Environment Waikato Technical Report 2005/21

Waikato River Water Quality Monitoring Programme:

Data Report 2004

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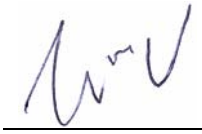
Bill Vant Initials  Date 20/6/05

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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, Environment Waikato, Hamilton provided hydrological flow data for the two other sites.

Disclaimer

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1 Introduction

1.1 Background

The year 2004 report follows the format of the previous data report (Smith, 2004), with the addition of the reporting of a pesticide survey conducted between September 2003 and June 2004.

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 Environment Waikato 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 13th since the re-design of the Waikato River Monitoring Programme (WARIMP) implemented in 1989[1]. Copies of reports can be obtained via the Environment Waikato Internet site http://www.ew.govt.nz/publications/index.htm or by contacting Environment Waikato (the Library) on 0800 800 401, e-mail: inforeq@ew.govt.nz.

1.2 Report Content

The report provides information on:

1. Routine monthly monitoring of water quality at 10 sites:
   - Year 2004 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 2004 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 Year 2004.
   - Pesticide data and parameters.

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 provides information on annual average flow at some locations for the previous 10 years.

   - Datasonde Deployments
     → Plots of deployments undertaken during 2004 showing the level of diurnal variation at five Waikato River sites (*Appendix II*).

[1] Regional Rivers reported on separately – See Smith, 2005

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 2004. 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 IV). The more stringent criteria identify "excellent" water, and reflect expert opinion. Samples gathered in 2004 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) (May-Sep)	fish (spawning)	<12	<10
(Oct-Apr)		<20	<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 IV for description of Guideline and Standards values used. These guidelines and standards are also defined on the Environment Waikato Internet site; *www.ew.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 ~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 summarised in *Table 2* and illustrated in *Figure 1*.

Table 2: Routine Sampling and Bathing Water Monitoring Locations.

Location Number	Distance[1] (km)	Location Name	Map Ref.	Field[ɾ] 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 left 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
1131.101	202.0	Hamilton – Narrows Bridge	S14:168-708	at jetty[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 1.8km 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] jetty at Hamilton Gardens.
[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 2002/2003 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.
[ɾ] Logistic considerations mean field measurements are often made at slightly different locations from sample collection (e.g. sampling from bridges).
[d] Datasonde deployment sites.

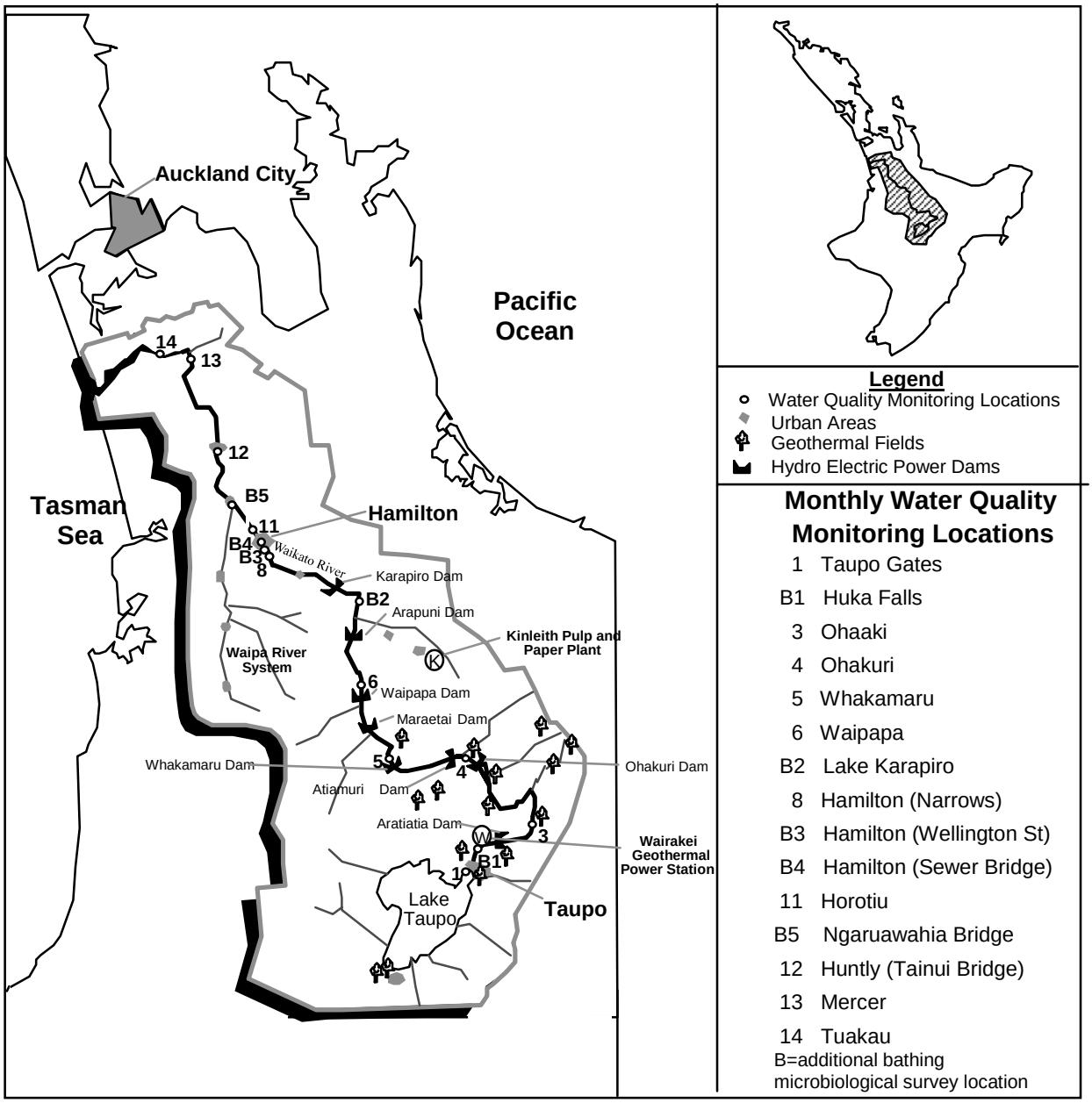


Figure 1: Waikato River Water Quality Monitoring Locations

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*).

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 IV*).

2.4 Quality Control, Data Storage and Analysis

Quality control measures are undertaken in accordance with Environment Waikato's ISO 9001:2000 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 Environment Waikato's water quality archiving database (TimeStudio).

Data analysis was performed using Statistica (version 6.0) 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

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

Environment Waikato Technical Report 2004/02 Trends in river water quality in the Waikato Region, 1987-2002 (Vant & Smith, 2004) 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 Environment Waikato website: http://www.ew.govt.nz/publications/index.htm

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

http://www.ew.govt.nz/enviroinfo/water/healthyrivers/waikato/index.htm

upon completion of the report. The "Healthy Rivers" page provides a link to 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

The results are presented in Section 3.1, containing the results and statistical summaries of the routine and pesticide monitoring of the Waikato River. The raw data is included.

3.1 Waikato River Monitoring Programme Routine Water Quality Monitoring

Summary Statistics

Key Parameter Graphs

Comparison with Water Quality Standards

Raw Data

Raw Pesticide Data and Parameters

Absorbance of filtered sample at 340 nm (units: cm^{-1})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.003	0.003	0.001	0.005	0.003	0.45	0.002
Ohaaki Bridge	12	0.003	0.003	0.002	0.006	0.001	1.39	0.003
Ohakuri Tailrace Bridge	12	0.007	0.006	0.005	0.012	0.002	**1.86**	0.006
Whakamaru Tailrace	12	0.008	0.008	0.005	0.014	0.002	1.13	0.007
Waipapa Tailrace	12	0.011	0.010	0.007	0.018	0.005	0.56	0.010
Narrows Bridge	12	0.016	0.015	0.010	0.032	0.006	1.66	0.012
Horotiu Bridge	12	0.016	0.015	0.010	0.026	0.007	0.74	0.013
Huntly-Tainui Bridge	12	0.025	0.023	0.013	0.048	0.011	0.88	0.019
Mercer Bridge	12	0.030	0.027	0.015	0.055	0.011	0.94	0.024
Tuakau Bridge	12	0.034	0.030	0.016	0.064	0.015	1.02	0.027

Absorbance of filtered sample at 440 nm (units: cm^{-1})								
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	0.003	0.000	**3.02**	0.001
Whakamaru Tailrace	12	0.001	0.001	0.001	0.003	0.000	**2.22**	0.001
Waipapa Tailrace	12	0.002	0.002	0.001	0.004	0.002	0.28	0.002
Narrows Bridge	12	0.004	0.003	0.002	0.011	0.001	**2.20**	0.002
Horotiu Bridge	12	0.004	0.003	0.002	0.007	0.002	1.09	0.003
Huntly-Tainui Bridge	12	0.005	0.005	0.003	0.010	0.004	0.87	0.004
Mercer Bridge	12	0.006	0.005	0.003	0.011	0.004	0.80	0.004
Tuakau Bridge	12	0.007	0.005	0.003	0.015	0.004	1.11	0.005

Arsenic - Total (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.010	0.010	0.010	0.011	0.001	0.71	0.010
Ohaaki Bridge	12	0.025	0.024	0.018	0.037	0.004	1.30	0.025
Ohakuri Tailrace Bridge	12	0.029	0.030	0.021	0.036	0.008	-0.20	0.030
Whakamaru Tailrace	12	0.028	0.028	0.021	0.040	0.010	0.35	0.029
Waipapa Tailrace	12	0.025	0.025	0.017	0.034	0.008	0.31	0.025
Narrows Bridge	12	0.022	0.020	0.017	0.030	0.007	0.79	0.023
Horotiu Bridge	12	0.021	0.020	0.017	0.029	0.007	0.80	0.022
Huntly-Tainui Bridge	12	0.015	0.015	0.007	0.021	0.003	-0.41	0.017
Mercer Bridge	12	0.015	0.015	0.010	0.022	0.005	0.49	0.015
Tuakau Bridge	12	0.014	0.014	0.009	0.020	0.003	0.54	0.015

Boron (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.17	0.16	0.15	0.19	0.01	0.59	0.16
Ohaaki Bridge	12	0.27	0.26	0.21	0.40	0.03	**1.83**	0.27
Ohakuri Tailrace Bridge	12	0.30	0.30	0.23	0.35	0.05	-0.37	0.31
Whakamaru Tailrace	12	0.29	0.31	0.21	0.33	0.07	-0.67	0.30
Waipapa Tailrace	12	0.26	0.26	0.18	0.31	0.05	-0.87	0.26
Narrows Bridge	12	0.24	0.23	0.21	0.28	0.03	0.44	0.24
Horotiu Bridge	12	0.24	0.23	0.21	0.27	0.04	0.39	0.24
Huntly-Tainui Bridge	12	0.17	0.19	0.08	0.21	0.05	-1.15	0.19
Mercer Bridge	12	0.18	0.19	0.10	0.22	0.04	-1.00	0.18
Tuakau Bridge	12	0.17	0.18	0.10	0.22	0.04	-0.75	0.18

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	5.2	5.2	3.2	7.7	1.9	0.27	5.8
Ohakuri Tailrace Bridge	12	3.2	3.2	1.7	5.5	1.4	0.55	2.9
Whakamaru Tailrace	11	2.8	2.8	1.7	4.1	1.0	0.36	2.4
Waipapa Tailrace	12	2.1	2.1	1.0	3.1	0.8	0.05	2.2
Narrows Bridge	12	1.5	1.5	1.0	2.0	0.4	-0.29	1.4
Horotiu Bridge	12	1.3	1.3	1.0	1.7	0.3	0.53	1.2
Huntly-Tainui Bridge	12	0.8	0.9	0.1	1.1	0.3	-1.36	0.8
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	0.6	0.6	0.1	0.8	0.2	-1.58	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	1.7	0.6	1.11	0.4
Ohaaki Bridge	12	0.5	0.4	0.2	1.0	0.6	0.55	0.4
Ohakuri Tailrace Bridge	12	0.7	0.7	0.2	1.4	0.3	0.84	0.6
Whakamaru Tailrace	12	0.7	0.5	0.4	1.3	0.3	1.24	0.7
Waipapa Tailrace	12	0.7	0.6	0.2	1.1	0.2	0.17	0.7
Narrows Bridge	12	0.9	1.0	0.3	1.4	0.5	-0.49	0.8
Horotiu Bridge	12	0.9	1.0	0.2	1.4	0.6	-0.47	0.9
Huntly-Tainui Bridge	12	1.0	0.9	0.2	1.9	0.7	0.49	1.0
Mercer Bridge	12	1.3	1.1	0.4	2.4	0.7	0.81	1.1
Tuakau Bridge	12	1.3	1.1	0.5	3.4	0.5	**1.92**	1.1

Carbon - Dissolved Organic (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.86	0.85	0.50	1.30	0.55	0.14	0.70
Ohaaki Bridge	12	0.76	0.70	0.40	1.20	0.30	0.75	0.70
Ohakuri Tailrace Bridge	12	0.84	0.75	0.40	1.50	0.55	0.46	0.80
Whakamaru Tailrace	12	0.97	0.95	0.50	1.80	0.50	0.78	0.90
Waipapa Tailrace	12	0.94	0.90	0.40	1.40	0.65	-0.11	0.90
Narrows Bridge	12	1.04	0.90	0.70	1.70	0.50	0.84	1.00
Horotiu Bridge	12	1.03	0.90	0.60	2.00	0.40	1.41	1.00
Huntly-Tainui Bridge	12	1.37	1.20	0.50	3.00	0.65	1.24	1.25
Mercer Bridge	12	1.73	1.55	0.70	3.90	0.70	1.45	1.50
Tuakau Bridge	12	1.88	1.60	1.10	4.40	0.75	**2.05**	1.60

Carbon - Total Organic (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	1.06	1.00	0.80	1.40	0.25	0.65	1.00
Ohaaki Bridge	12	1.02	1.00	0.80	1.40	0.20	1.01	1.00
Ohakuri Tailrace Bridge	12	1.18	1.15	0.80	1.60	0.30	0.32	1.10
Whakamaru Tailrace	12	1.40	1.20	1.10	2.80	0.30	**2.28**	1.20
Waipapa Tailrace	12	1.51	1.45	1.10	2.20	0.50	0.81	1.40
Narrows Bridge	12	1.86	1.80	1.50	2.50	0.55	0.66	1.70
Horotiu Bridge	12	1.91	1.80	1.30	2.90	0.45	0.92	1.70
Huntly-Tainui Bridge	12	2.40	2.25	1.60	4.10	0.60	1.28	2.20
Mercer Bridge	12	3.17	2.85	1.80	4.80	1.35	0.26	2.60
Tuakau Bridge	12	3.40	3.20	1.90	6.30	0.75	1.24	3.05

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	9	9	7	10	1	-1.28	9
Ohaaki Bridge	12	16	16	11	24	2	1.27	17
Ohakuri Tailrace Bridge	12	18	19	14	22	5	-0.19	21
Whakamaru Tailrace	12	18	19	12	24	4	-0.22	20
Waipapa Tailrace	12	17	18	10	24	4	-0.31	19
Narrows Bridge	12	17	16	16	23	2	**1.76**	18
Horotiu Bridge	12	17	17	16	23	3	1.49	18
Huntly-Tainui Bridge	12	16	16	11	21	2	-0.23	17
Mercer Bridge	12	17	17	12	21	2	-0.03	17
Tuakau Bridge	12	17	17	12	21	2	0.00	18

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	0.003	0.000	**3.02**	0.002
Ohaaki Bridge	12	0.002	0.002	0.002	0.002	0.000	1.00	0.002
Ohakuri Tailrace Bridge	12	0.006	0.005	0.002	0.012	0.008	0.36	0.005
Whakamaru Tailrace	12	0.011	0.006	0.003	0.056	0.007	**2.74**	0.007
Waipapa Tailrace	12	0.008	0.006	0.002	0.030	0.005	**1.95**	0.007
Narrows Bridge	12	0.011	0.010	0.002	0.023	0.008	0.56	0.011
Horotiu Bridge	12	0.011	0.009	0.004	0.027	0.009	1.14	0.013
Huntly-Tainui Bridge	12	0.011	0.007	0.003	0.036	0.010	1.60	0.013
Mercer Bridge	12	0.015	0.014	0.005	0.040	0.011	1.29	0.019
Tuakau Bridge	12	0.018	0.015	0.003	0.066	0.013	**1.94**	0.019

Colour (Munsell Colour Units)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	12	48.1	47.5	45.0	52.5	6.3	0.32	50.0
Ohakuri Tailrace Bridge	12	39.6	40.0	32.5	45.0	3.8	-0.52	40.0
Whakamaru Tailrace	11	38.9	40.0	32.5	45.0	7.5	-0.08	37.5
Waipapa Tailrace	12	35.0	35.0	30.0	40.0	2.5	0.00	35.0
Narrows Bridge	12	33.5	33.8	30.0	37.5	2.5	-0.13	35.0
Horotiu Bridge	12	32.5	32.5	30.0	35.0	5.0	0.00	32.5
Huntly-Tainui Bridge	12	30.6	30.0	27.5	35.0	2.5	0.38	30.0
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	27.9	27.5	25.0	30.0	2.5	-0.23	27.5

Conductivity at 25 ^{o}C (ms m^{-1})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	12.3	12.4	11.8	12.5	0.4	-0.92	12.1
Ohaaki Bridge	12	15.1	14.9	13.9	17.9	0.9	1.40	15.2
Ohakuri Tailrace Bridge	12	16.4	16.3	15.2	18.2	1.4	0.42	16.5
Whakamaru Tailrace	12	16.6	16.6	14.8	18.5	2.0	0.12	16.3
Waipapa Tailrace	12	15.8	16.0	13.1	17.2	1.4	-0.99	16.0
Narrows Bridge	12	15.4	15.0	14.1	16.8	1.7	0.33	15.5
Horotiu Bridge	12	15.6	15.5	14.3	16.9	1.9	0.07	15.6
Huntly-Tainui Bridge	12	14.6	14.5	12.5	16.0	0.7	-0.63	14.8
Mercer Bridge	12	15.1	15.1	12.0	16.5	1.1	-1.40	15.1
Tuakau Bridge	12	14.9	15.1	11.8	16.2	0.9	**-1.75**	15.1

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	10.2	10.2	9.2	11.7	1.0	0.50	10.0
Ohaaki Bridge	12	10.8	10.7	8.9	12.3	2.2	-0.12	10.0
Ohakuri Tailrace Bridge	12	10.0	9.7	8.8	11.3	1.8	0.17	9.7
Whakamaru Tailrace	12	10.1	10.2	8.1	11.4	1.4	-0.47	9.9
Waipapa Tailrace	12	10.3	10.2	8.2	11.8	1.4	-0.27	10.0
Narrows Bridge	12	10.0	9.9	6.6	11.3	1.6	-1.26	10.0
Horotiu Bridge	12	9.9	10.0	7.3	11.7	1.7	-0.44	10.0
Huntly-Tainui Bridge	12	9.6	9.8	7.3	11.5	1.3	-0.46	9.8
Mercer Bridge	12	9.3	9.6	6.8	11.0	0.9	-0.83	9.8
Tuakau Bridge	12	9.1	9.4	5.7	10.9	1.3	-1.16	9.8

