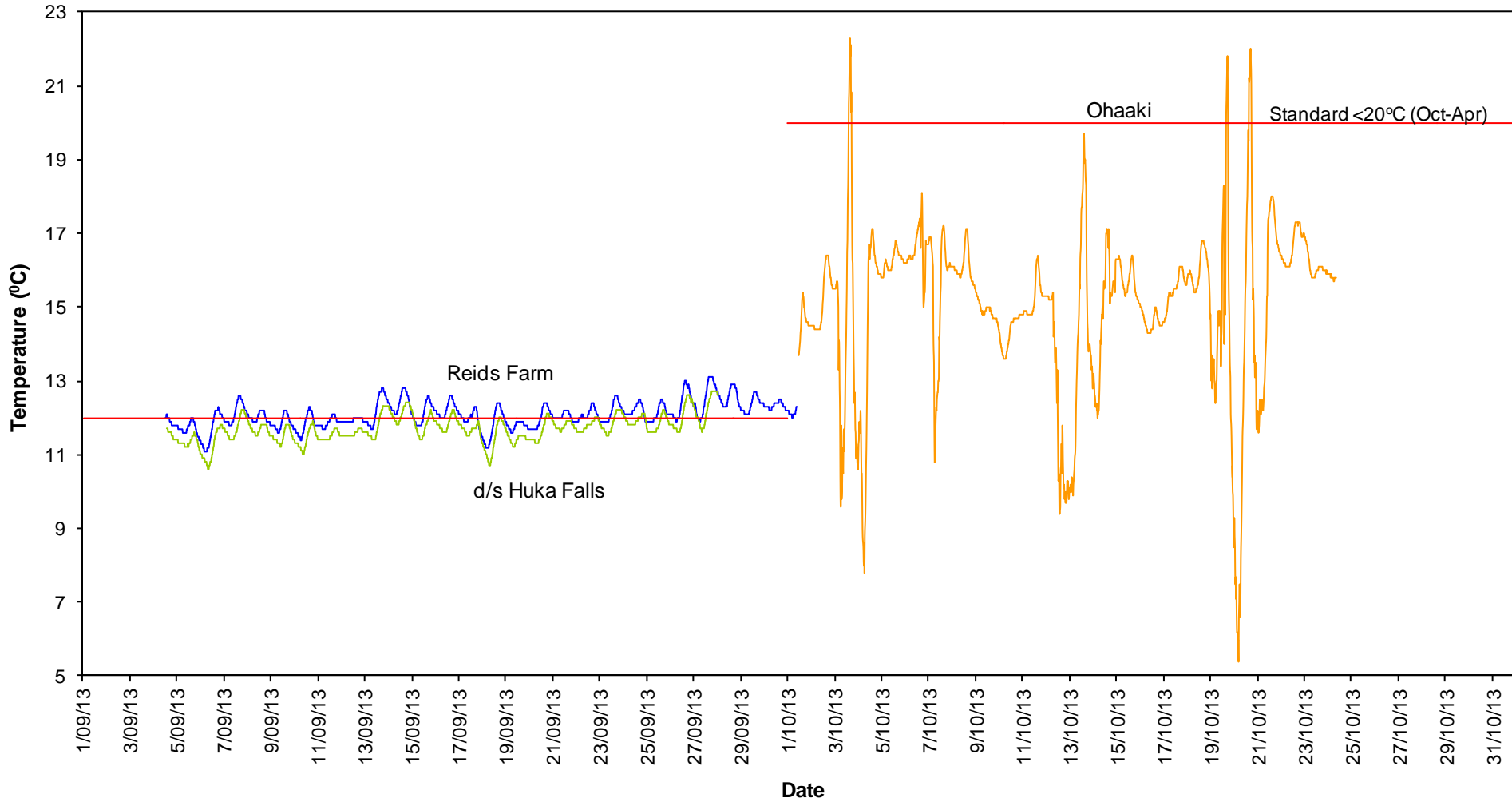
pH: Upper Waikato (March - June)



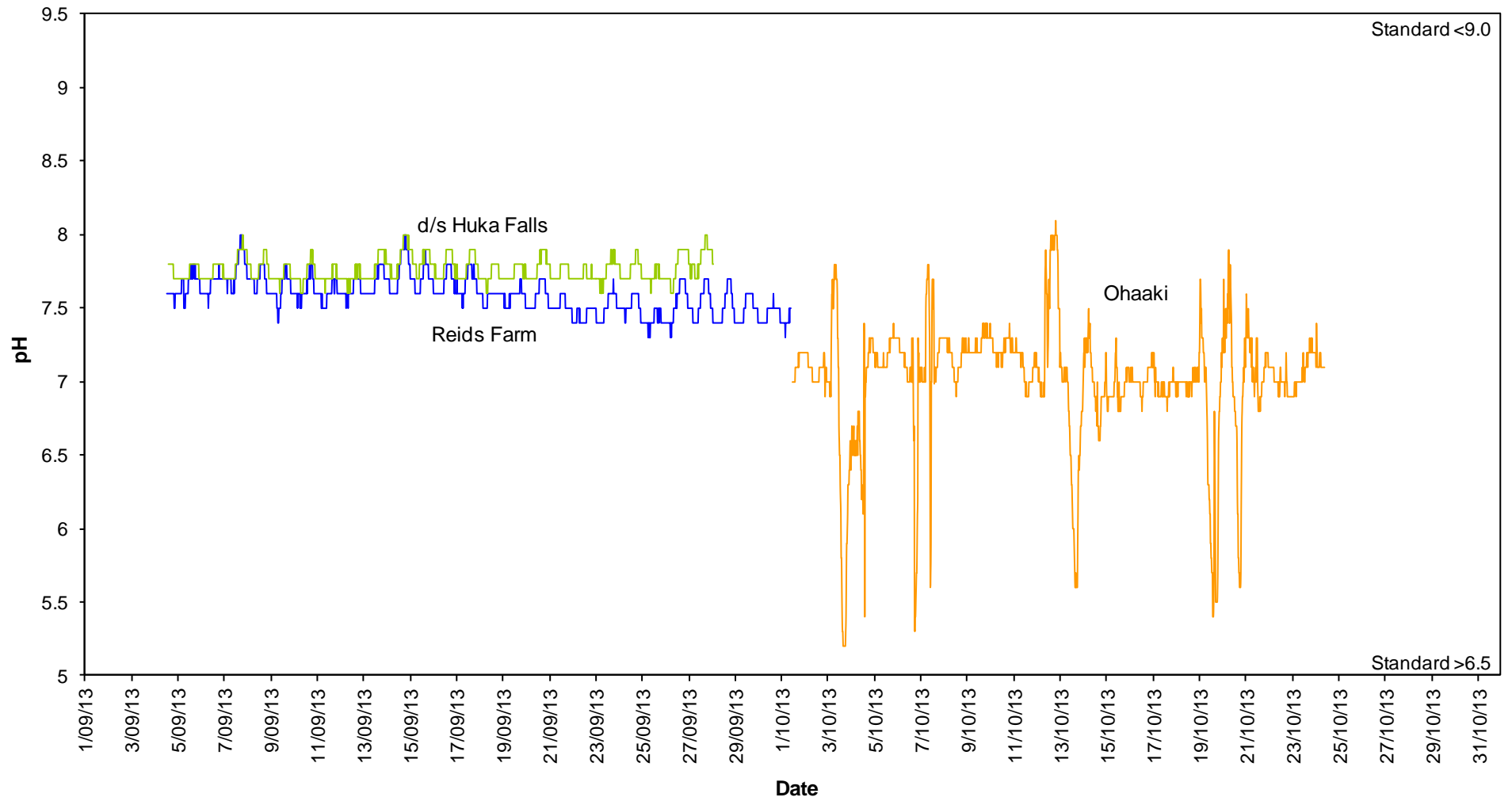
Dissolved Oxygen, % saturation: Upper Waikato (March - June)