Dissolved Oxygen (% Saturation)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	103.4	101.8	98.2	119.1	5.1	**1.92**	100.8
Ohaaki Bridge	12	109.8	109.0	97.5	121.4	9.1	-0.13	104.8
Ohakuri Tailrace Bridge	12	103.9	104.4	95.2	116.4	6.0	0.61	101.3
Whakamaru Tailrace	12	103.5	103.0	95.8	115.8	7.6	0.63	104.6
Waipapa Tailrace	12	103.7	104.8	94.3	112.6	7.9	-0.01	103.0
Narrows Bridge	12	99.6	101.3	76.3	108.3	5.8	**-2.04**	100.9
Horotiu Bridge	12	98.5	99.4	84.2	104.3	8.6	-1.09	100.2
Huntly-Tainui Bridge	12	95.3	96.6	81.2	104.0	6.5	-0.80	98.5
Mercer Bridge	12	93.7	95.3	75.9	104.3	6.5	-1.04	97.8
Tuakau Bridge	12	91.6	94.3	60.4	104.5	11.5	-1.34	99.0

Enterococci (n/100 mL)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	4	1	1	21	4	**2.09**	2
Ohaaki Bridge	12	15	9	1	46	26	0.87	8
Ohakuri Tailrace Bridge	12	2	1	1	6	3	1.25	1
Whakamaru Tailrace	12	7	7	2	17	7	0.67	4
Waipapa Tailrace	12	15	6	1	76	11	**1.88**	3
Narrows Bridge	12	47	26	4	140	73	0.98	22
Horotiu Bridge	12	98	32	4	430	76	1.61	36
Huntly-Tainui Bridge	12	78	38	6	300	86	1.46	33
Mercer Bridge	12	63	19	6	230	95	1.20	15
Tuakau Bridge	12	68	32	7	280	78	1.63	22

Escherichia coli (n/100 mL)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	2	1	1	9	4	1.34	1
Ohaaki Bridge	12	19	19	4	40	22	0.24	16
Ohakuri Tailrace Bridge	12	9	3	1	72	5	**2.95**	2
Whakamaru Tailrace	12	12	6	1	47	12	1.53	5
Waipapa Tailrace	12	34	7	1	190	48	**2.03**	10
Narrows Bridge	12	61	55	12	180	58	1.17	48
Horotiu Bridge	12	83	65	9	250	85	1.17	70
Huntly-Tainui Bridge	12	159	105	20	470	190	0.97	130
Mercer Bridge	12	146	100	18	540	151	1.49	90
Tuakau Bridge	12	124	55	10	520	106	**1.78**	80

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

Faecal Coliforms (n/100 mL)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	3	1	1	10	6	0.92	1
Ohaaki Bridge	12	27	31	4	61	27	0.45	24
Ohakuri Tailrace Bridge	12	10	3	1	80	6	**2.93**	2
Whakamaru Tailrace	12	13	6	1	51	15	1.43	5
Waipapa Tailrace	12	42	9	3	200	69	1.53	14
Narrows Bridge	12	75	57	12	290	64	**2.03**	78
Horotiu Bridge	12	126	75	10	430	117	1.42	170
Huntly-Tainui Bridge	12	259	150	21	1080	250	**1.76**	335
Mercer Bridge	12	219	115	21	960	235	**1.79**	250
Tuakau Bridge	12	185	87	24	840	149	**1.99**	180

Lithium (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.040	0.039	0.037	0.045	0.002	1.27	0.040
Ohaaki Bridge	12	0.081	0.078	0.062	0.127	0.015	1.62	0.085
Ohakuri Tailrace Bridge	12	0.101	0.102	0.075	0.123	0.028	-0.21	0.109
Whakamaru Tailrace	12	0.101	0.108	0.072	0.123	0.033	-0.34	0.109
Waipapa Tailrace	12	0.089	0.095	0.058	0.111	0.022	-0.52	0.095
Narrows Bridge	12	0.080	0.078	0.067	0.094	0.019	0.21	0.085
Horotiu Bridge	12	0.079	0.076	0.067	0.095	0.021	0.41	0.085
Huntly-Tainui Bridge	12	0.056	0.060	0.025	0.071	0.016	-1.10	0.066
Mercer Bridge	12	0.057	0.057	0.033	0.076	0.013	-0.46	0.061
Tuakau Bridge	12	0.055	0.057	0.033	0.073	0.014	-0.42	0.060

Nitrate/Nitrite Nitrogen (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.006	0.001	0.001	0.056	0.002	**3.00**	0.001
Ohaaki Bridge	12	0.028	0.023	0.014	0.054	0.015	0.96	0.024
Ohakuri Tailrace Bridge	12	0.074	0.066	0.028	0.127	0.066	0.17	0.051
Whakamaru Tailrace	12	0.096	0.107	0.018	0.164	0.095	-0.15	0.052
Waipapa Tailrace	12	0.149	0.148	0.060	0.223	0.095	-0.09	0.104
Narrows Bridge	12	0.229	0.221	0.113	0.386	0.116	0.44	0.125
Horotiu Bridge	12	0.254	0.241	0.135	0.425	0.099	0.63	0.151
Huntly-Tainui Bridge	12	0.445	0.444	0.192	0.807	0.250	0.40	0.326
Mercer Bridge	12	0.431	0.437	0.143	0.687	0.207	-0.04	0.330
Tuakau Bridge	12	0.417	0.450	0.059	0.671	0.221	-0.41	0.290

Nitrogen - Ammoniacal (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.01	0.01	0.01	0.01	0.00	**1.79**	0.005
Ohaaki Bridge	12	0.01	0.01	0.01	0.02	0.00	**2.21**	0.005
Ohakuri Tailrace Bridge	12	0.01	0.01	0.01	0.03	0.02	0.91	0.005
Whakamaru Tailrace	12	0.01	0.01	0.01	0.03	0.01	1.27	0.005
Waipapa Tailrace	12	0.02	0.01	0.01	0.06	0.02	**1.79**	0.010
Narrows Bridge	12	0.03	0.02	0.01	0.11	0.02	**2.54**	0.020
Horotiu Bridge	12	0.03	0.02	0.01	0.11	0.03	**2.36**	0.020
Huntly-Tainui Bridge	12	0.03	0.02	0.01	0.10	0.02	1.61	0.020
Mercer Bridge	12	0.02	0.01	0.01	0.06	0.02	1.43	0.005
Tuakau Bridge	12	0.01	0.01	0.01	0.05	0.01	**1.73**	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	0.14	0.09	0.03	0.42	0.10	1.38	0.07
Ohaaki Bridge	12	0.16	0.12	0.03	0.46	0.12	1.33	0.09
Ohakuri Tailrace Bridge	12	0.20	0.18	0.03	0.38	0.18	0.26	0.12
Whakamaru Tailrace	12	0.15	0.17	0.05	0.31	0.10	0.75	0.13
Waipapa Tailrace	12	0.16	0.15	0.07	0.26	0.09	0.43	0.15
Narrows Bridge	12	0.26	0.24	0.16	0.55	0.10	1.56	0.21
Horotiu Bridge	12	0.25	0.22	0.14	0.61	0.10	**1.82**	0.23
Huntly-Tainui Bridge	12	0.33	0.28	0.15	0.81	0.12	**1.71**	0.28
Mercer Bridge	12	0.43	0.38	0.28	0.80	0.11	1.49	0.34
Tuakau Bridge	12	0.40	0.36	0.22	0.63	0.18	0.61	0.35

Nitrogen - Total (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.14	0.09	0.03	0.42	0.13	1.23	0.07
Ohaaki Bridge	12	0.19	0.15	0.05	0.48	0.14	1.17	0.11
Ohakuri Tailrace Bridge	12	0.28	0.23	0.12	0.44	0.21	0.23	0.17
Whakamaru Tailrace	12	0.24	0.23	0.17	0.33	0.06	0.42	0.20
Waipapa Tailrace	12	0.31	0.31	0.23	0.37	0.06	-0.15	0.26
Narrows Bridge	12	0.49	0.48	0.33	0.76	0.15	0.86	0.37
Horotiu Bridge	12	0.51	0.48	0.35	0.87	0.18	1.27	0.41
Huntly-Tainui Bridge	12	0.77	0.77	0.46	1.33	0.25	0.97	0.57
Mercer Bridge	12	0.86	0.81	0.51	1.35	0.31	0.66	0.67
Tuakau Bridge	12	0.81	0.75	0.45	1.25	0.28	0.47	0.64

pH (pH Units)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	7.6	7.6	7.3	7.8	0.3	-0.34	7.6
Ohaaki Bridge	12	7.4	7.4	7.0	7.6	0.1	-0.88	7.3
Ohakuri Tailrace Bridge	12	7.5	7.5	7.1	7.8	0.2	-0.05	7.4
Whakamaru Tailrace	12	7.5	7.6	7.1	7.7	0.3	-0.96	7.5
Waipapa Tailrace	12	7.5	7.5	7.1	7.7	0.2	-0.76	7.4
Narrows Bridge	12	7.5	7.6	7.2	7.8	0.3	-0.29	7.5
Horotiu Bridge	12	7.5	7.5	7.2	7.8	0.4	0.02	7.5
Huntly-Tainui Bridge	12	7.5	7.5	7.2	7.8	0.3	0.12	7.5
Mercer Bridge	12	7.5	7.5	7.2	7.8	0.3	0.12	7.5
Tuakau Bridge	12	7.5	7.5	7.1	7.8	0.4	-0.08	7.5

Phosphorus - Dissolved Reactive (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.006	0.007	0.002	0.011	0.002	-0.20	0.006
Ohaaki Bridge	12	0.010	0.010	0.002	0.017	0.003	-0.26	0.010
Ohakuri Tailrace Bridge	12	0.013	0.012	0.009	0.021	0.003	1.48	0.012
Whakamaru Tailrace	12	0.014	0.014	0.006	0.024	0.003	0.55	0.011
Waipapa Tailrace	12	0.016	0.017	0.006	0.025	0.006	-0.21	0.015
Narrows Bridge	12	0.019	0.021	0.011	0.030	0.010	0.14	0.015
Horotiu Bridge	12	0.024	0.025	0.014	0.033	0.007	-0.24	0.020
Huntly-Tainui Bridge	12	0.024	0.024	0.017	0.032	0.006	0.23	0.023
Mercer Bridge	12	0.022	0.024	0.015	0.030	0.009	-0.18	0.018
Tuakau Bridge	12	0.020	0.021	0.012	0.029	0.009	0.10	0.016

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	0.006	0.006	0.002	0.010	0.003	0.51	0.006
Ohaaki Bridge	12	0.011	0.010	0.006	0.021	0.006	1.02	0.012
Ohakuri Tailrace Bridge	12	0.019	0.019	0.014	0.028	0.006	0.77	0.020
Whakamaru Tailrace	12	0.022	0.021	0.016	0.035	0.007	0.99	0.024
Waipapa Tailrace	12	0.029	0.030	0.012	0.042	0.012	-0.22	0.028
Narrows Bridge	12	0.036	0.034	0.016	0.056	0.016	0.28	0.034
Horotiu Bridge	12	0.046	0.044	0.033	0.071	0.014	0.92	0.045
Huntly-Tainui Bridge	12	0.083	0.063	0.044	0.239	0.019	**1.98**	0.063
Mercer Bridge	12	0.093	0.076	0.059	0.220	0.032	**1.84**	0.069
Tuakau Bridge	12	0.091	0.078	0.057	0.222	0.027	**1.94**	0.076

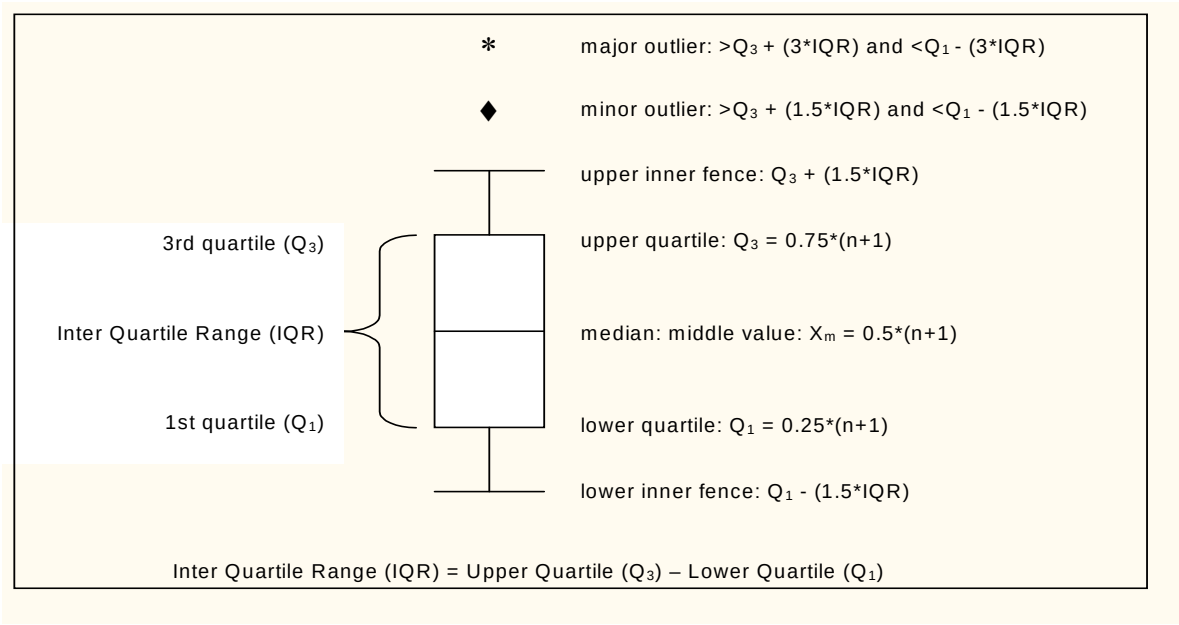
Temperature (^{o}C)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	14.3	14.1	10.6	20.0	5.2	0.46	14.3
Ohaaki Bridge	12	15.4	15.3	11.6	21.2	5.3	0.35	16.2
Ohakuri Tailrace Bridge	12	15.9	15.9	11.6	22.1	5.3	0.39	16.3
Whakamaru Tailrace	12	15.9	15.9	11.6	22.3	5.5	0.37	16.2
Waipapa Tailrace	12	15.6	15.9	11.3	21.7	5.1	0.34	16.2
Narrows Bridge	12	15.5	15.8	10.7	21.6	5.4	0.24	16.0
Horotiu Bridge	12	15.5	15.8	10.5	21.5	5.5	0.23	16.0
Huntly-Tainui Bridge	12	15.3	15.8	10.2	21.2	5.5	0.18	16.1
Mercer Bridge	12	15.9	16.4	10.6	21.9	4.7	0.20	16.8
Tuakau Bridge	12	16.2	16.5	10.8	22.6	4.8	0.24	17.0

Dissolved Solids - Total (g m^{-3})								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	85	85	78	104	5	**1.86**	87
Ohaaki Bridge	12	101	101	90	117	11	0.49	108
Ohakuri Tailrace Bridge	12	116	119	102	126	11	-0.69	120
Whakamaru Tailrace	12	116	118	105	125	14	-0.34	121
Waipapa Tailrace	12	115	118	99	124	8	-0.93	119
Narrows Bridge	12	114	113	99	130	11	-0.02	118
Horotiu Bridge	12	114	113	101	126	10	0.06	118
Huntly-Tainui Bridge	12	107	107	96	122	14	0.22	112
Mercer Bridge	12	111	111	100	118	11	-0.45	116
Tuakau Bridge	12	111	111	103	120	12	0.01	115

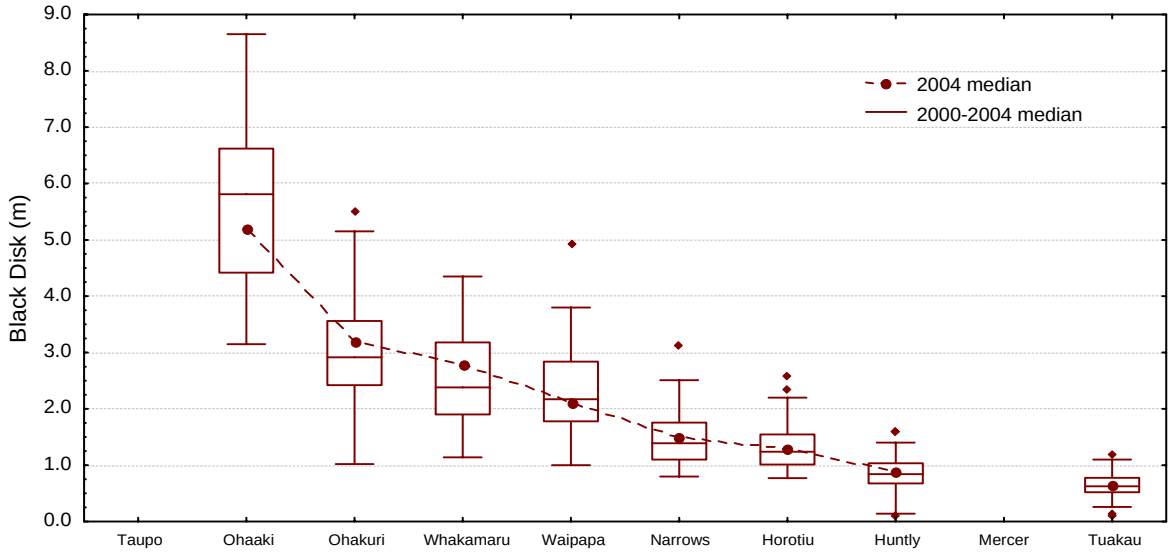
Turbidity (NTU)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 Yr Median**
Taupo Control Gates	12	0.4	0.3	0.2	0.8	0.1	1.61	0.3
Ohaaki Bridge	12	0.6	0.6	0.3	0.9	0.2	-0.01	0.6
Ohakuri Tailrace Bridge	12	1.0	1.0	0.6	1.4	0.4	-0.14	1.0
Whakamaru Tailrace	12	1.2	1.1	0.6	2.1	0.4	0.99	1.2
Waipapa Tailrace	12	1.7	1.4	0.7	3.6	0.7	1.32	1.4
Narrows Bridge	12	2.4	2.4	1.7	3.8	0.8	0.82	2.4
Horotiu Bridge	12	2.9	2.9	2.0	4.1	1.0	0.51	3.0
Huntly-Tainui Bridge	12	15.6	5.4	4.4	108	3.7	**2.90**	5.2
Mercer Bridge	12	18.8	9.5	6.6	107	5.7	**2.93**	8.5
Tuakau Bridge	12	19.0	11.7	6.6	101.0	6.0	**2.82**	9.7

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

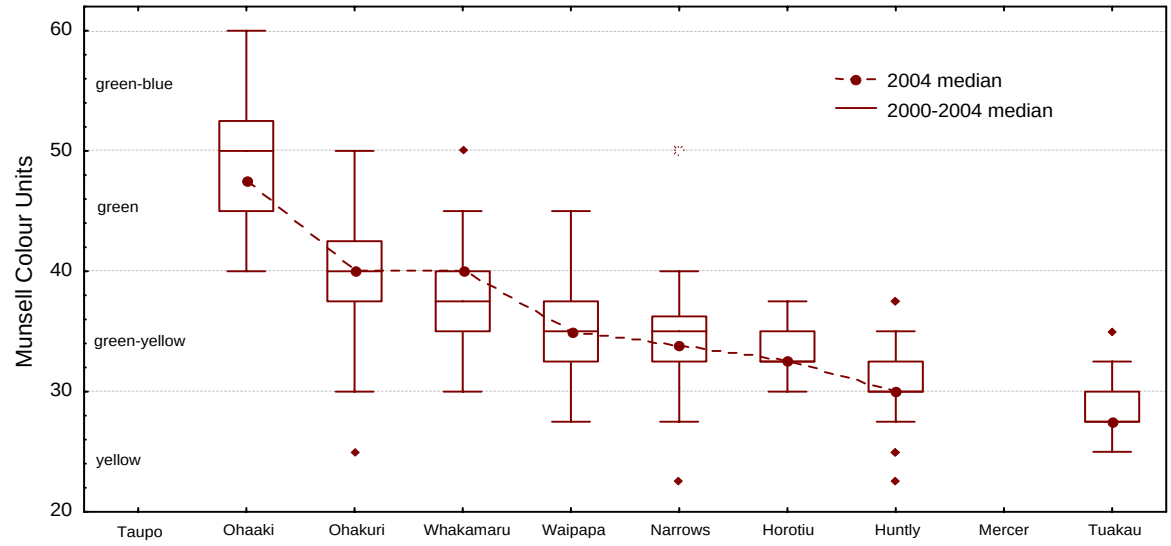
Boxplots are used to present data

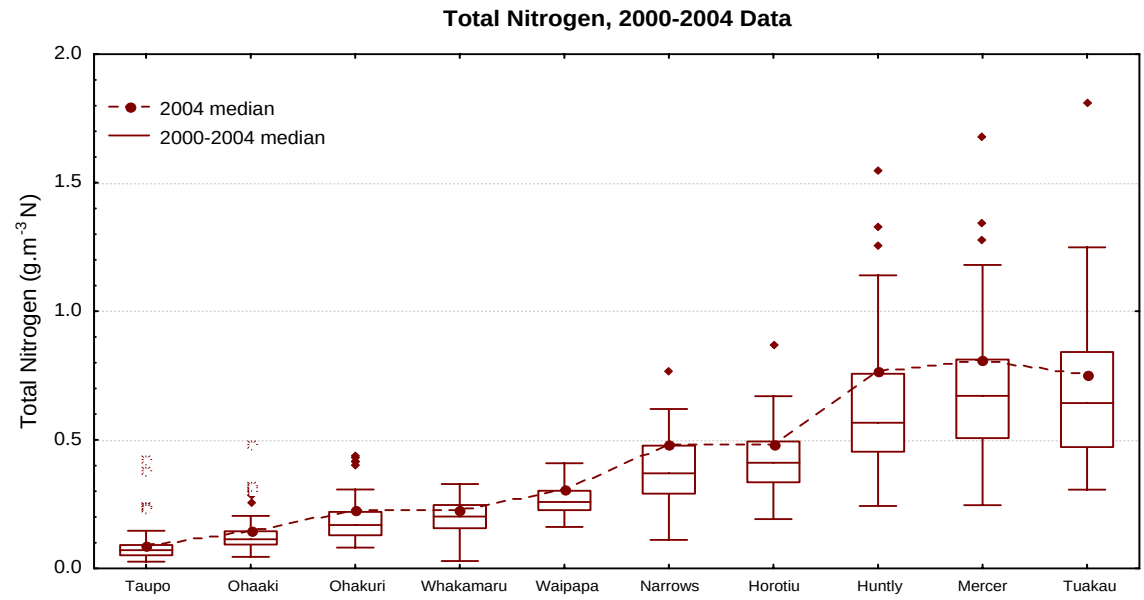


Black Disk, 2000-2004 Data



Colour, 2000-2004 Data




Total Nitrogen, 2000-2004 Data
2004 median
2000-2004 median
Total Nitrogen (g.m-3 N)
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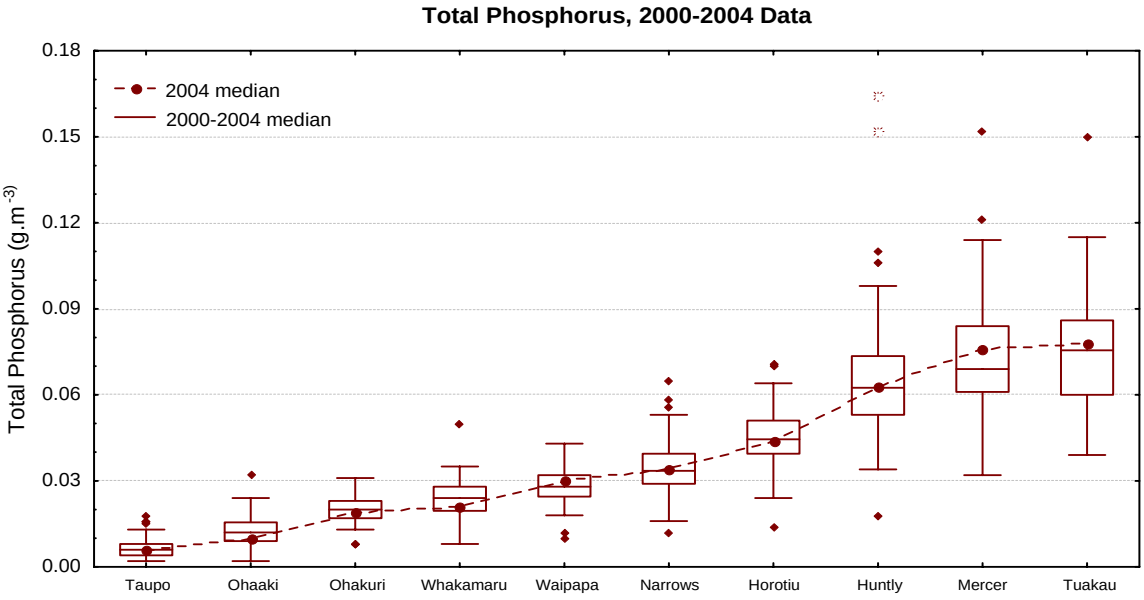
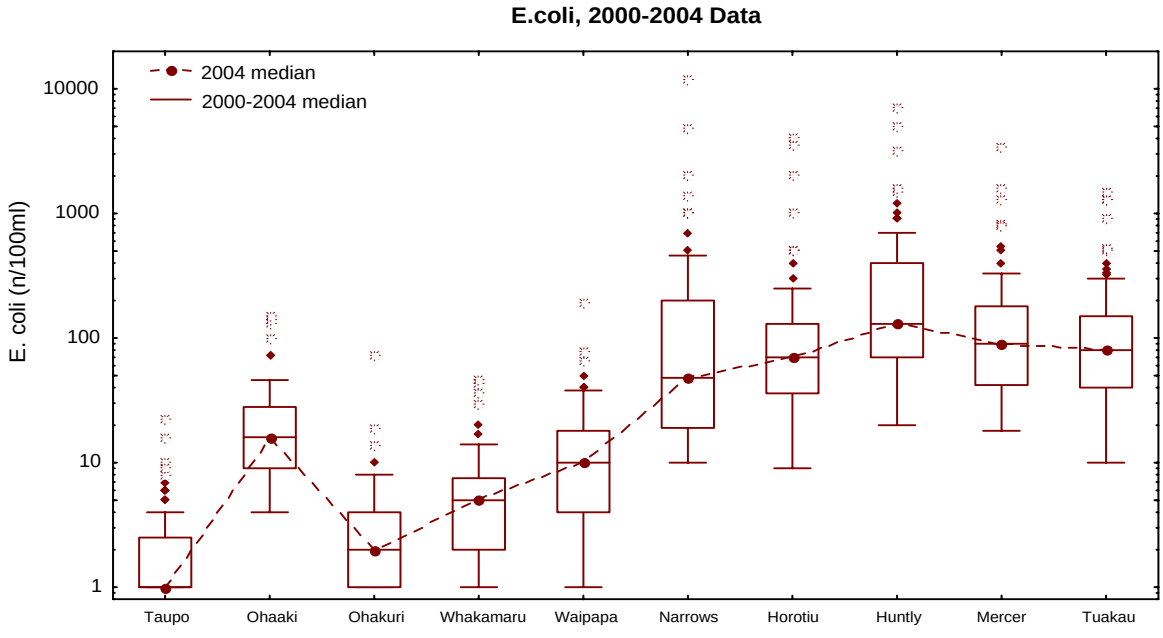
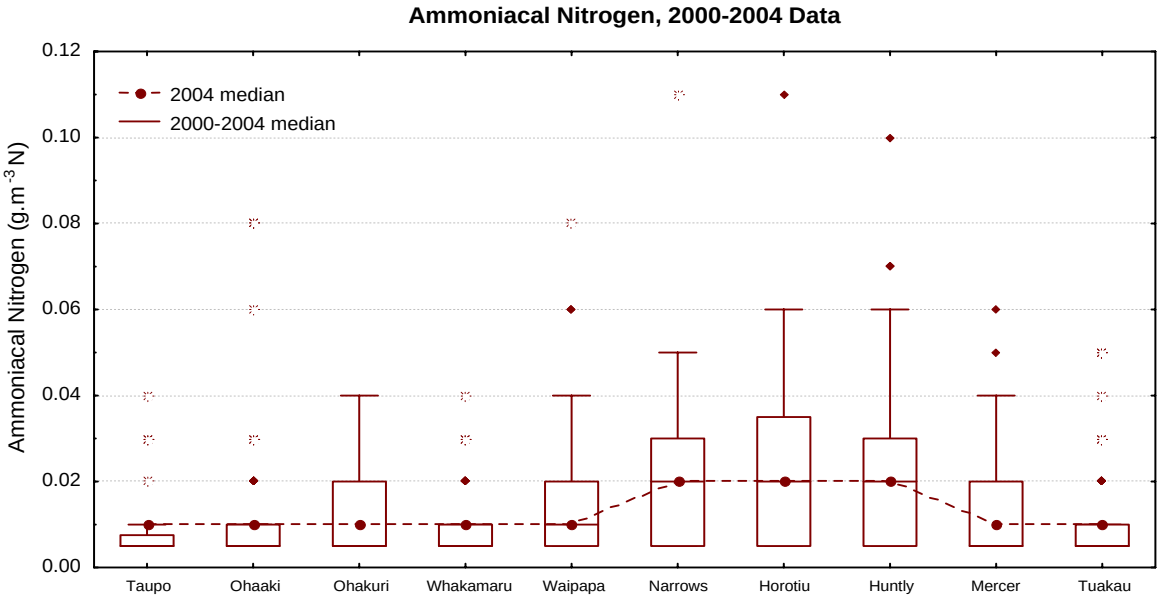
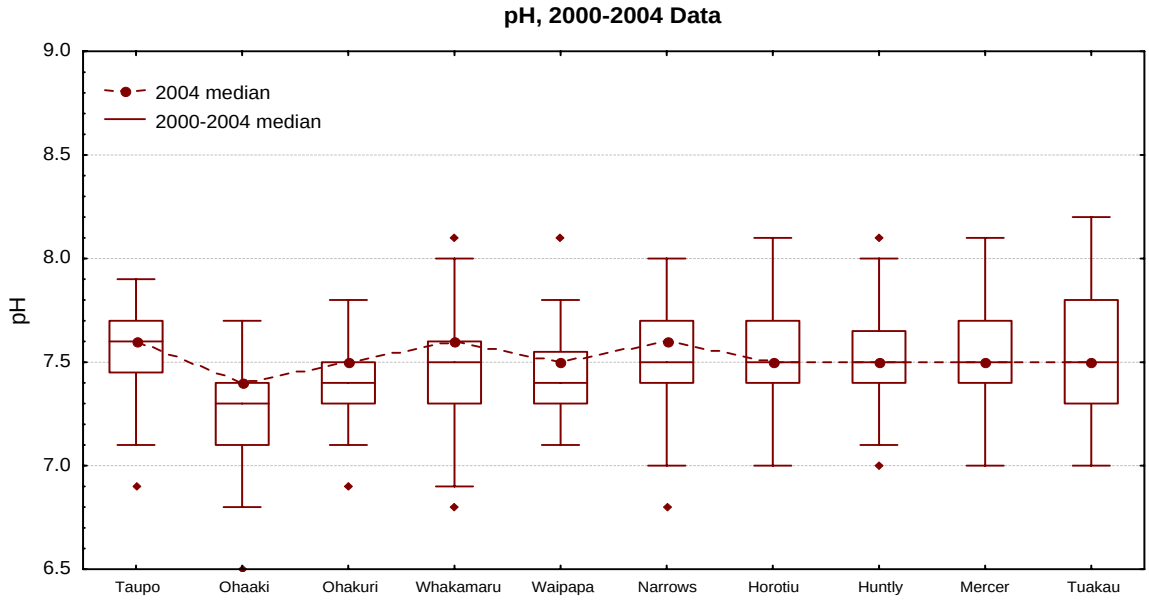
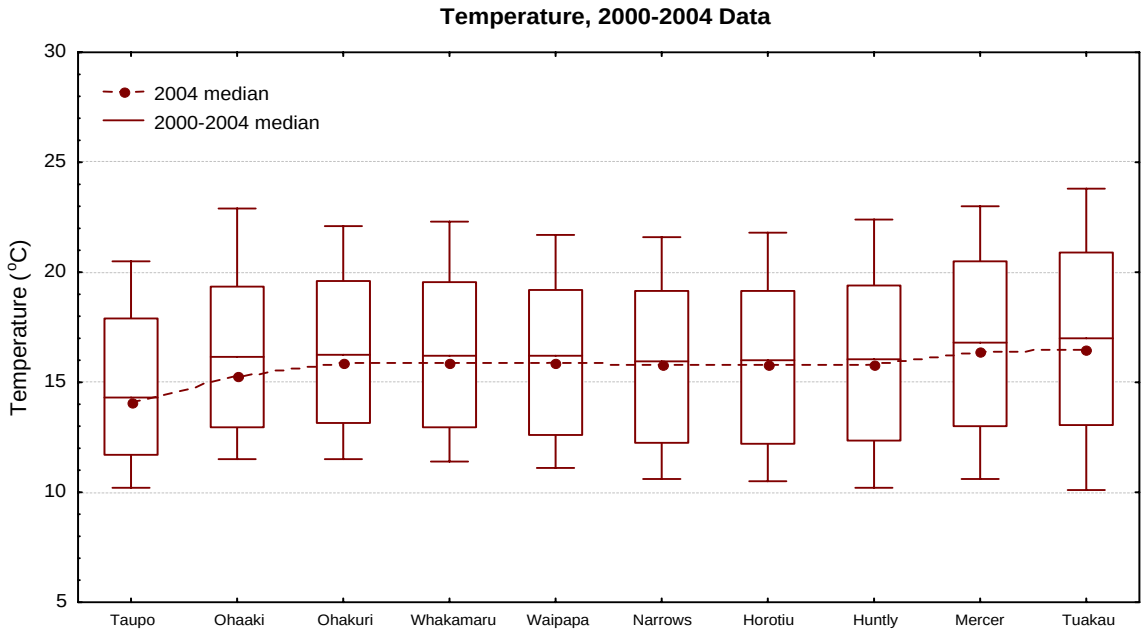
1.5
1.0
0.5
0.0
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau

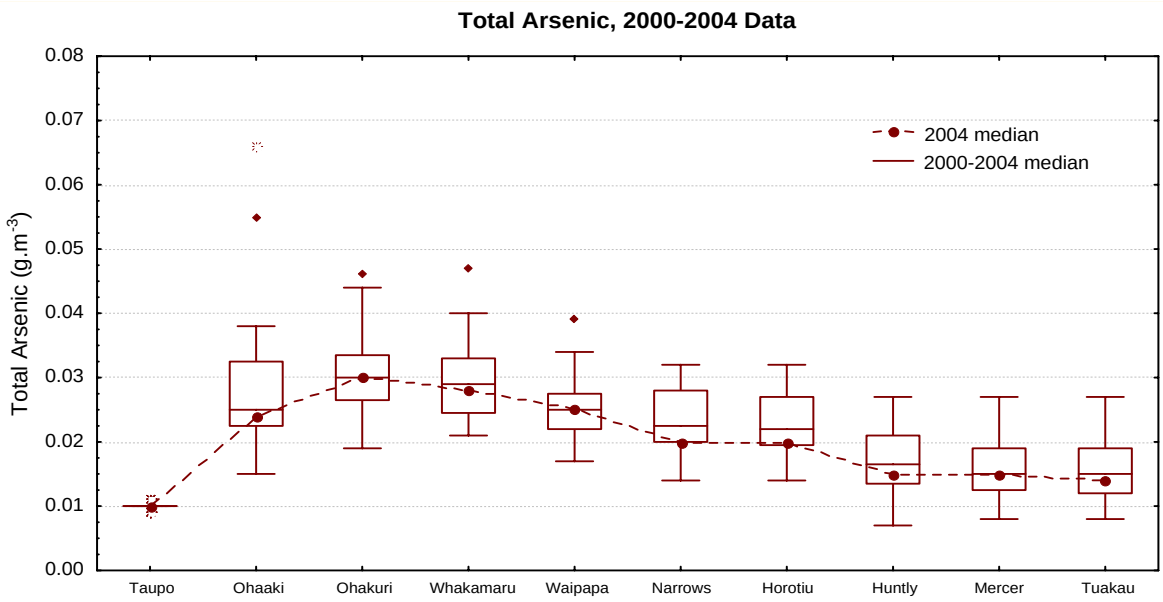

Total Phosphorus, 2000-2004 Data
2004 median
2000-2004 median
Total Phosphorus (g.m-3)
0.18
0.15
0.12
0.09
0.06
0.03
0.00
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau