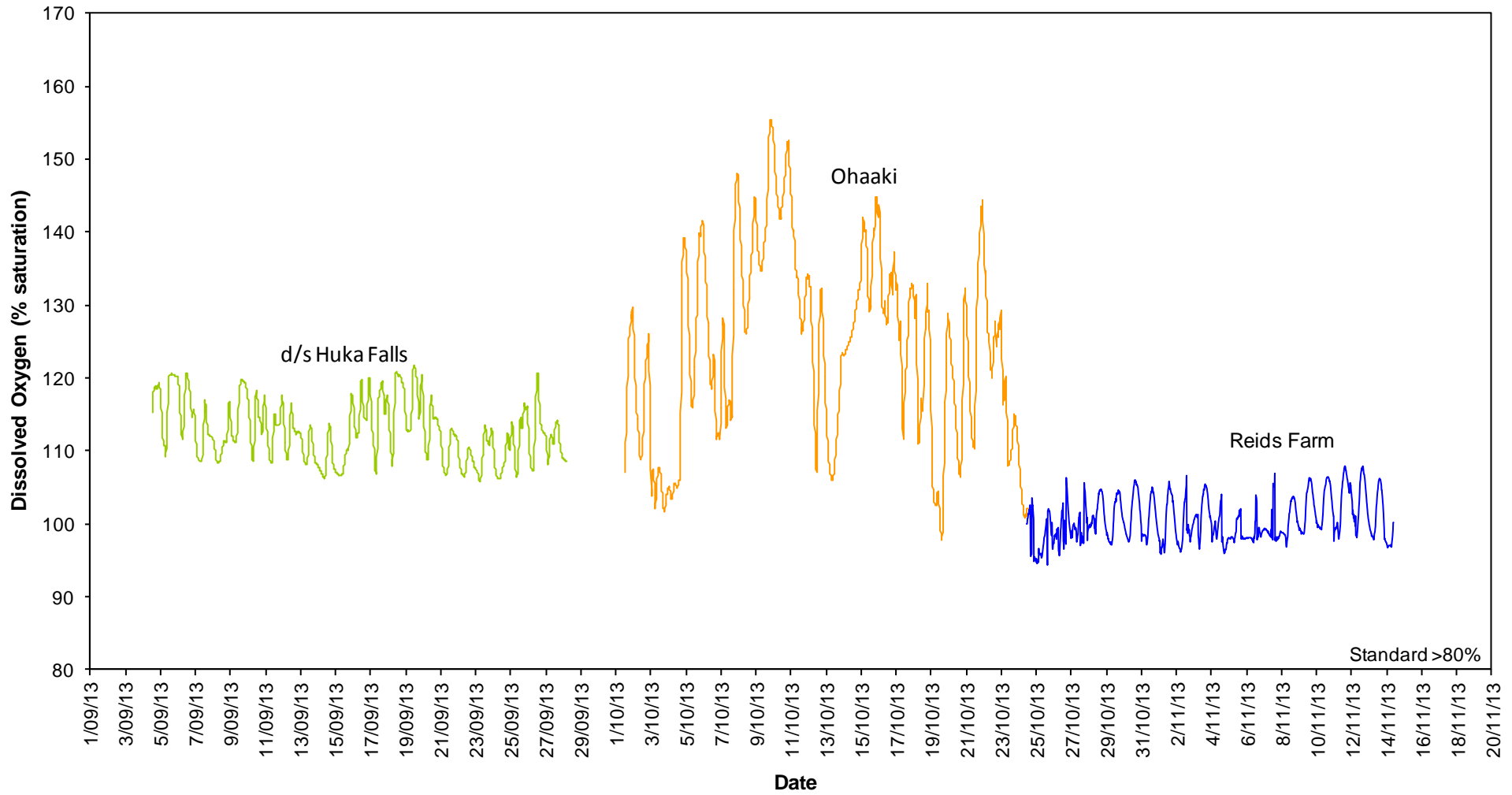
Temperature: Upper Waikato (September to November)



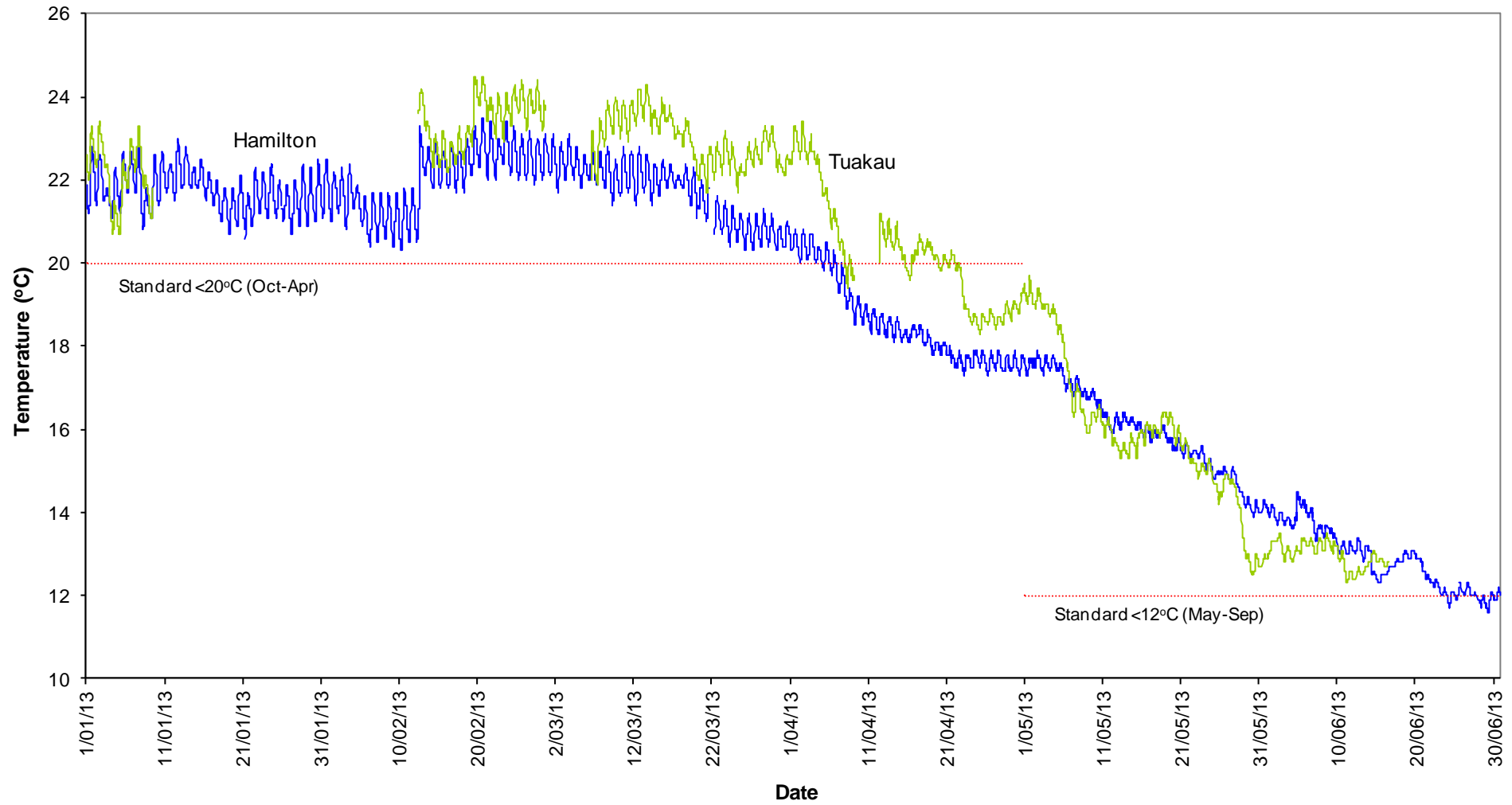
pH: Upper Waikato (September to November)



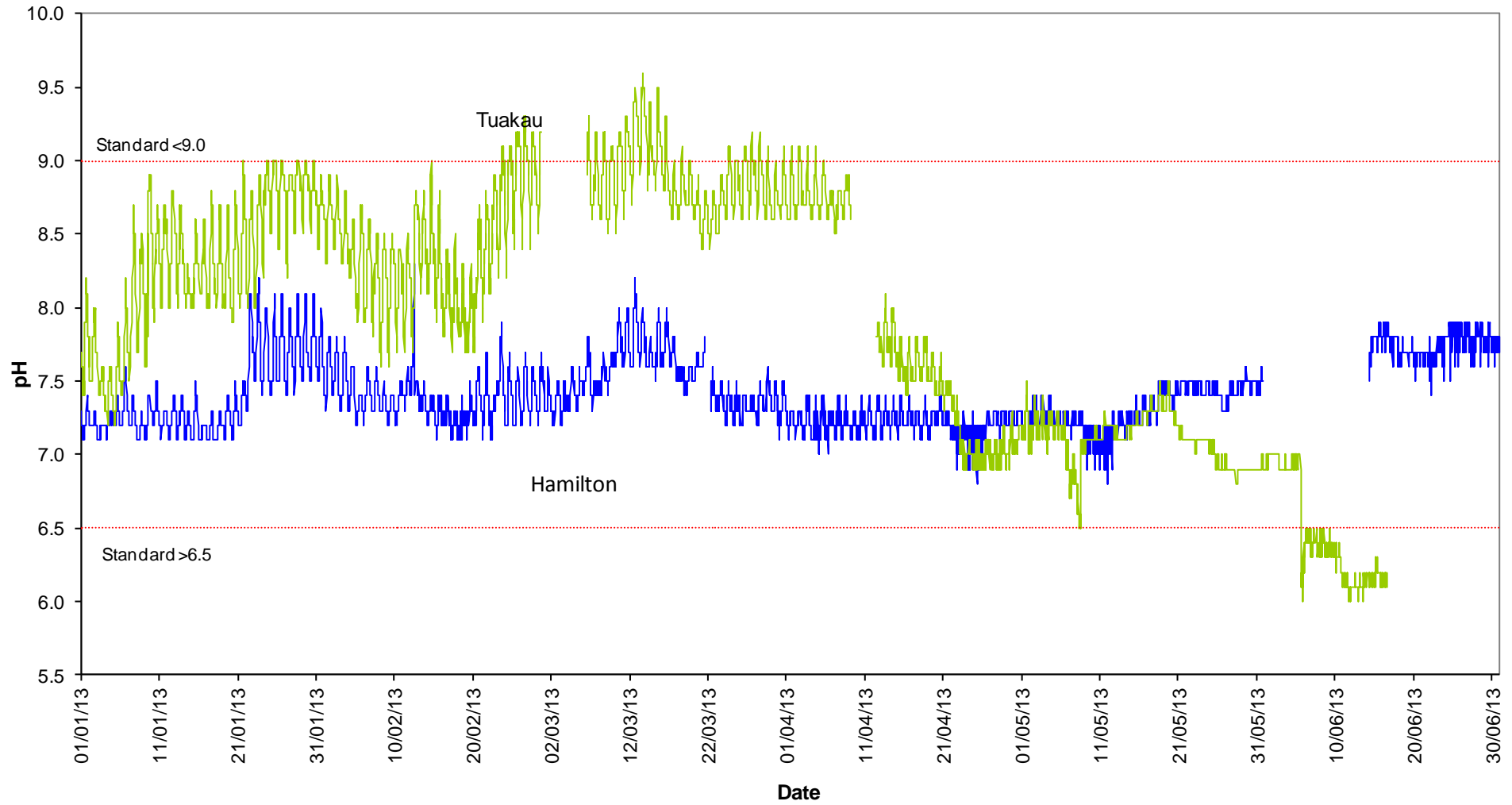
Dissolved Oxygen, % saturation: Upper Waikato (September to November)