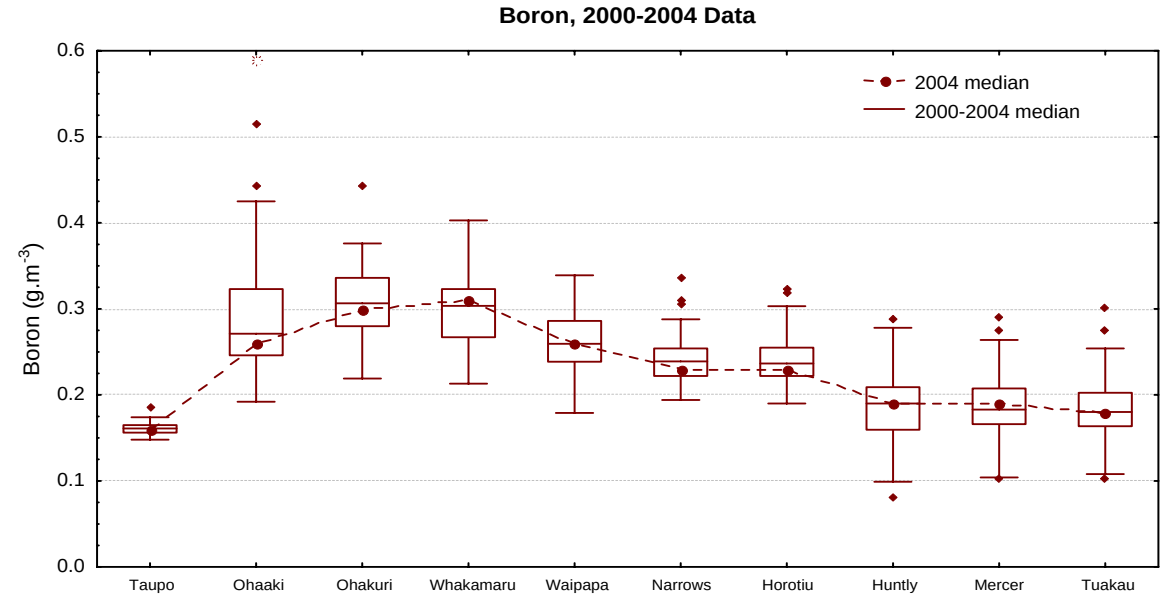

E.coli, 2000-2004 Data
2004 median
2000-2004 median
E. coli (n/100ml)
10000
1000
100
10
1
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau


Ammoniacal Nitrogen, 2000-2004 Data
2004 median
2000-2004 median
Ammoniacal Nitrogen (g.m-3 N)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau


pH, 2000-2004 Data
2004 median
2000-2004 median
pH
9.0
8.5
8.0
7.5
7.0
6.5
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau


Temperature, 2000-2004 Data
2004 median
2000-2004 median
Temperature (°C)
30
25
20
15
10
5
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau


Total Arsenic, 2000-2004 Data
Total Arsenic (g.m-3)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
2004 median
2000-2004 median
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau


Boron, 2000-2004 Data
Boron (g.m-3)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2004 median
2000-2004 median
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau

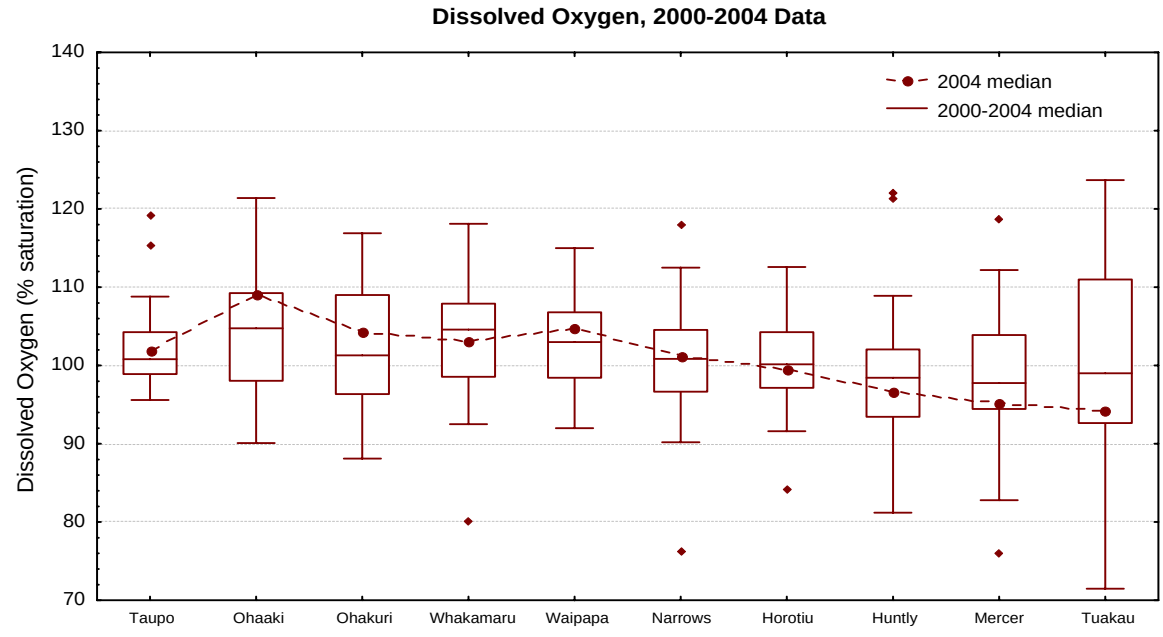

Dissolved Oxygen, 2000-2004 Data
Dissolved Oxygen (% saturation)
140
130
120
110
100
90
80
70
2004 median
2000-2004 median
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Narrows
Horotiu
Huntly
Mercer
Tuakau

Table 3: Samples (Year 2004) complying with the 'Satisfactory' Water Quality Guidelines and Standards. n = 12.

	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			water supply	drinking water	
Location	DO	pH	Turb	NH_4N	Temp	TP	TN	Bk[1] Disk	E coli	Median E coli	CHL*a*	As	B
Taupo Gates	12	12	12	12	9	12	12	-	12	Y	12	8	12
Ohaaki Bridge	12	12	12	12	8	12	12	10/10	12	Y	12	0	12
Ohakuri Tailrace Br	12	12	12	12	7	12	12	7/7	12	Y	12	0	12
Whakamaru Tailrace	12	12	12	12	8	12	12	11/11	12	Y	11	0	12
Waipapa Tailrace	12	12	12	12	8	10	12	4/5	12	Y	11	0	12
Hamilton – Narrows	12	12	12	12	8	9	7	4/8	12	Y	11	0	12
Horotiu Bridge	12	12	12	12	8	5	7	1/9	12	Y	10	0	12
Huntly – Tainui Br	12	12	5	12	8	0	1	0/10	12	Y	10	2	12
Mercer Bridge	11	12	0	12	7	0	0	-	12	Y	10	1	12
Tuakau Bridge	10	12	0	12	7	0	1	-	12	Y	9	1	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 2004) complying with the 'Excellent' Water Quality Guidelines and Standards. n = 12.

	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			water supply	Drinking water	
Location	DO	pH	Turb	NH_4N	Temp	TP	TN	Bk[1] Disk	E coli	Median E coli	CHL*a*	As	B
Taupo Gates	12	12	12	12	3	11	7	-	12	Y	12	n/a	n/a
Ohaaki Bridge	12	12	12	12	2	6	2	8/10	12	Y	12	n/a	n/a
Ohakuri Tailrace Br	11	12	12	12	2	0	0	3/7	11	Y	6	n/a	n/a
Whakamaru Tailrace	12	12	11	12	2	0	0	2/11	12	Y	4	n/a	n/a
Waipapa Tailrace	12	12	9	12	2	0	0	0/5	9	Y	5	n/a	n/a
Hamilton – Narrows	11	12	3	11	2	0	0	0/8	6	N	2	n/a	n/a
Horotiu Bridge	11	12	0	11	1	0	0	0/9	5	N	2	n/a	n/a
Huntly – Tainui Br	10	12	0	11	1	0	0	0/10	4	N	3	n/a	n/a
Mercer Bridge	10	12	0	12	1	0	0	-	6	N	0	n/a	n/a
Tuakau Bridge	9	12	0	12	1	0	0	-	6	N	1	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 dd/mm/yy	TIME* HH:MM	FLOW m^3/s	BDISK m	COLOR units	COND mS/m	PH units	TEMP 'C	DO g/m^3	PCDO %Sat	BOD5 g/m^3	TURB NTU	TDS g/m^3	NNN g/m^3	NO3-N g/m^3	NH4-N g/m^3
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep) <20 (Oct-Apr)		>80	-	<5	-	-	-	<0.88
1131-127		UD=264 m^3/s	*(Flows from "Reids Farm")*												
Waikato River @ Taupo Control Gates															
06/01/04	08:15	146	-	-	12.1	7.8	**20.0**	10.5	106.2	0.8	0.28	84	< 0.002	< 0.002	< 0.01
03/02/04	08:12	230	-	-	12.4	7.8	19.3	9.2	104.3	< 0.4	0.31	86	< 0.002	< 0.002	< 0.01
03/03/04	07:53	308	-	-	12.5	7.7	16.7	9.4	101.2	< 0.4	0.29	82	< 0.002	< 0.002	< 0.01
06/04/04	09:03	281	-	-	11.8	7.7	16.1	9.5	101.6	1.0	0.79	86	0.056	0.053	0.01
04/05/04	09:10	200	-	-	12.4	7.5	**14.6**	10.2	106.2	0.6	0.39	87	< 0.002	< 0.002	< 0.01
03/06/04	09:05	179	-	-	12.5	7.6	**13.5**	9.8	98.3	1.7	0.33	85	0.003	0.003	0.01
06/07/04	09:10	285	-	-	12.5	7.6	11.5	10.2	98.2	0.5	0.31	79	< 0.002	< 0.002	< 0.01
03/08/04	09:25	276	-	-	12.5	7.4	10.8	10.7	100.1	1.0	0.43	104	0.003	0.003	< 0.01
07/09/04	09:12	260	-	-	12.5	7.8	10.6	10.9	100.3	0.6	0.32	84	< 0.002	< 0.002	< 0.01
05/10/04	08:22	262	-	-	12.4	7.6	11.0	11.7	119.1	0.6	0.28	81	< 0.002	< 0.002	< 0.01
02/11/04	08:20	282	-	-	11.9	7.3	12.9	10.5	101.9	0.4	0.21	88	0.002	< 0.002	< 0.01
01/12/04	09:10	101	-	-	12.1	7.4	15.1	9.8	103.0	< 0.4	0.59	78	< 0.002	< 0.002	< 0.01
1131-105		UD=275 m^3/s	*(Flows from Ohaaki Bridge Recorder, +/- 20%)*												
Waikato River @ Ohaaki Br															
06/01/04	08:55	193	5.3	52.5	14.5	7.4	**21.2**	10.7	109.2	0.4	0.50	103	0.023	0.023	< 0.01
03/02/04	08:54	156	6.3	47.5	14.8	7.4	19.5	9.4	106.8	< 0.4	0.62	100	0.023	0.023	< 0.01
03/03/04	08:50	339	(>4.2)	47.5	14.3	7.4	17.6	10.2	110.7	< 0.4	0.47	93	0.014	0.014	< 0.01
06/04/04	09:40	169	5.7	52.5	13.9	7.4	16.3	10.1	107.5	< 0.4	0.89	90	0.031	0.031	< 0.01
04/05/04	10:03	112	7.7	45.0	16.3	7.4	**16.4**	9.4	99.8	0.4	0.31	110	0.044	0.044	< 0.01
03/06/04	09:50	168	6.2	52.5	15.4	7.2	**14.3**	10.6	106.7	1.0	0.47	105	0.038	0.038	0.01
06/07/04	10:15	299	(3.2)	45.0	14.6	7.5	**12.0**	12.1	117.2	0.7	0.60	96	0.020	0.020	0.02
03/08/04	10:30	275	4.0	50.0	14.9	7.4	11.6	12.3	116.4	0.9	0.84	109	0.015	0.015	< 0.01
07/09/04	10:10	226	5.2	50.0	15.2	7.6	11.7	11.8	108.8	0.5	0.68	96	0.021	0.020	< 0.01
05/10/04	09:17	187	4.5	45.0	15.2	7.6	12.3	12.1	121.4	0.9	0.70	101	0.028	0.027	< 0.01
02/11/04	09:20	256	4.0	45.0	13.9	7.0	14.0	11.7	115.3	< 0.4	0.67	96	0.020	0.020	< 0.01
01/12/04	10:02	100	5.9	45.0	17.9	7.3	17.3	8.9	97.5	< 0.4	0.60	117	0.054	0.051	0.01
1131-107		UD=308 m^3/s	*(Flows from Ohakuri Dam - Total)*												
Waikato River @ Ohakuri Tailrace Br															
06/01/04	10:00	166	1.7	37.5	16.3	7.4	**21.1**	8.8	99.2	0.9	1.29	119	0.059	0.056	< 0.01
03/02/04	10:00	253	3.0	37.5	17.1	7.5	**22.1**	8.8	104.3	0.5	1.21	123	0.028	0.028	< 0.01
03/03/04	09:45	375	(3.8)	40.0	15.2	7.4	18.3	9.5	105.3	0.4	0.85	106	0.041	0.041	0.01
06/04/04	10:45	248	4.1	42.5	15.8	7.5	17.4	9.3	100.5	< 0.4	0.99	114	0.039	0.038	< 0.01
04/05/04	11:01	120	5.5	40.0	16.7	7.4	**16.0**	9.3	97.2	0.6	0.67	119	0.072	0.069	0.02
03/06/04	10:45	223	4.0	45.0	18.2	7.3	**14.2**	9.5	95.2	0.7	0.56	126	0.121	0.120	0.02
06/07/04	11:25	353	(2.8)	40.0	15.2	7.5	**12.0**	10.6	101.7	0.5	0.97	102	0.100	0.099	0.02
03/08/04	11:35	322	(2.1)	32.5	15.6	7.8	11.6	11.1	104.5	1.4	1.08	116	0.127	0.125	< 0.01
07/09/04	11:10	357	(3.4)	42.5	16.0	7.6	11.9	11.1	104.5	0.8	0.97	104	0.101	0.100	< 0.01
05/10/04	10:09	274	3.4	40.0	17.6	7.7	13.2	11.2	111.2	0.7	0.81	120	0.111	0.108	< 0.01
02/11/04	10:30	334	(2.2)	37.5	16.2	7.1	15.7	11.3	116.4	0.7	1.38	119	0.054	0.052	0.03
01/12/04	11:02	243	2.8	40.0	17.0	7.4	17.1	9.8	106.4	0.8	1.33	121	0.030	0.027	0.01
1131-147		UD=305 m^3/s	*(Flows from Whakamaru Dam - Total)*												
Waikato River @ Whakamaru Tailrace															
06/01/04	10:50	159	1.7	35.0	16.7	7.7	**21.3**	10.0	106.2	1.1	2.09	118	0.018	0.017	< 0.01
03/02/04	10:45	283	2.4	32.5	17.9	7.4	**22.3**	8.1	99.4	0.4	1.51	125	0.030	0.030	0.03
03/03/04	10:40	469	-	-	14.8	7.6	18.7	10.6	115.8	0.4	1.12	106	0.068	0.066	< 0.01
06/04/04	11:30	250	2.8	35.0	18.5	7.6	17.5	9.1	99.0	0.5	0.94	110	0.065	0.064	< 0.01
04/05/04	12:00	212	4.1	40.0	17.2	7.4	**16.2**	9.2	96.2	0.5	1.17	125	0.103	0.102	< 0.01
03/06/04	11:30	201	4.0	45.0	17.6	7.4	**13.5**	9.6	95.8	0.5	0.61	123	0.160	0.159	< 0.01
06/07/04	12:15	300	2.7	42.5	15.5	7.5	11.8	10.5	98.9	0.5	0.92	108	0.164	0.162	0.01
03/08/04	12:25	304	3.2	42.5	15.4	7.7	11.6	10.9	101.6	1.3	1.16	120	0.152	0.151	< 0.01
07/09/04	11:55	299	3.2	42.5	15.5	7.7	11.6	11.3	104.8	0.8	0.96	105	0.112	0.110	< 0.01
05/10/04	10:55	228	2.8	37.5	17.3	7.7	13.4	11.4	112.9	0.8	1.06	118	0.137	0.133	< 0.01
02/11/04	11:15	294	2.1	40.0	15.9	7.1	15.6	10.3	104.4	0.5	1.32	115	0.110	0.107	0.03
01/12/04	11:50	224	1.9	35.0	16.4	7.5	17.2	9.9	106.9	0.5	1.40	122	0.035	0.033	0.02

Note: < = less than value stated
UD = upper decile flow (period 1985-2004 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 value – don't assess for compliance