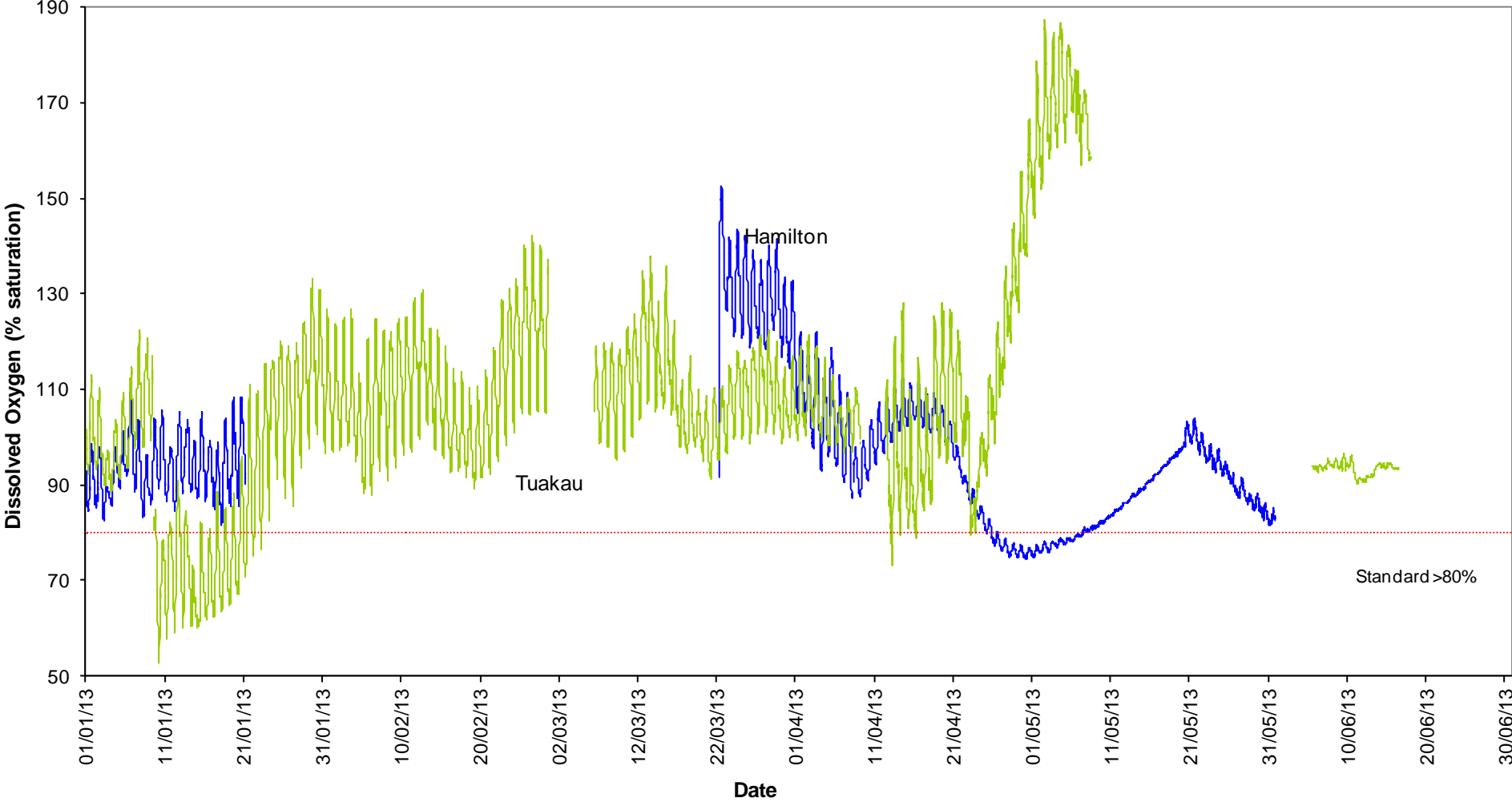
Temperature: Lower Waikato (January-June)



pH: Lower Waikato (January - June)

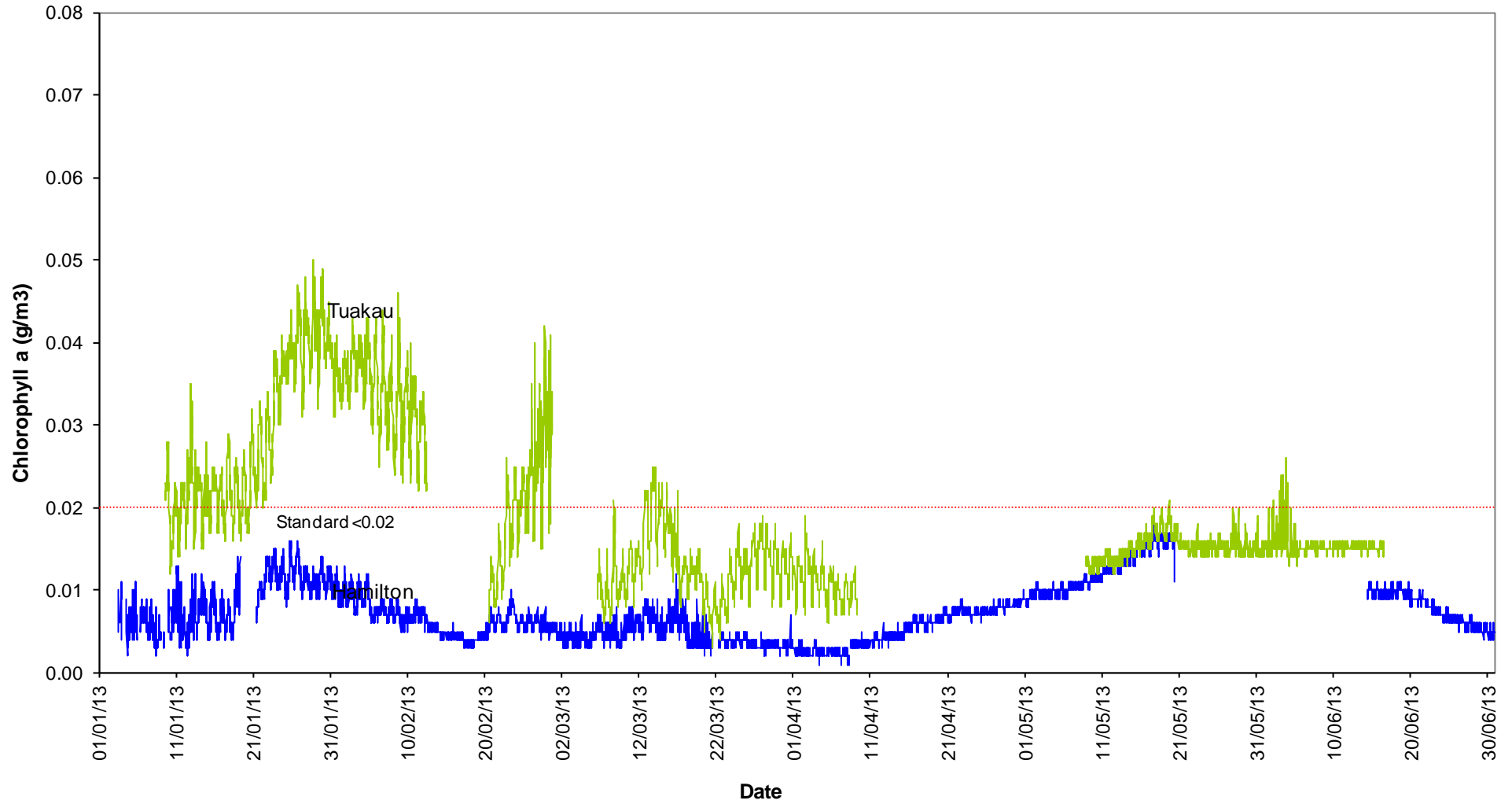


Dissolved Oxygen (% saturation): Lower Waikato (January - June)