TKN g/m³	TN g/m³	DRP g/m³	TP g/m³	CL g/m³	AS g/m³	B g/m³	LI g/m³	A340F /cm	A440F /cm	ENT	FC	E coli	CHLA g/m³	DOC g/m³	TOC g/m³
										cfu/100ml					
-	<0.5	-	<0.04	-	<0.01	<1.4	-	-	-	<77	-	<550	<0.02		
0.38	0.38	0.004	0.004	10.0	0.010	0.17	0.039	0.005	< 0.002	< 1	8	4	< 0.003	1.2	1.3
0.08	0.08	0.008	0.006	9.0	0.010	0.15	0.037	0.005	< 0.002	1	2	1	< 0.003	1.1	1.1
0.08	0.08	< 0.004	0.006	9.6	0.010	0.15	0.038	< 0.002	< 0.002	10	8	6	< 0.003	0.6	1.0
0.18	0.24	0.006	0.006	9.1	0.010	0.16	0.037	< 0.002	< 0.002	2	< 1	< 1	< 0.003	0.6	0.8
0.09	0.09	< 0.004	0.010	8.7	0.010	0.17	0.038	0.005	< 0.002	21	10	9	< 0.003	0.5	1.0
0.42	0.42	0.007	0.004	6.8	0.010	0.16	0.039	0.002	< 0.002	< 1	1	1	< 0.003	1.3	1.4
0.06	0.06	0.006	0.005	8.6	0.010	0.16	0.038	0.003	< 0.002	< 1	< 1	< 1	< 0.003	1.2	1.0
0.12	0.12	0.007	0.007	8.7	**0.011**	0.17	0.040	< 0.002	< 0.002	< 1	1	1	0.003	0.5	1.3
0.14	0.14	0.007	0.004	8.9	0.010	0.16	0.040	0.003	< 0.002	< 1	< 1	< 1	< 0.003	0.9	0.9
< 0.05	0.03	0.007	0.004	8.5	**0.011**	0.16	0.044	0.003	< 0.002	1	< 1	< 1	< 0.003	0.6	0.9
< 0.05	0.03	0.007	< 0.004	9.3	**0.011**	0.19	0.045	< 0.002	< 0.002	1	< 1	< 1	< 0.003	0.8	1.0
0.06	0.06	0.011	0.008	8.8	**0.011**	0.17	0.040	< 0.002	< 0.002	6	5	4	< 0.003	1.0	1.0
0.46	0.48	0.012	0.016	17.3	**0.023**	0.26	0.075	0.006	< 0.002	19	39	25	< 0.003	1.2	1.2
0.09	0.11	0.011	0.011	16.3	**0.026**	0.25	0.079	0.004	< 0.002	37	61	40	< 0.003	1.2	1.4
0.10	0.11	0.008	0.010	13.9	**0.018**	0.21	0.062	0.003	< 0.002	40	59	35	< 0.003	0.6	0.8
0.29	0.32	< 0.004	0.008	15.2	**0.022**	0.25	0.070	0.003	< 0.002	46	30	26	< 0.003	0.7	1.0
0.13	0.17	0.007	0.006	18.9	**0.029**	0.30	0.094	0.004	< 0.002	12	7	5	< 0.003	0.4	0.9
0.26	0.30	0.010	0.008	11.4	**0.025**	0.26	0.083	0.002	< 0.002	3	12	10	< 0.003	0.6	0.9
< 0.05	0.05	0.009	0.006	14.2	**0.020**	0.24	0.067	0.003	< 0.002	1	10	10	< 0.003	1.0	1.0
0.11	0.13	0.009	0.009	14.5	**0.023**	0.26	0.074	0.003	< 0.002	< 1	4	4	< 0.003	0.7	1.2
0.17	0.19	0.012	0.010	16.0	**0.022**	0.26	0.080	0.003	< 0.002	< 1	5	5	< 0.003	0.6	1.0
0.06	0.09	0.011	0.008	16.2	**0.026**	0.27	0.090	0.003	< 0.002	5	32	32	< 0.003	0.7	1.0
0.11	0.13	0.010	0.020	14.9	**0.024**	0.27	0.078	0.003	< 0.002	12	32	18	< 0.003	0.6	0.9
0.15	0.20	0.017	0.021	24.1	**0.037**	0.40	0.127	0.004	< 0.002	3	31	20	< 0.003	0.8	0.9
0.38	0.44	0.015	0.028	22.4	**0.032**	0.31	0.105	0.012	0.003	3	7	7	0.009	1.5	1.6
0.17	0.20	0.012	0.021	21.2	**0.036**	0.31	0.113	0.007	< 0.002	< 1	7	6	0.009	1.2	1.5
0.08	0.12	0.009	0.019	16.0	**0.022**	0.23	0.075	0.007	< 0.002	3	6	4	0.004	0.7	1.0
0.38	0.42	0.010	0.014	19.5	**0.028**	0.30	0.095	0.005	< 0.002	1	1	1	< 0.003	0.8	1.2
0.16	0.23	0.011	0.016	18.5	**0.027**	0.29	0.098	0.006	< 0.002	4	4	4	< 0.003	0.4	1.1
0.31	0.43	0.021	0.018	13.9	**0.031**	0.34	0.123	0.005	< 0.002	< 1	7	5	< 0.003	0.5	0.8
< 0.05	0.13	0.014	0.015	15.8	**0.021**	0.25	0.076	0.006	< 0.002	1	2	2	< 0.003	1.1	1.1
0.18	0.31	0.013	0.019	15.7	**0.025**	0.28	0.081	0.006	< 0.002	1	< 1	< 1	0.005	0.6	1.2
0.30	0.40	0.012	0.014	17.6	**0.024**	0.27	0.091	0.005	< 0.002	< 1	< 1	< 1	0.004	1.1	1.5
0.10	0.21	0.012	0.016	20.2	**0.034**	0.32	0.123	0.006	< 0.002	< 1	1	1	0.007	0.7	0.9
0.17	0.22	0.011	0.022	19.2	**0.032**	0.33	0.111	0.008	< 0.002	6	80	72	0.011	0.5	1.2
0.19	0.22	0.014	0.027	20.7	**0.033**	0.35	0.115	0.007	< 0.002	1	1	1	0.012	1.0	1.1
0.31	0.33	0.010	0.035	23.5	**0.033**	0.32	0.109	0.014	0.003	12	12	12	**0.056**	1.3	1.7
0.17	0.20	0.014	0.026	22.7	**0.040**	0.33	0.122	0.010	0.002	5	22	17	0.006	1.1	1.6
0.10	0.17	0.013	0.021	15.4	**0.021**	0.21	0.072	0.009	< 0.002	9	46	36	0.004	0.6	1.2
0.17	0.24	0.012	0.022	19.2	**0.028**	0.28	0.096	0.008	< 0.002	2	7	7	0.005	0.6	1.1
0.16	0.26	0.006	0.016	19.9	**0.027**	0.31	0.106	0.006	< 0.002	7	5	3	0.003	0.5	1.1
0.05	0.21	0.024	0.021	12.0	**0.027**	0.31	0.117	0.007	< 0.002	2	1	1	0.003	1.1	1.2
0.08	0.24	0.017	0.021	15.9	**0.021**	0.24	0.078	0.008	< 0.002	13	5	5	0.003	1.2	1.2
0.08	0.23	0.016	0.020	15.1	**0.023**	0.26	0.081	0.007	< 0.002	17	2	2	0.007	0.9	1.3
0.17	0.28	0.013	0.016	16.8	**0.023**	0.25	0.084	0.005	< 0.002	8	< 1	< 1	0.006	1.8	2.8
0.08	0.22	0.015	0.018	20.0	**0.033**	0.32	0.123	0.007	< 0.002	6	3	3	0.011	0.8	1.1
0.19	0.30	0.014	0.026	19.6	**0.032**	0.32	0.109	0.009	< 0.002	3	51	47	0.009	0.7	1.3
0.18	0.22	0.014	0.026	19.5	**0.033**	0.33	0.113	0.009	< 0.002	5	7	7	0.014	1.0	1.2

Note: < = less than value stated

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

* New Zealand Standard Time

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

DATE dd/mm/yy	TIME* HH:MM	FLOW m^3/s	BDISK m	COLOR units	COND mS/m	PH units	TEMP 'C	DO g/m^3	PCDO %Sat	BOD5 g/m^3	TURB NTU	TDS g/m^3	NNN g/m^3	NO3-N g/m^3	NH4-N g/m^3
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep) <20 (Oct-Apr)		>80	-	<5	-	-	-	<0.88
1131-143		UD=350 m^3/s	*(Flows from Waipapa Dam - Total)*												
Waikato River @ Waipapa Tailrace															
06/01/04	11:30	167	**1.6**	35.0	16.4	7.5	**20.5**	9.4	105.7	0.7	2.19	124	0.060	0.059	< 0.01
03/02/04	11:25	390	(1.9)	30.0	17.2	7.4	**21.7**	8.2	94.3	0.6	2.34	119	0.082	0.078	0.06
03/03/04	11:35	474	(1.0)	32.5	13.1	7.5	17.8	10.6	112.6	0.5	3.56	99	0.171	0.170	0.02
06/04/04	12:00	354	(2.6)	35.0	15.4	7.5	17.1	9.6	100.3	0.6	1.43	113	0.093	0.089	0.01
04/05/04	12:51	301	2.2	37.5	16.9	7.4	**16.0**	9.6	99.3	0.6	1.16	123	0.147	0.145	0.02
03/06/04	12:10	258	3.1	40.0	17.0	7.3	**13.4**	10.0	96.9	< 0.4	0.70	120	0.223	0.220	< 0.01
06/07/04	12:55	418	(1.8)	35.0	15.0	7.5	11.8	10.6	99.5	0.6	1.40	100	0.213	0.210	0.02
03/08/04	13:00	427	(2.3)	32.5	15.2	7.6	11.3	11.8	108.4	1.1	1.41	118	0.220	0.218	< 0.01
07/09/04	12:30	423	(2.8)	37.5	16.1	7.6	11.6	11.4	105.1	0.8	1.35	111	0.174	0.169	< 0.01
05/10/04	11:33	313	2.2	35.0	15.9	7.7	13.0	11.4	111.5	1.0	1.43	118	0.149	0.147	< 0.01
02/11/04	11:45	364	(1.5)	35.0	15.3	7.1	15.7	10.4	104.5	0.7	1.95	112	0.145	0.140	0.01
01/12/04	12:38	284	2.0	35.0	16.2	7.4	16.9	10.0	106.2	0.5	1.47	119	0.105	0.101	0.03
1131-101		UD=356 m^3/s	*(Flows from Karapiro Dam - Total)*												
Waikato River @ Narrows Br															
07/01/04	08:30	278	**1.5**	32.5	16.4	7.7	**20.7**	8.9	99.9	1.4	2.55	118	0.117	0.115	< 0.01
04/02/04	07:40	242	**1.5**	32.5	16.7	7.6	**21.6**	6.6	**76.3**	0.9	2.90	120	0.214	0.205	0.11
03/03/04	07:15	482	(1.1)	32.5	14.1	7.2	18.2	9.8	104.4	0.7	3.83	112	0.197	0.194	0.02
07/04/04	08:30	275	**1.4**	35.0	14.3	7.6	16.8	9.8	103.1	1.1	1.66	104	0.113	0.112	0.03
05/05/04	08:25	215	**1.0**	35.0	16.6	7.5	**15.7**	9.6	96.7	0.7	2.92	130	0.229	0.225	0.01
02/06/04	08:45	244	1.8	35.0	16.8	7.3	**13.3**	10.0	94.8	0.7	2.22	122	0.314	0.311	0.03
07/07/04	08:45	382	(2.0)	37.5	14.9	7.4	11.7	11.2	104.7	< 0.5	2.50	111	0.386	0.382	0.01
04/08/04	08:20	429	(1.4)	30.0	14.8	7.4	10.7	11.2	101.4	1.2	2.22	114	0.378	0.375	0.02
07/09/04	08:37	359	(1.5)	32.5	14.8	7.7	11.0	11.3	100.9	1.2	2.48	111	0.224	0.220	< 0.01
06/10/04	07:20	203	1.7	35.0	15.1	7.8	13.0	11.3	108.3	0.8	1.68	110	0.217	0.213	0.02
03/11/04	07:45	298	1.8	30.0	15.5	7.5	15.9	10.4	103.8	1.0	2.06	122	0.236	0.232	0.02
01/12/04	07:55	225	1.7	35.0	14.9	7.6	17.2	9.6	101.1	1.0	1.73	99	0.121	0.118	0.02
1131-69		UD=380 m^3/s	*(Flows from Hamilton - Bridge Street Bridge)*												
Waikato River @ Horotiu Br															
07/01/04	09:33	211	**1.1**	30.0	16.6	7.7	**20.7**	9.0	100.2	1.4	3.85	115	0.135	0.132	< 0.01
04/02/04	08:30	304	**1.4**	32.5	16.8	7.6	**21.5**	7.3	84.2	0.9	3.55	118	0.262	0.254	0.11
03/03/04	08:20	594	(1.0)	32.5	14.3	7.2	18.6	8.8	94.7	0.6	4.14	107	0.228	0.226	0.02
07/04/04	09:20	252	**1.2**	32.5	14.4	7.6	16.5	10.0	103.5	1.2	2.99	111	0.145	0.143	0.03
05/05/04	09:30	198	**1.1**	35.0	16.7	7.5	**15.4**	9.2	94.2	0.7	2.87	126	0.244	0.241	< 0.01
02/06/04	09:40	209	**1.5**	35.0	16.9	7.3	**13.4**	10.0	95.7	0.8	2.40	123	0.318	0.314	0.02
07/07/04	09:40	439	(1.7)	35.0	16.1	7.3	11.7	10.6	98.5	< 0.4	2.95	113	0.425	0.422	0.02
04/08/04	09:15	431	(1.4)	30.0	14.7	7.3	10.5	11.3	101.3	1.2	2.31	111	0.418	0.414	0.03
07/09/04	09:30	342	**1.2**	30.0	14.8	7.8	11.1	11.7	104.2	1.3	3.08	112	0.238	0.235	< 0.01
06/10/04	08:20	185	1.7	35.0	15.4	7.8	13.1	10.9	104.3	1.0	2.04	110	0.228	0.227	0.02
03/11/04	08:35	307	**1.2**	30.0	15.6	7.5	16.1	10.4	104.1	1.2	2.55	122	0.257	0.253	< 0.01
01/12/04	09:05	202	**1.4**	32.5	15.0	7.5	17.1	9.2	96.8	0.5	2.25	101	0.154	0.151	0.03
1131-77		UD=580 m^3/s	*(Flows from Huntly Power Station Recorder)*												
Waikato River @ Huntly-Tainui Br															
07/01/04	10:12	320	**0.8**	30.0	15.0	7.8	**21.2**	9.2	104.0	1.9	4.63	108	0.192	0.187	< 0.01
04/02/04	09:05	602	(0.7)	27.5	14.4	7.5	**20.7**	7.6	85.5	1.8	**20.8**	105	0.443	0.433	0.10
03/03/04	09:00	1131	(0.1)	27.5	12.5	7.3	18.0	7.3	81.2	0.9	**108**	96	0.807	0.782	0.07
07/04/04	10:10	314	**1.1**	32.5	14.3	7.6	16.4	9.7	99.2	1.2	4.37	99	0.208	0.205	0.02
05/05/04	10:10	311	**0.6**	30.0	15.7	7.4	**15.6**	9.2	92.5	1.0	**8.30**	115	0.444	0.439	0.02
02/06/04	10:24	358	**0.8**	30.0	16.0	7.2	**13.0**	9.9	93.1	0.6	**7.20**	122	0.476	0.471	0.03
07/07/04	10:30	551	**1.1**	35.0	14.9	7.3	11.2	10.4	95.2	< 0.4	**5.71**	112	0.661	0.657	0.03
04/08/04	10:10	504	**1.0**	30.0	14.9	7.6	10.2	11.0	98.0	0.7	**5.06**	106	0.617	0.611	0.02
07/09/04	10:30	413	**1.0**	30.0	14.5	7.7	11.2	11.5	102.8	1.4	4.93	111	0.333	0.329	< 0.01
06/10/04	09:10	357	**0.8**	32.5	13.8	7.7	13.3	10.3	98.8	0.7	**8.80**	99	0.485	0.481	0.01
03/11/04	09:35	469	**1.1**	30.0	14.3	7.4	16.0	9.9	99.3	0.9	4.79	114	0.404	0.399	< 0.01
01/12/04	10:00	286	**0.9**	32.5	14.5	7.4	17.1	9.0	94.1	0.5	4.93	99	0.270	0.266	0.02

Note: < = less than value stated
UD = upper decile flow (period 1985-2004 inclusive)

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

* New Zealand Standard Time

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

TKN g/m³	TN g/m³	DRP g/m³	TP g/m³	CL g/m³	AS g/m³	B g/m³	LI g/m³	A340F /cm	A440F /cm	ENT	FC cfu/100ml	E coli	CHLA g/m³	DOC g/m³	TOC g/m³
-	<0.5	-	<0.04	-	<0.01	<1.4	-	-	-	<77	-	<550	<0.02		
0.26	0.32	0.011	0.039	23.5	**0.033**	0.31	0.111	0.016	0.003	< 1	9	7	**0.030**	1.3	1.8
0.21	0.29	0.017	0.040	20.4	**0.034**	0.26	0.095	0.018	0.004	76	105	65	0.004	1.3	2.1
0.13	0.30	0.011	0.031	13.6	**0.017**	0.18	0.058	0.014	0.003	50	114	78	0.004	0.5	1.4
0.14	0.23	0.014	0.026	18.2	**0.024**	0.26	0.082	0.009	< 0.002	1	8	6	0.005	0.7	1.2
0.13	0.28	0.006	0.012	19.4	**0.023**	0.29	0.100	0.007	< 0.002	5	4	3	0.003	0.4	1.1
0.15	0.37	0.025	**0.042**	10.2	**0.025**	0.29	0.107	0.009	< 0.002	8	5	4	< 0.003	1.0	1.2
0.07	0.28	0.019	0.023	15.3	**0.019**	0.23	0.073	0.008	< 0.002	6	4	4	< 0.003	1.3	1.3
0.11	0.33	0.019	0.024	15.1	**0.021**	0.25	0.075	0.009	< 0.002	5	9	9	0.008	0.8	1.5
0.16	0.33	0.017	0.028	17.1	**0.021**	0.24	0.080	0.010	0.002	1	4	1	0.006	1.4	2.2
0.11	0.26	0.014	0.022	17.0	**0.025**	0.27	0.100	0.010	0.002	8	40	38	0.016	0.6	1.2
0.21	0.36	0.018	0.032	18.8	**0.029**	0.30	0.098	0.013	0.003	16	200	190	0.007	0.8	1.6
0.26	0.37	0.018	0.031	18.7	**0.029**	0.29	0.094	0.014	0.003	2	3	3	0.009	1.2	1.5
0.31	0.43	0.011	0.039	22.7	**0.029**	0.26	0.094	0.032	0.011	40	40	40	0.019	1.4	2.2
0.55	**0.76**	0.025	**0.056**	17.7	**0.028**	0.21	0.077	0.022	0.004	27	290	180	0.003	1.7	2.5
0.21	0.41	0.030	**0.053**	15.5	**0.019**	0.21	0.067	0.017	0.003	**120**	120	110	0.008	0.8	1.6
0.22	0.33	0.011	0.016	15.8	**0.017**	0.23	0.068	0.010	0.002	**120**	44	36	0.018	0.8	1.5
0.25	0.48	0.021	0.039	18.5	**0.020**	0.27	0.088	0.012	0.003	**140**	70	70	0.011	0.7	1.8
0.21	**0.52**	0.027	**0.047**	17.0	**0.020**	0.28	0.091	0.019	0.006	45	100	70	0.007	1.2	1.8
0.16	**0.55**	0.023	0.031	16.1	**0.019**	0.22	0.081	0.013	0.002	17	21	14	< 0.003	0.9	1.5
0.17	**0.55**	0.021	0.035	15.9	**0.021**	0.23	0.076	0.015	0.003	4	22	13	0.007	1.0	2.1
0.16	0.38	0.015	0.026	16.3	**0.018**	0.23	0.072	0.012	0.002	5	12	12	**0.023**	0.9	1.8
0.26	0.48	0.014	0.024	15.6	**0.019**	0.22	0.069	0.015	0.003	25	77	77	0.011	1.6	2.2
0.38	**0.62**	0.020	0.032	18.5	**0.030**	0.25	0.091	0.014	0.003	12	78	78	0.011	0.7	1.6
0.26	0.38	0.014	0.029	15.7	**0.024**	0.24	0.080	0.013	0.003	7	28	26	0.007	0.8	1.7
0.29	0.43	0.030	**0.055**	23.0	**0.028**	0.26	0.093	0.025	0.007	40	80	70	**0.027**	1.4	2.3
0.61	**0.87**	0.033	**0.071**	17.8	**0.026**	0.21	0.075	0.026	0.005	22	430	250	0.004	2.0	2.9
0.23	0.46	0.026	**0.057**	15.6	**0.019**	0.21	0.067	0.019	0.004	**140**	140	110	0.009	0.7	1.8
0.23	0.38	0.014	0.039	15.6	**0.017**	0.23	0.067	0.011	0.002	**430**	180	150	0.015	0.8	1.6
0.18	0.42	0.025	**0.043**	18.6	**0.020**	0.26	0.088	0.013	0.003	**380**	120	120	0.013	0.6	2.2
0.19	**0.51**	0.029	**0.049**	18.9	**0.020**	0.27	0.094	0.020	0.007	41	70	50	0.008	1.2	1.8
0.18	**0.61**	0.025	0.038	16.5	**0.018**	0.22	0.079	0.015	0.003	21	41	23	0.004	1.2	1.8
0.14	**0.56**	0.024	0.039	15.7	**0.021**	0.23	0.075	0.015	0.003	5	10	9	0.006	0.9	2.0
0.14	0.38	0.016	0.034	16.5	**0.018**	0.22	0.071	0.010	0.002	4	20	20	**0.025**	0.9	1.3
0.27	0.50	0.023	0.033	15.9	**0.018**	0.23	0.069	0.013	0.003	23	46	37	0.010	0.8	1.5
0.38	**0.64**	0.020	**0.049**	18.5	**0.029**	0.27	0.095	0.016	0.003	18	70	60	0.008	1.0	2.0
0.20	0.35	0.022	**0.044**	15.9	**0.023**	0.23	0.078	0.014	0.003	50	300	100	0.005	0.9	1.7
0.33	**0.52**	0.024	**0.065**	20.6	**0.021**	0.20	0.071	0.029	0.007	10	110	80	**0.036**	1.6	2.1
0.81	**1.25**	0.027	**0.164**	14.8	**0.016**	0.14	0.047	0.048	0.010	**78**	1080	470	0.004	3.0	4.1
0.52	**1.33**	0.020	**0.239**	11.3	0.007	0.08	0.025	0.036	0.007	**210**	610	360	0.004	1.7	3.7
0.25	0.46	0.017	**0.055**	18.5	**0.015**	0.21	0.060	0.013	0.003	**80**	90	80	0.017	0.5	1.7
0.32	**0.76**	0.032	**0.073**	17.0	**0.014**	0.20	0.063	0.027	0.005	**300**	330	180	0.011	1.0	2.5
0.27	**0.75**	0.032	**0.072**	17.4	**0.015**	0.21	0.069	0.032	0.010	**120**	190	130	0.005	2.0	2.5
0.15	**0.81**	0.027	**0.052**	15.9	**0.014**	0.17	0.060	0.020	0.004	30	80	50	0.003	1.1	1.9
0.16	**0.78**	0.026	**0.047**	15.0	**0.015**	0.17	0.054	0.019	0.003	17	27	23	0.005	1.3	2.3
0.23	**0.56**	0.019	**0.044**	16.3	**0.016**	0.20	0.064	0.013	0.003	6	21	20	**0.023**	0.8	1.6
0.29	**0.78**	0.023	**0.059**	15.9	0.009	0.12	0.035	0.022	0.005	45	290	250	0.008	1.3	2.3
0.37	**0.77**	0.023	**0.063**	16.7	**0.021**	0.21	0.071	0.023	0.004	12	240	220	0.006	1.1	2.2
0.24	**0.51**	0.023	**0.063**	15.3	**0.017**	0.19	0.060	0.021	0.004	22	40	40	0.007	1.0	1.9