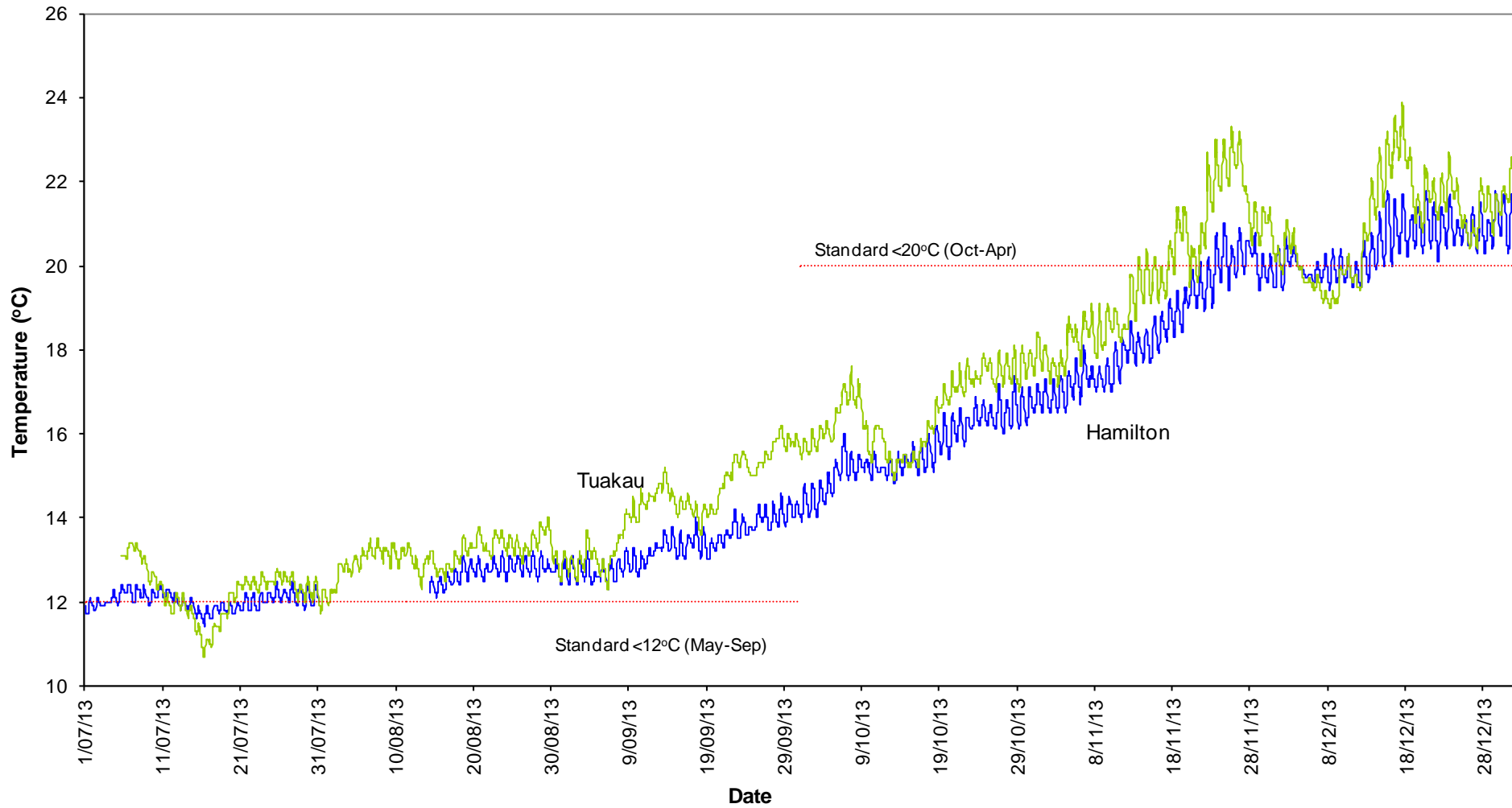


XX

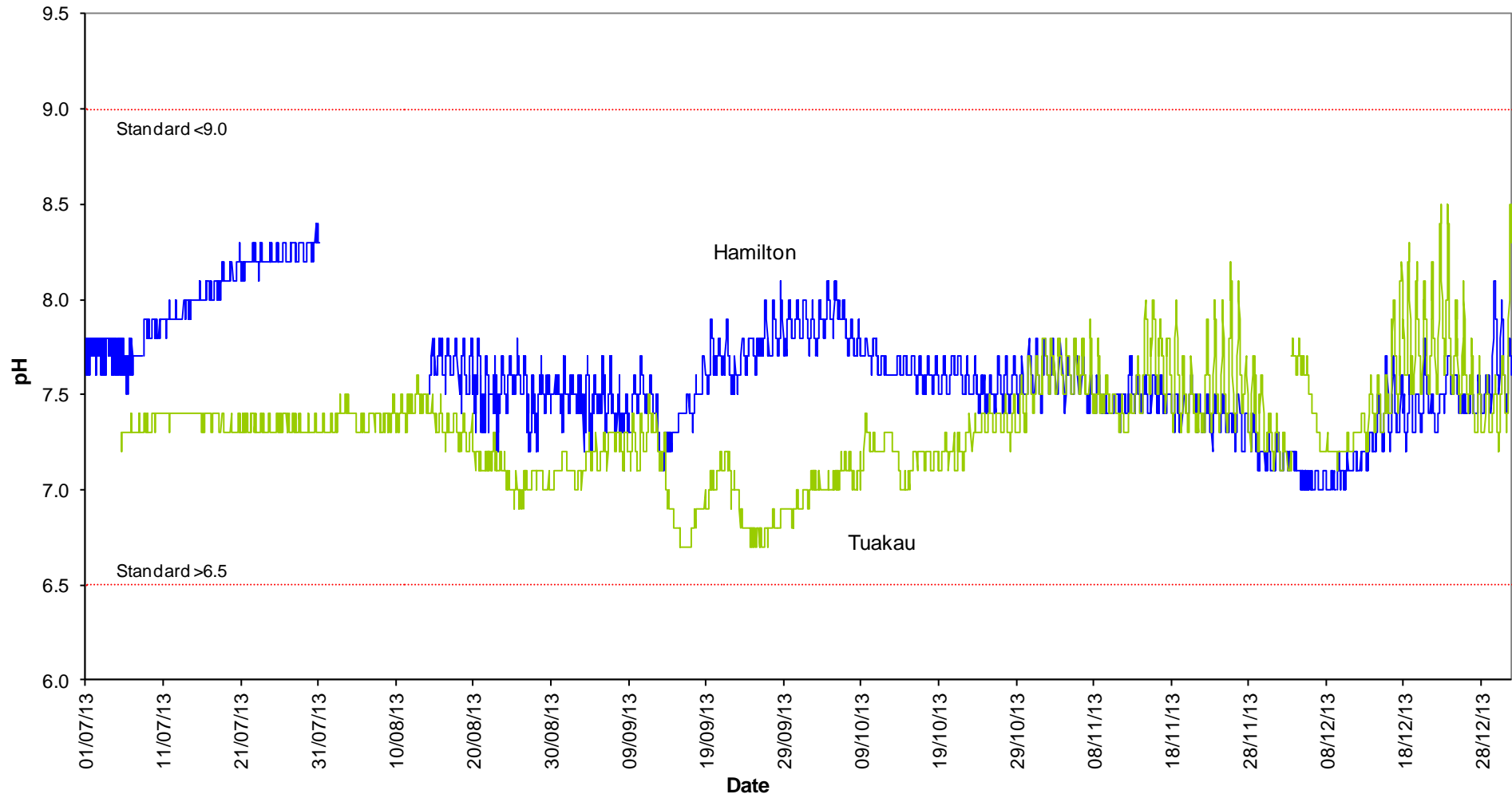
Chlorophyll a: Lower Waikato (January- June)



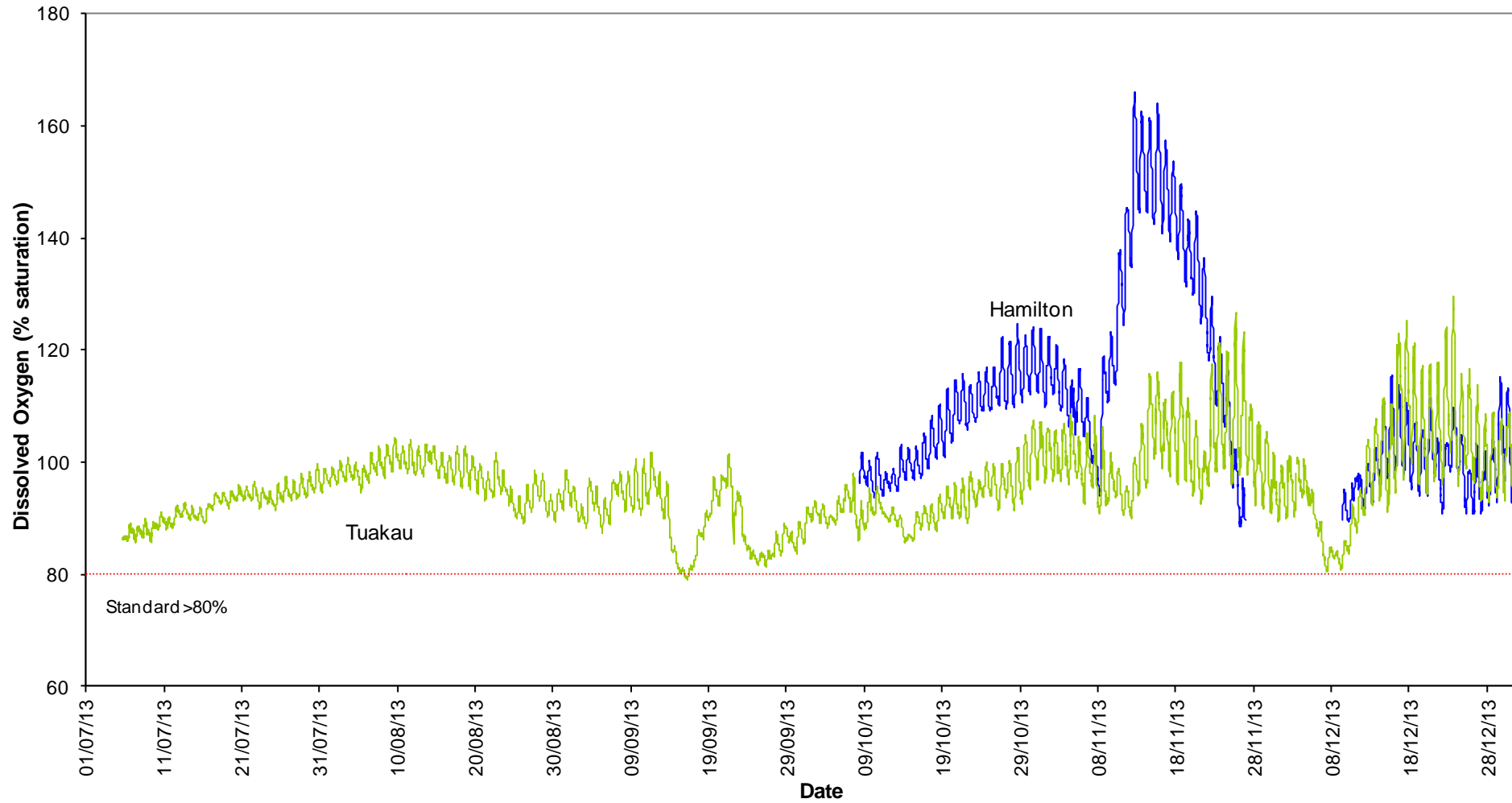
Temperature: Lower Waikato (July-December)



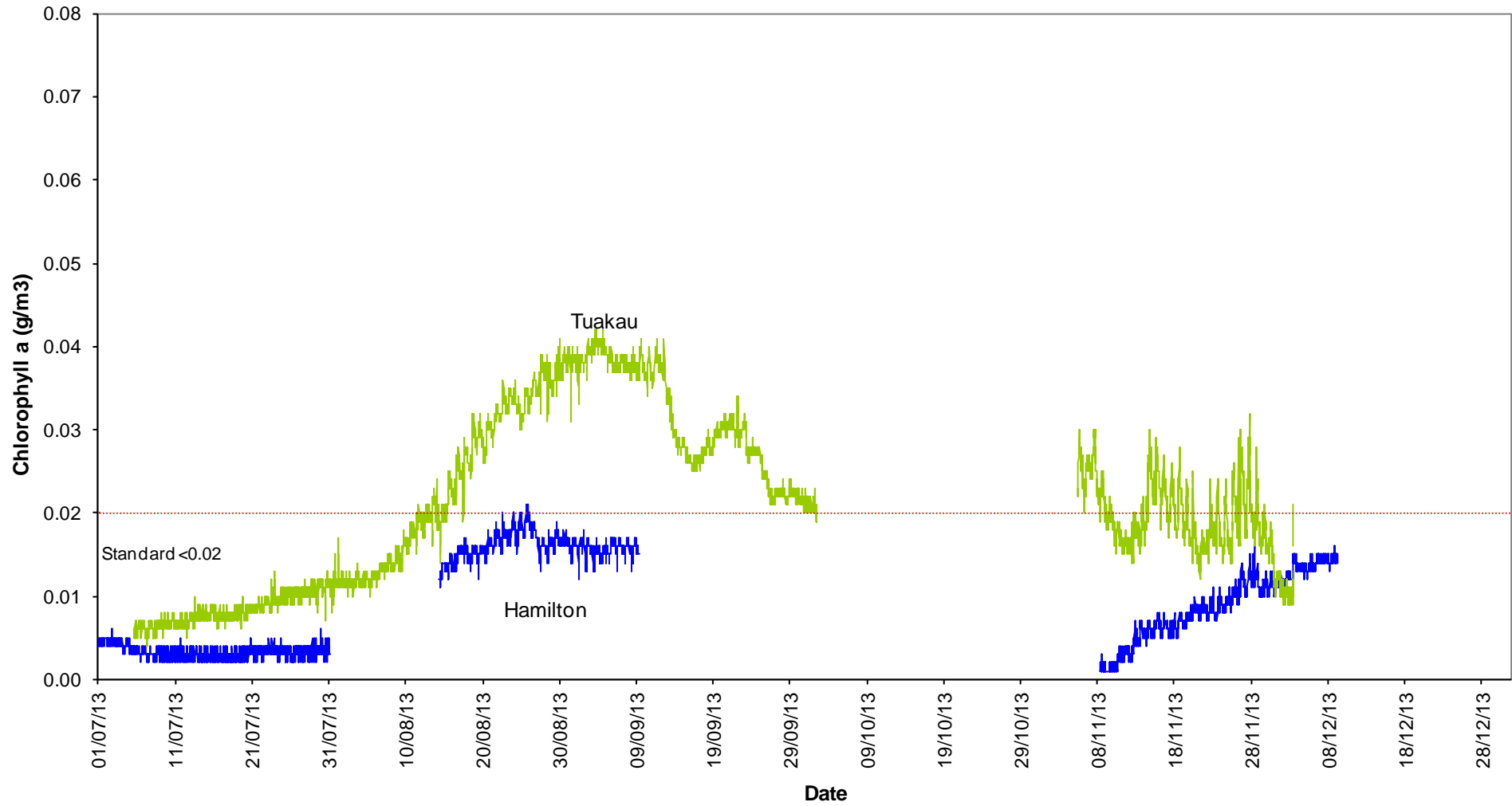
pH: Lower Waikato (July - December)



Dissolved Oxygen (% saturation): Lower Waikato (July - December)



Chlorophyll a: Lower Waikato (July - December)



Appendix III:
Water quality parameters
Guidelines and standards
Analytical methods

Waikato River water quality monitoring programme parameters

Water quality parameter	Reason for monitoring	Parameter monitored ¹	Comments ²
Dissolved oxygen	- requirement for aquatic life	DO (conc.)	routine (field)
	- indicator of organic pollution	DO (%sat.)	routine (field)
	- indicator of photosynthesis (plant growth)		
Temperature	- indicator of biological activity	Temperature	routine (field)
	- requirement for aquatic life		
	- mixing processes		
	- modelling studies (e.g. nutrient uptake)		
Conductivity	- indicator of total salts dissolved in water	Conductivity	routine
	- indicator for geothermal input	TDS	routine
pH	- aquatic life protection	pH	routine
	- indicator of industrial discharges, mining		
Clarity - turbidity - black disk (visual clarity)	- aesthetic appearance	Turbidity	routine
	- light availability for excessive plant growth	Black disk	routine (field)
	- aquatic life protection		
	- indicator of catchment condition, land use		
Colour - light absorption	- aesthetic appearance	Munsell colour	routine (field)
	- light availability for excessive plant growth	Absorbance at:	routine
	- indicator of presence of organic matter	340,440,780nm	
Nutrients (N and P) chlorophyll a	- enrichment, excessive plant growth	NO ₃ -N+NO ₂ -N	routine
	- nutrient limitation for plant/algal growth	NH ₄ -N,TKN DRP, TP, Chl a	
Geothermal contaminants	- indicators of geothermal inflows	Cl, Li, B, As	routine
	- aquatic life protection (ecotoxicity)		
	- drinking water (human health aspects)		
Organic carbon	- indicator of organic pollution	BOD ₅	routine
	- catchment characteristics	TOC/DOC	routine
Faecal bacteria - E. coli - enterococci - faecal coliforms	- indicator of pollution with faecal matter	E. Coli	routine
	- disease risk for swimming etc.	ENT	routine
		FC	routine

¹ see the page 49 for the meaning of the abbreviations.