Note: < = less than value stated

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

* New Zealand Standard Time

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

DATE dd/mm/yy	TIME* HH:MM	FLOW m^3/s	BDISK m	COLOR units	COND mS/m	PH units	TEMP 'C	DO g/m^3	PCDO %Sat	BOD5 g/m^3	TURB NTU	TDS g/m^3	NNN g/m^3	NO3-N g/m^3	NH4-N 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=627 m^3/s		*(Flows from Mercer Bridge Recorder)*											
Waikato River @ Mercer Br															
07/01/04	11:01	369	-	-	15.6	7.8	**21.9**	9.1	104.3	2.4	**9.18**	110	0.143	0.141	< 0.01
04/02/04	09:50	648	-	-	15.0	7.5	**21.0**	7.4	84.3	2.2	**18.7**	108	0.479	0.469	0.06
03/03/04	09:55	1205	-	-	12.0	7.2	18.1	6.8	**75.9**	0.9	**107**	101	0.687	0.676	0.05
07/04/04	11:00	330	-	-	14.3	7.6	16.7	9.4	97.4	1.1	**6.61**	100	0.227	0.225	0.01
05/05/04	11:00	375	-	-	16.5	7.4	**16.0**	9.0	91.6	1.1	**16.3**	118	0.471	0.466	0.02
02/06/04	11:10	456	-	-	16.2	7.3	**13.8**	9.8	93.6	0.9	**12.0**	117	0.471	0.468	< 0.01
07/07/04	11:20	694	-	-	16.3	7.3	11.7	9.9	91.7	0.4	**8.88**	117	0.681	0.678	0.02
04/08/04	11:00	623	-	-	15.7	7.4	10.6	10.6	95.6	0.9	**8.55**	116	0.574	0.570	0.02
07/09/04	11:23	421	-	-	15.1	7.7	**12.5**	11.0	101.2	1.9	**8.45**	110	0.403	0.399	< 0.01
06/10/04	10:05	444	-	-	15.0	7.7	14.1	9.8	95.4	0.9	**11.4**	112	0.400	0.396	< 0.01
03/11/04	10:10	540	-	-	14.8	7.4	16.7	9.9	98.8	1.3	**9.87**	118	0.374	0.371	< 0.01
01/12/04	11:00	299	-	-	14.9	7.6	17.6	9.0	95.1	1.0	**8.38**	104	0.266	0.263	0.01
1131-133															
Waikato River @ Tuakau Br															
07/01/04	11:33	-	**0.6**	27.5	15.4	7.8	**22.6**	9.0	104.5	3.4	**11.6**	103	0.059	0.057	< 0.01
04/02/04	10:15	-	**0.4**	25.0	15.0	7.6	**21.4**	6.7	**71.5**	1.3	**25.7**	116	0.499	0.489	0.05
03/03/04	10:40	-	**0.1**	25.0	11.8	7.1	18.4	5.7	**60.4**	0.9	**101**	106	0.659	0.650	0.05
07/04/04	11:30	-	**0.8**	30.0	14.4	7.6	16.7	9.4	97.3	1.4	**6.61**	104	0.202	0.199	0.01
05/05/04	11:30	-	**0.5**	27.5	16.0	7.4	**16.2**	9.0	91.6	1.1	**12.5**	111	0.459	0.454	< 0.01
02/06/04	11:43	-	**0.6**	30.0	16.2	7.3	**13.7**	9.8	93.5	0.8	**14.3**	120	0.475	0.472	< 0.01
07/07/04	11:55	-	**0.7**	27.5	15.5	7.2	11.7	9.4	86.8	0.5	**13.4**	118	0.671	0.665	0.01
04/08/04	11:20	-	**0.8**	30.0	15.1	7.2	10.8	10.5	95.0	0.9	**6.96**	111	0.557	0.555	0.01
07/09/04	12:00	-	**0.7**	27.5	15.2	7.6	**12.9**	10.9	101.1	1.9	**11.8**	114	0.441	0.437	< 0.01
06/10/04	10:30	-	**0.7**	30.0	14.8	7.7	14.8	10.2	100.3	1.0	**8.45**	109	0.344	0.340	< 0.01
03/11/04	10:45	-	**0.7**	27.5	14.3	7.4	17.3	10.1	103.8	1.3	**7.17**	117	0.369	0.365	< 0.01
01/12/04	11:20	-	**0.6**	27.5	15.1	7.5	17.8	8.7	93.3	0.7	**8.48**	104	0.271	0.269	< 0.01

Note: < = less than value stated
UD = upper decile flow (period 1985-2004 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 value – 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	FC	E coli cfu/100ml	CHLA g/m^3	DOC g/m^3	TOC g/m^3
-	<0.5	-	<0.04	-	<0.01	<1.4	-	-	-	<77	-	<550	<0.02		
0.44	**0.58**	0.016	**0.085**	21.1	**0.020**	0.21	0.069	0.032	0.008	10	40	30	**0.040**	1.7	2.5
0.80	**1.28**	0.030	**0.152**	15.8	**0.017**	0.14	0.049	0.055	0.011	61	960	540	0.005	3.9	4.8
0.66	**1.35**	0.026	**0.220**	12.1	0.010	0.10	0.033	0.045	0.008	**230**	530	330	0.007	1.8	4.3
0.28	**0.51**	0.015	**0.059**	15.8	**0.014**	0.20	0.056	0.015	0.003	12	50	50	0.019	0.7	1.8
0.34	**0.81**	0.025	**0.103**	18.1	**0.015**	0.21	0.063	0.027	0.005	**210**	300	180	0.015	1.1	3.9
0.34	**0.81**	0.029	**0.089**	17.3	**0.014**	0.20	0.063	0.037	0.011	**150**	250	190	0.006	2.0	2.7
0.38	**1.06**	0.026	**0.060**	16.7	**0.012**	0.17	0.056	0.027	0.005	24	40	30	0.006	1.4	2.6
0.33	**0.90**	0.025	**0.061**	16.4	**0.015**	0.18	0.058	0.026	0.005	13	60	38	0.008	1.7	3.9
0.31	**0.71**	0.015	**0.068**	17.3	**0.013**	0.18	0.051	0.022	0.004	6	21	18	**0.030**	1.3	3.0
0.44	**0.84**	0.019	**0.069**	15.2	**0.011**	0.16	0.046	0.031	0.006	25	170	150	0.014	2.7	3.8
0.44	**0.81**	0.021	**0.082**	17.7	**0.022**	0.22	0.076	0.026	0.005	11	170	150	0.013	1.2	2.6
0.37	**0.64**	0.022	**0.068**	16.1	**0.018**	0.21	0.064	0.020	0.004	8	40	40	0.015	1.2	2.1
0.57	**0.63**	0.014	**0.093**	21.0	**0.020**	0.19	0.065	0.037	0.009	50	52	50	**0.066**	2.4	3.1
0.63	**1.13**	0.029	**0.150**	15.6	**0.015**	0.14	0.046	0.064	0.013	60	840	520	0.006	4.4	6.3
0.59	**1.25**	0.026	**0.222**	12.1	0.009	0.10	0.033	0.046	0.009	**280**	460	320	< 0.006	1.6	4.8
0.25	0.45	0.015	**0.057**	15.8	**0.014**	0.21	0.056	0.016	0.003	23	60	60	**0.022**	1.1	1.9
0.40	**0.86**	0.023	**0.079**	18.2	**0.013**	0.19	0.060	0.029	0.005	**130**	200	130	0.017	1.2	3.7
0.41	**0.89**	0.023	**0.087**	17.3	**0.013**	0.19	0.061	0.045	0.015	**160**	200	150	0.007	2.2	2.9
0.34	**1.01**	0.021	**0.069**	16.9	**0.011**	0.16	0.053	0.033	0.006	40	74	42	0.007	2.0	3.3
0.22	**0.78**	0.021	**0.057**	15.7	**0.015**	0.18	0.057	0.024	0.005	9	34	26	0.008	1.6	3.2
0.29	**0.73**	0.012	**0.078**	17.6	**0.012**	0.16	0.047	0.028	0.005	13	24	23	**0.034**	1.8	3.5
0.38	**0.72**	0.014	**0.059**	15.1	**0.012**	0.17	0.048	0.030	0.005	22	120	110	0.016	1.4	3.2
0.33	**0.70**	0.019	**0.077**	17.1	**0.019**	0.22	0.073	0.029	0.005	7	100	10	0.014	1.3	2.8
0.33	**0.60**	0.020	**0.067**	16.3	**0.015**	0.20	0.062	0.022	0.004	22	50	50	0.015	1.5	2.1

Note: < = less than value stated

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

* New Zealand Standard Time

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

Table 5: Samples for the 10 pesticides for which the results were above detection limits (values shown in bold). For all the 89 other pesticides analysed for no contamination was detected.

Date dd/mm/yy	Time* hh:mm	Acetochl mg/m3	Alachlor mg/m3	Atrazine mg/m3	Dieldrin mg/m3	Gamma-BH mg/m3	Hexazino mg/m3	Metsulfm mg/m3	Myclobut mg/m3	Procymid mg/m3	Terbuthy mg/m3
1131-127	***Waikato River @ Taupo Control Gates***										
02/09/03	09:20	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
02/12/03	08:10	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
03/03/04	07:53	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
04/05/04	09:10	< 0.02	< 0.008	< 0.004			< 0.004	< 0.005	< 0.004	< 0.004	< 0.004
03/06/04	09:05	< 0.02	< 0.008	< 0.004			< 0.004	< 0.010	< 0.004	< 0.004	< 0.004
1131-107	***Waikato River @ Ohakuri Tailrace Br***										
02/09/03	11:10	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
02/12/03	10:00	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
03/03/04	09:45	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
04/05/04	11:01	< 0.02	**0.018**	< 0.004			< 0.004	< 0.005	< 0.004	**0.790**	**1.040**
03/06/04	10:45	< 0.02	< 0.008	< 0.004			< 0.004	< 0.010	**0.009**	< 0.004	< 0.004
1131-147	***Waikato River @ Whakamaru Tailrace***										
04/05/04	12:00	< 0.02	< 0.008	< 0.004			< 0.004	< 0.005	< 0.004	< 0.004	< 0.004
03/06/04	11:30	< 0.02	< 0.008	< 0.004			**0.009**	< 0.010	< 0.004	< 0.004	< 0.004
1131-143	***Waikato River @ Waipapa Tailrace***										
04/05/04	12:51	< 0.02	< 0.008	< 0.004			< 0.004	< 0.005	< 0.004	< 0.004	< 0.004
03/06/04	12:10	< 0.02	< 0.008	< 0.004			**0.008**	< 0.010	< 0.004	< 0.004	< 0.004
1131-101	***Waikato River @ Narrows Br***										
02/09/03	08:44	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
04/12/03	08:05	< 0.02	< 0.008	**0.004**	< 0.0004	< 0.0004	**0.027**		< 0.004	< 0.004	**0.007**
03/03/04	07:15	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	**0.015**		< 0.004	< 0.004	< 0.004
05/05/04	08:25	< 0.02	< 0.008	< 0.004			**0.007**	< 0.005	< 0.004	< 0.004	< 0.004
02/06/04	08:45	< 0.02	< 0.008	< 0.004			**0.008**	< 0.010	< 0.004	< 0.004	< 0.004
1131-69	***Waikato River @ Horotiu Br***										
02/09/03	09:35	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
04/12/03	08:40	< 0.02	< 0.008	**0.004**	< 0.0004	< 0.0004	**0.024**		< 0.004	< 0.004	**0.008**
03/03/04	08:20	< 0.02	< 0.008	< 0.004	< 0.0004	**0.0007**	**0.014**		< 0.004	< 0.004	< 0.004
05/05/04	12:35	< 0.02	< 0.008	< 0.004			**0.008**	< 0.005	< 0.004	< 0.004	< 0.004
02/06/04	09:40	< 0.02	< 0.008	< 0.004			**0.011**	< 0.010	< 0.004	< 0.004	< 0.004
1131-133	***Waikato River @ Tuakau Br***										
02/09/03	11:20	< 0.02	< 0.008	< 0.004	< 0.0004	< 0.0004	< 0.004		< 0.004	< 0.004	< 0.004
04/12/03	11:05	**0.02**	< 0.008	**0.021**	< 0.0004	< 0.0004	**0.014**		< 0.004	< 0.004	**0.006**
03/03/04	10:40	< 0.02	< 0.008	< 0.004	**0.0010**	< 0.0004	**0.007**		< 0.004	< 0.004	< 0.004
05/05/04	11:30	< 0.02	< 0.008	< 0.004			**0.005**	**0.018**	< 0.004	< 0.004	< 0.004
02/06/04	11:43	< 0.02	< 0.008	< 0.004			**0.011**	**0.020**	< 0.004	< 0.004	< 0.004

< = less than value stated

*Time = New Zealand Standard Time

Table 6: Pesticide parameters analysed for, with respective detection limits, total number of samples and method of analysis.

Code	Parameter	#D.L., n	*Method
2,4"-DDD	2,4"-DDD	a, 15	GC-ECD
2,4"-DDE	2,4"-DDE	a, 15	GC-ECD
2,4"-DDT	2,4"-DDT	a, 15	GC-ECD
4,4"-DDD	4,4"-DDD	a, 15	GC-ECD
4,4"-DDE	4,4"-DDE	a, 15	GC-ECD
4,4"-DDT	4,4"-DDT	a, 15	GC-ECD
Acephate	Acephate	g, 29	ONOP
Acetochl	Acetochlor	g, 29	ONOP
Alachlor	Alachlor	e, 29	ONOP
Aldrin	Aldrin	a, 15	GC-ECD
Alpha-BH	Alpha-BHC	a, 15	GC-ECD
Atrazind	Atrazine-desethyl	c, 29	ONOP
Atrazine	Atrazine	c, 29	ONOP
Atrazini	Atrazine-deisopropyl	c, 29	ONOP
Azinphos	Azinphos-methyl	e, 29	ONOP
Benalaxy	Benalaxyl	g, 29	ONOP
Beta-BHC	Beta-BHC	a, 15	GC-ECD
Bitertan	Bitertanol	e, 29	ONOP
Bromacil	Bromacil	c, 29	ONOP
Bromopro	Bromopropylate	c, 29	ONOP
Captan	Captan	c, 29	ONOP
Carbaryl	Carbaryl	g, 29	ONOP
Carbofur	Carbofuran	a, 29	ONOP
Chlorflu	Chlorfluazuron	a, 29	ONOP
Chloroth	Chlorothalonil	a, 29	ONOP
Chlorpyf	Chlorpyrifos	a, 29	ONOP
Chlorpym	Chlorpyrifos-methyl	a, 29	ONOP
Chlortol	Chlortoluron	f, 29	ONOP
cis-Chlo	cis-Chlordane	a, 15	GC-ECD
Cyfluthr	Cyfluthrin	e, 29	ONOP
Cyhaloth	Cyhalothrin	e, 29	ONOP
Cynanazi	Cynanazine	c, 29	ONOP
Cypermet	Cypermethrin	e, 29	ONOP
Delta-BH	Delta-BHC	a, 15	GC-ECD
Deltamet	Deltamethrin	c, 29	ONOP
Diazinon	Diazinon	c, 29	ONOP
Dichlofl	Dichlofluanid	c, 29	ONOP
Dichlorv	Dichlorvos	e, 29	ONOP
Dicloran	Dicloran	f, 29	ONOP
Dieldrin	Dieldrin	a, 15	GC-ECD
Difenoco	Difenoconazole	c, 29	ONOP
Diphenyl	Diphenylamine	g, 29	ONOP
Diuron	Diuron	g, 29	ONOP
EndosuI	Endosulfan I	a, 15	GC-ECD
EndosuII	Endosulfan II	a, 15	GC-ECD
Endosulp	Endosulfan sulphate	a, 15	GC-ECD
Endrin	Endrin	a, 15	GC-ECD
Endrin a	Endrin aldehyde	a, 15	GC-ECD
Fluazifo	Fluazifop-p-butyl	g, 29	ONOP
Fluometu	Fluometuron	c, 29	ONOP
Flusilaz	Flusilazole	g, 29	ONOP
Furalaxy	Furalaxyl	g, 29	ONOP
Gamma-BH	Gamma-BHC (Lindane)	a, 15	GC-ECD
Haloxyrm	Haloxyfop-r-methyl	g, 29	ONOP
Heptachl	Heptachlor	a, 15	GC-ECD
Heptaepo	Heptachlor epoxide	a, 15	GC-ECD
Hexachlo	Hexachlorobenzene	a, 15	GC-ECD
Hexazino	Hexazinone	c, 29	ONOP
Iprodion	Iprodione	c, 29	ONOP
Kresoxim	Kresoxim-methyl	c, 29	ONOP
Linuron	Linuron	g, 29	ONOP
Malathio	Malathion	c, 29	ONOP
Metalaxy	Metalaxyl	g, 29	ONOP
Methoxyc	Methoxychlor	a, 15	GC-ECD
Metolach	Metolachlor	c, 29	ONOP
Metribuz	Metribuzin	e, 29	ONOP
Metsulfm	Metsulfuron - methyl	d,f, 14	LC-MS
Myclobut	Myclobutanil	c, 29	ONOP
Naled	Naled	e, 29	ONOP
Norflura	Norflurazon	e, 29	ONOP
Oxadiazo	Oxadiazon	c, 29	ONOP
Oxyfluof	Oxyfluofen	c, 29	ONOP
Paclobut	Paclobutrazol	g, 29	ONOP
Parathie	Parathion-ethyl	c, 29	ONOP
Parathim	Parathion-methyl	c, 29	ONOP
Pendimet	Pendimethalin	c, 29	ONOP
Permethr	Permethrin	e, 29	ONOP
Pirimica	Pirimicarb	f, 29	ONOP
Pirimiph	Pirimiphos Methyl	c, 29	ONOP
Prochlor	Prochloraz	c, 29	ONOP
Procymid	Procymidone	c, 29	ONOP
Prometry	Prometryne	e, 29	ONOP
Propachl	Propachlor	c, 29	ONOP
Propazin	Propazine	c, 29	ONOP
Propicon	Propiconazole	e, 29	ONOP
Quizalet	Quizalofop-p-ethyl	g, 29	ONOP
Simazine	Simazine	c, 29	ONOP
Sulfentr	Sulfentrazone	e, 29	ONOP
Tebucona	Tebuconazole	c, 29	ONOP
Terbacil	Terbacil	e, 29	ONOP
Terbumet	Terbumeton	e, 29	ONOP
Terbutde	Terbuthylazine desethyl	c, 29	ONOP
Terbuthy	Terbuthylazine	c, 29	ONOP
Tolyflua	Tolyfluanid	c, 29	ONOP
Total Ch	Total Chlordane (cis+trans)*100/42)	b, 15	GC-ECD
trans-Ch	trans-Chlordane	a, 15	GC-ECD
Triazoph	Triazophos	e, 29	ONOP
Triflura	Trifluralin	c, 29	ONOP
Vinclozo	Vinclozolin	c, 29	ONOP

 # Detection Limit (mg/m3), and number of samples

a	0.0004
b	0.0020
c	0.0040
d	0.0050
e	0.0080
f	0.0100
g	0.0200

*** Analytical Method**

GC-ECD	Solid phase or liquid/liquid extraction, SPE Cleanup, GC-ECD.In-house method.
LC-MS	Isolation and preconcentration by SPE, LC-MS analysis. In-house method.
ONOP	ONOP screen/trace/ultratrace method,water: Solid phase or liquid/liquid extraction, GC-ECD/NPD, GC-MS. In-house method.

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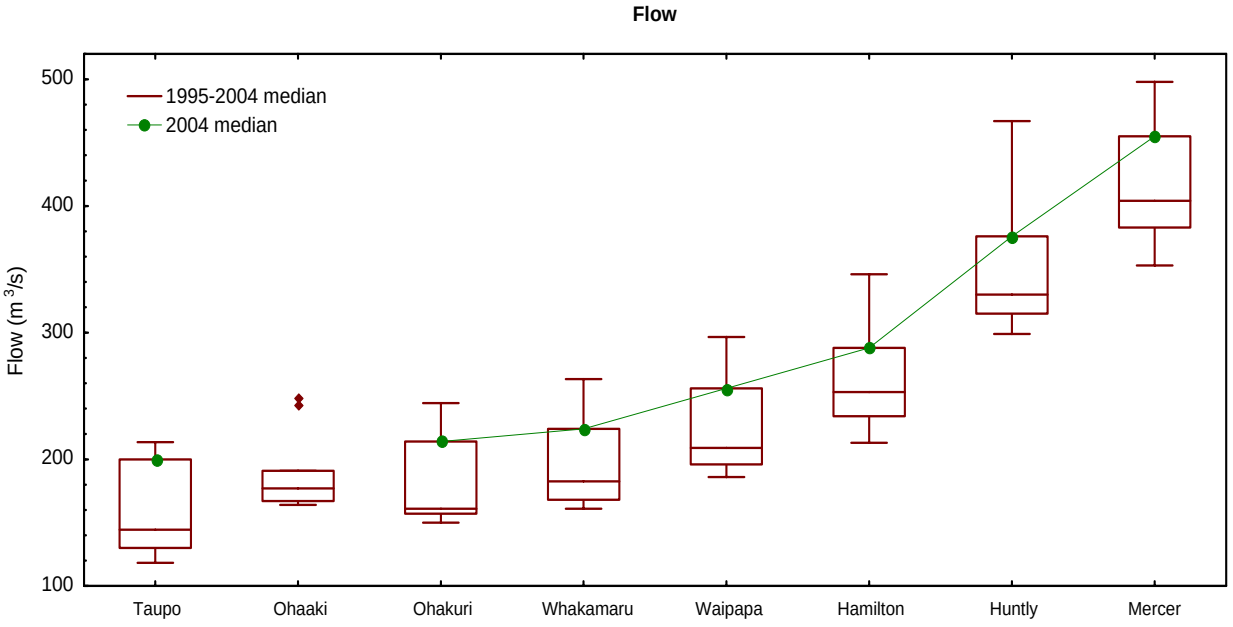
Appendix I

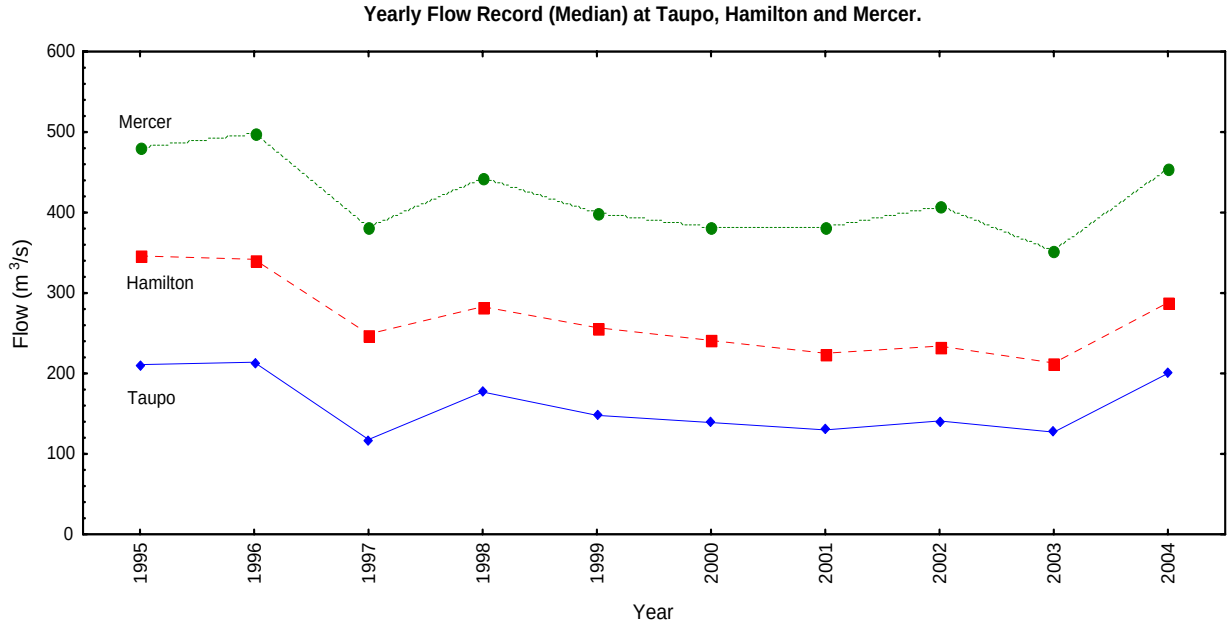
Flow Information

Median Flows of the Waikato River and Main Tributaries

	DISTANCE	FLOW RATE^{+} (m^3/s)										10 YEAR
Location	km	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Median
Taupo	4.2	211	214	118	177	148	139	130	141	127	200	161
Ohakuri	75.8	236	244	153	187	157	158	150	164	157	214	179
Whakamaru	105.0	263	263	182	204	174	168	161	183	168	224	199
Waipapa	126.1	297	297	207	232	205	196	186	211	192	256	225
Hamilton	211.5	346	342	249	283	257	241	225	234	213	288	261
Huntly	246.5	452	467	332	364	327	314	299	328	315	376	349
Mercer	286.3	480	498	383	442	400	381	383	408	353	455	415
Waiotapu Stm	46.6	4.0	3.7	3.8	3.5	3.4	2.8	3.2	2.8	2.6	3.7	3.3
Waipa River	232.7	76	95	58	66	55	52	62	73	61	87	66

$^{+}$Rating curve errors mean estimates of flow are $\pm$ 8%

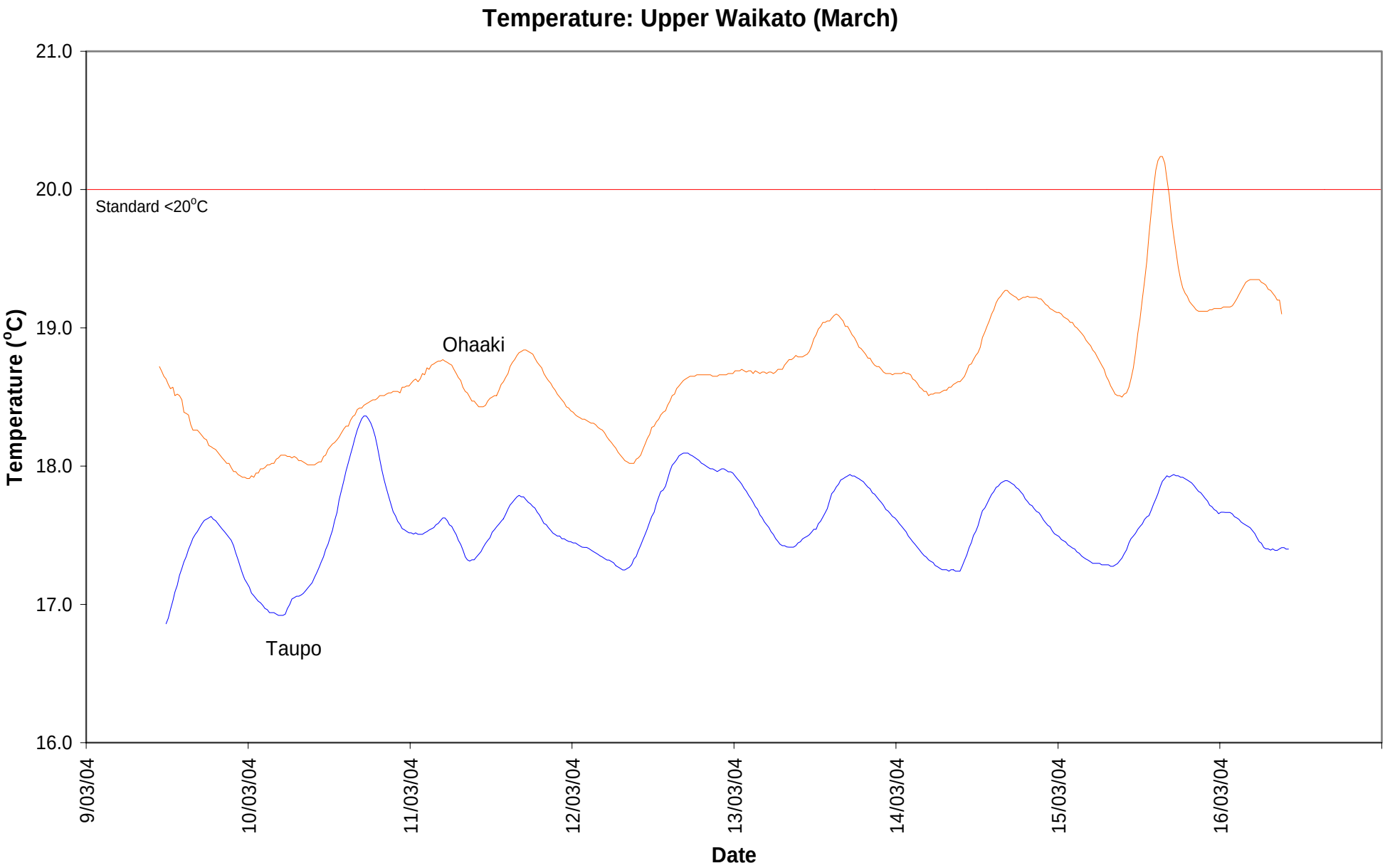


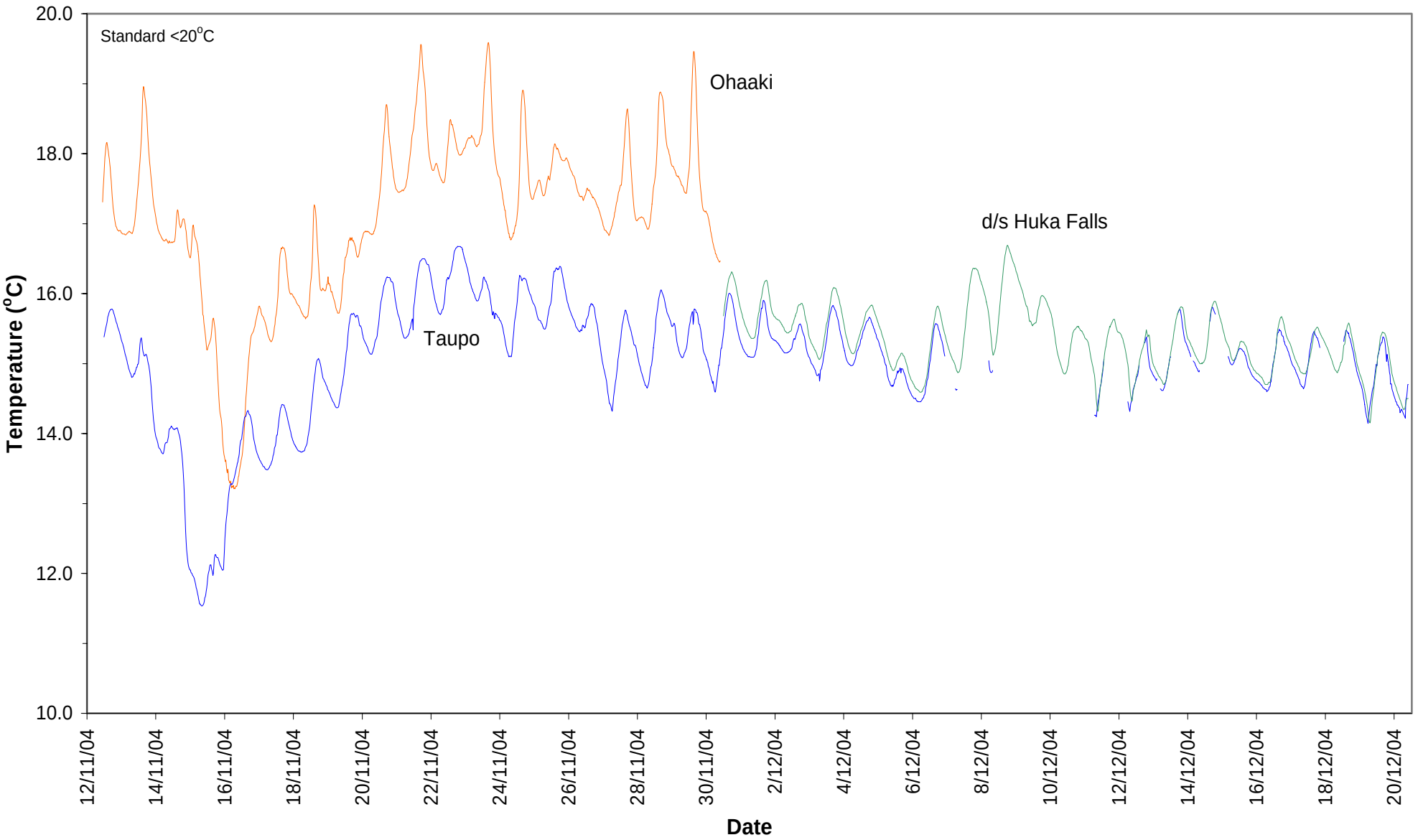


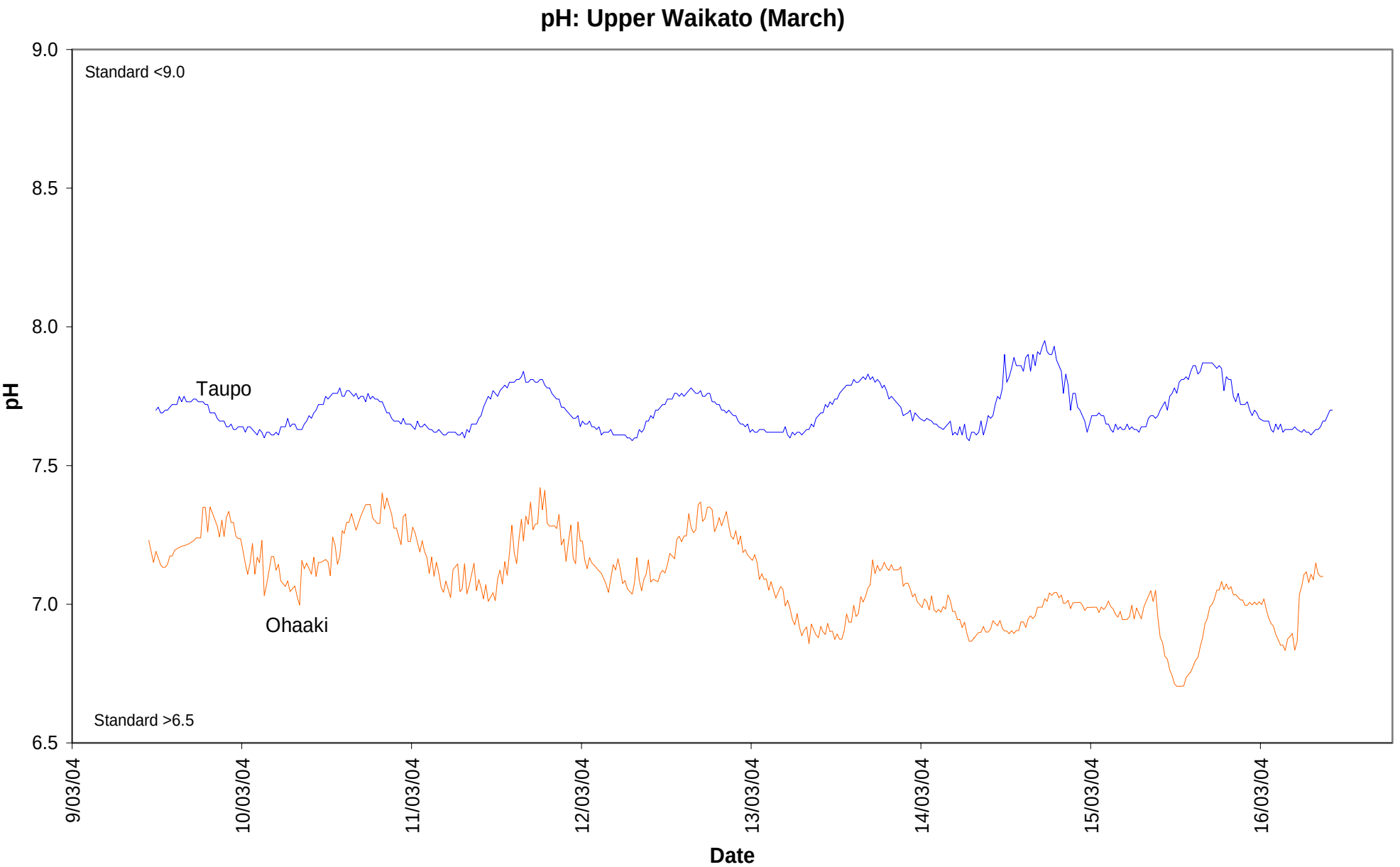
Appendix II

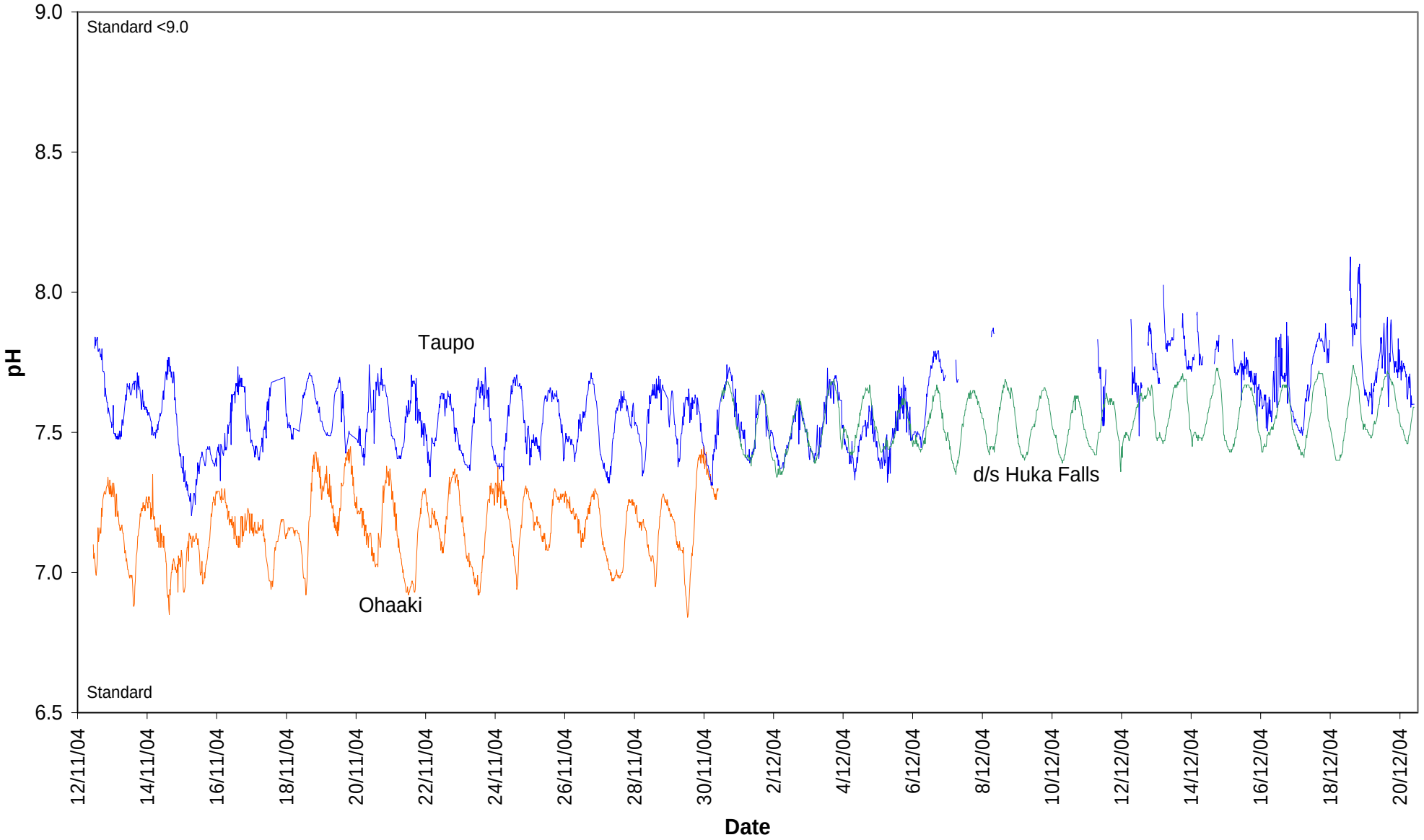
Datasonde Deployments

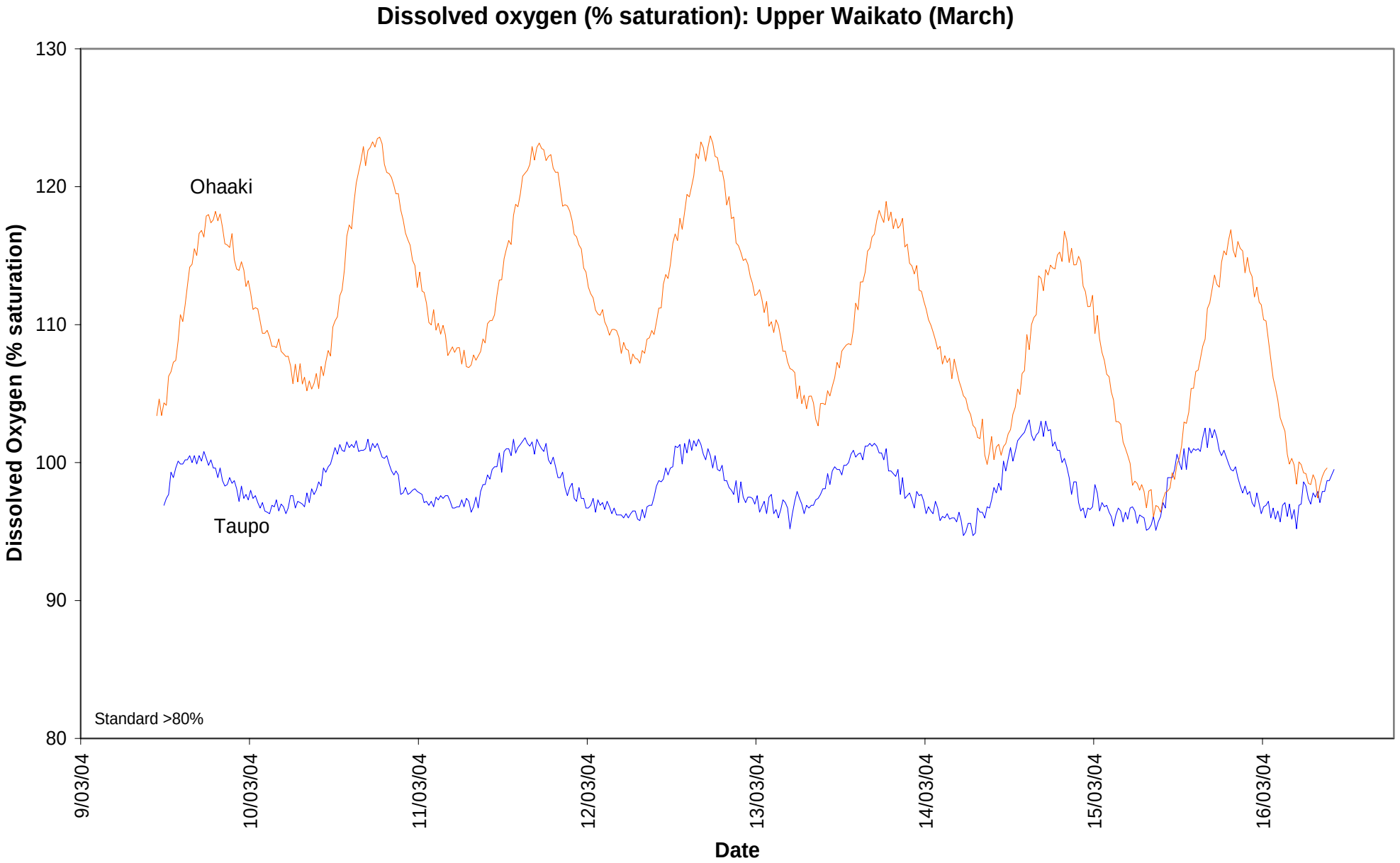
Diurnal variation of Some Water Quality Parameters


Temperature: Upper Waikato (March)
21.0
20.0
19.0
18.0
17.0
16.0
Temperature (°C)
Standard <20°C
Ohaaki
Taupo
9/03/04
10/03/04
11/03/04
12/03/04
13/03/04
14/03/04
15/03/04
16/03/04
Date

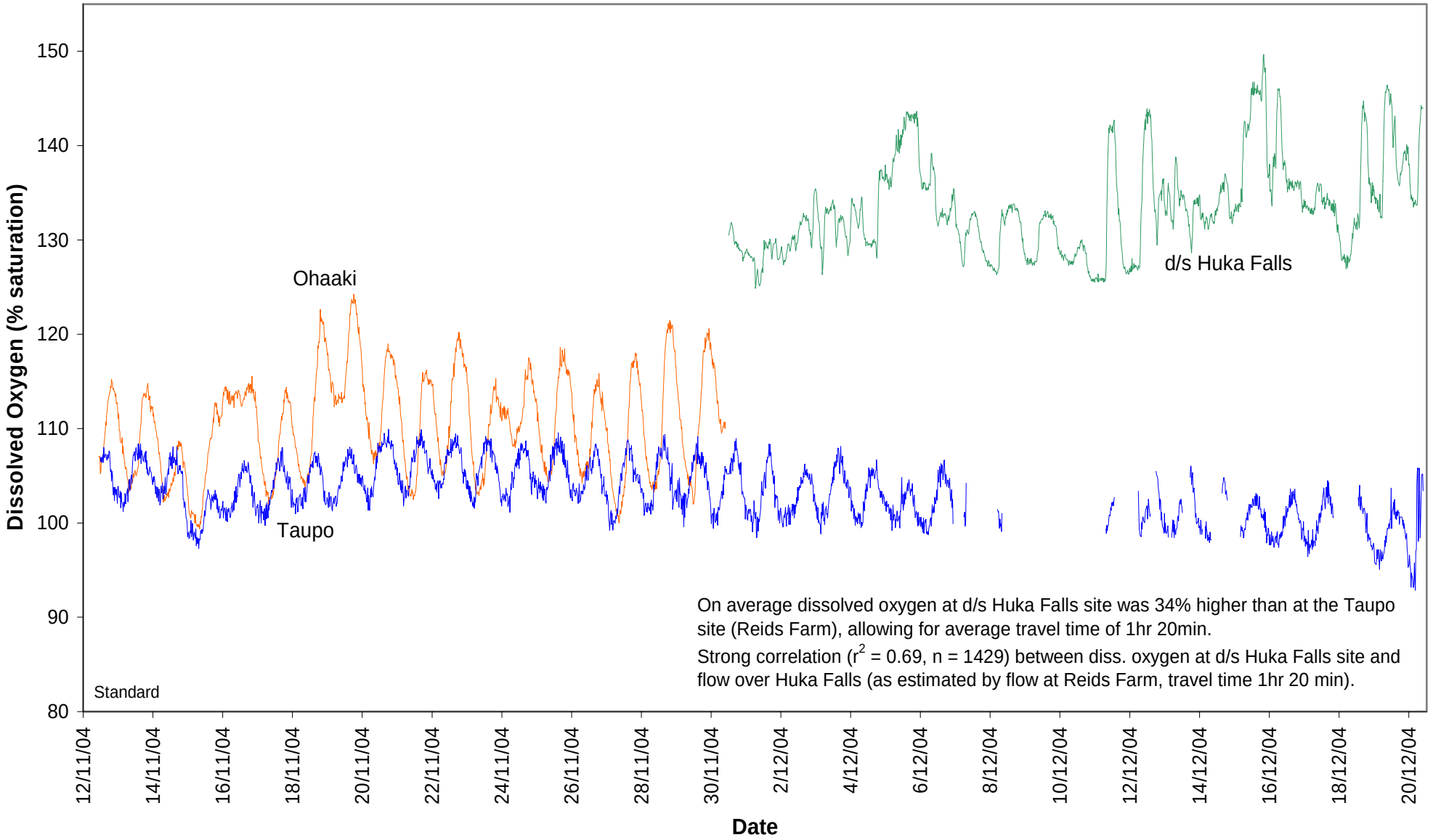

Temperature: Upper Waikato (November - December)
Standard <20°C
Ohaaki
Taupo
d/s Huka Falls
Temperature (°C)
20.0
18.0
16.0
14.0
12.0
10.0
12/11/04
14/11/04
16/11/04
18/11/04
20/11/04
22/11/04
24/11/04
26/11/04
28/11/04
30/11/04
2/12/04
4/12/04
6/12/04
8/12/04
10/12/04
12/12/04
14/12/04
16/12/04
18/12/04
20/12/04
Date

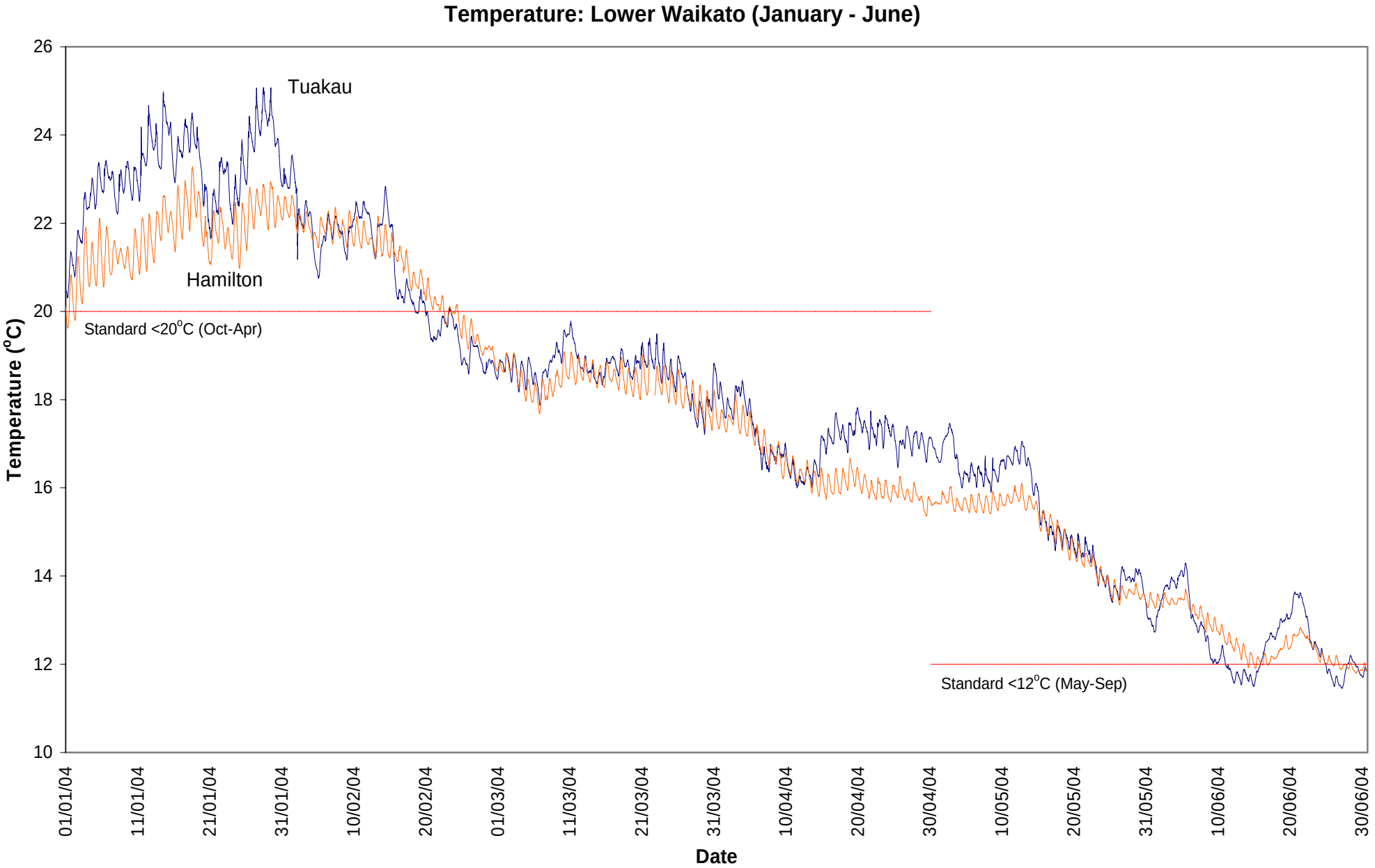

pH: Upper Waikato (March)
Standard <9.0
Standard >6.5
Taupo
Ohaaki
pH
9.0
8.5
8.0
7.5
7.0
6.5
9/03/04
10/03/04
11/03/04
12/03/04
13/03/04
14/03/04
15/03/04
16/03/04
Date