² routine means sampled monthly.

Details of water quality standards and guidelines for “satisfactory” water quality

Parameter	Critical value(s)	Source
Dissolved oxygen	>80% of saturation concentration	RMA Third Schedule, Classes AE, F, and FS.
pH	6.5–9	ANZECC (1992) and Canadian guidelines for freshwater aquatic life (1987).
Turbidity	<5 NTU	Studies of adverse effects on underwater light—and thus on plant and invertebrate production—in certain South Island streams (Davies-Colley 1991).
Ammoniacal-nitrogen	<0.88 g/m ³	USEPA (1998) value for 1-hour exposure at pH 9.
Temperature	<12°C (May – Sep) <20°C (Oct – Apr)	Waikato Regional Council Proposed Regional Plan standards for trout fisheries and trout spawning (1998).
Total phosphorus	<0.04 g/m ³	From upper quartile values for 77 New Zealand rivers in NIWA's National Water Quality Network (after Smith & Maasdam 1994)—note that the guidelines for “excellent” conditions are the lower quartile concentrations for these rivers.
Total nitrogen	<0.5 g/m ³	From upper quartile values for 77 New Zealand rivers in NIWA's National Water Quality Network (after Smith & Maasdam 1994)—note that the guidelines for “excellent” conditions are the lower quartile concentrations for these rivers.
Water clarity at baseflow	>1.6 m	“Baseflow” defined as flows less than the upper decile flow. Guideline from Ministry for the Environment (1994).
Escherichia coli	<550/100 mL	Ministry for the Environment (2003) guidelines for the management of recreational and marine shellfish-gathering waters.
Median Escherichia coli	<126/100 mL	Ministry for the Environment (1999) guidelines for the management of recreational and marine shellfish-gathering waters.
Enterococci	<77/100 mL	Department of Health (1992) guidelines for “moderate” level of recreational use.
Chlorophyll a	<0.02 g/m ³	Ministry for the Environment (1992).
Arsenic	<0.01 g/m ³	Ministry of Health (2001).
Boron	<1.4 g/m ³	Ministry of Health (2001).

Waikato River monitoring programme - water quality parameters and analytical methods

Id ¹	Parameter	Method
A340F	Absorbance @ 340 nm filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
A440F	Absorbance @ 440 nm filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
A780F	Absorbance @ 780 nm filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
As	Arsenic total	Nitric acid digestion, ICP-MS, APHA method 3125 B / USEPA 200B
B	Boron	ICP-MS, APHA method 3125 B
BDISK	Black disk	Field measurement, horizontal water transparency (20mm, 60mm, 100mm, 200mm disk) in river
BOD ₅	Biochemical oxygen Demand (5 day)	Incubation 5 days at 20°C, DO-meter, No nitrification inhibitor added, unseeded, APHA method 5210 B
CHLA	Chlorophyll a	Acetone extraction. Spectroscopy. APHA method 10200 H (modified)
Cl	Chloride	Filtered sample. Ferric thiocyanate colorimetry, Discrete analyser. APHA method 4500 ClE (modified)
COLOUR	Colour	Field measurement, Munsell colour patches
COND	Conductivity	Lab Meter @ 25°C. APHA method 2510B
DO	Dissolved oxygen	Field measurement (Hach DO meter, model HQ 30d)
DO (% Sat)	Dissolved oxygen (percent saturation)	Field measurement (Hach DO meter, model HQ 30d)
DOC	Dissolved organic Carbon	Filtration, acidification, purging to remove inorganic C, persulphate oxidation, IR detection. APHA method 5310 C (modified)
DRP	Dissolved reactive Phosphorus	Filtration, Molybdenum Blue Colorimetry. Discrete analyser. APHA 4500 PE (modified)
E. coli	Escherichia coli	Membrane Filtration (mFC Agar) confirmation by MUG Agar. APHA method 9222 G
ENT	Enterococci bacteria	Membrane Filtration (mE Agar) confirmation by EIA Agar. APHA method 9230 C
FC	Faecal coliforms	Membrane Filtration (mFC Agar). APHA method 9222 D
Flow	Flow – instantaneous	Calculated from rating curve ± 8%
Li	Lithium	ICP-MS, method APHA 3125 B
NH ₄ -N	Ammoniacal Nitrogen (Total)	Filtration, Phenol/Hypochlorite Colorimetry. Discrete analyser. APHA method 4500-NH ₃ F (modified).
NNN	Nitrite/Nitrate Nitrogen	Automated Cadmium reduction. Flow injection analyser. APHA method 4500 – NO ₃ -I (modified)
NO ₃ -N	Nitrate nitrogen	Calculation: (Nitrate-N + Nitrite -N) – Nitrite - N
pH	pH	Lab Meter @ 25°C. APHA method 4500-H ⁺ B
TDS	Total dissolved solids	Filtration, gravimetric. APHA 2540 C (modified)
TEMP	Temperature	Field measurement (Hach DO meter, model HQ 30d)
TKN	Total Kjeldahl-Nitrogen	Acid digestion. Phenol/Hypochlorite colorimetry. Discrete analyser. APHA method 4500-N _{org} D (modified), 4500 NH ₃ F (modified)
TOC	Total Organic Carbon	Acidification, purging to remove inorganic C, persulphate oxidation, IR detection. APHA method 5310 C (modified)
TN	Total Nitrogen	Calculated from NNN + TKN (Nitrite/Nitrate Nitrogen + Total Kjeldahl-Nitrogen)
TP	Total Phosphorus	Acid persulphate digestion, Colorimetry. Discrete Analyser. APHA method 4500-P B & E (modified), corrected values to take into account possible interference from arsenic present in the sample.
TURB	Turbidity	Turbidity Meter Hach 2100N. APHA method 2130 B

¹ Water quality parameter identification code refers to Waikato Regional Council's water quality database (TimeStudio) parameter short name.

APHA = Standards Methods for the Examination of Water and Wastewater, 22nd Edition, 2012, APHA, AWWA, WEF

ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy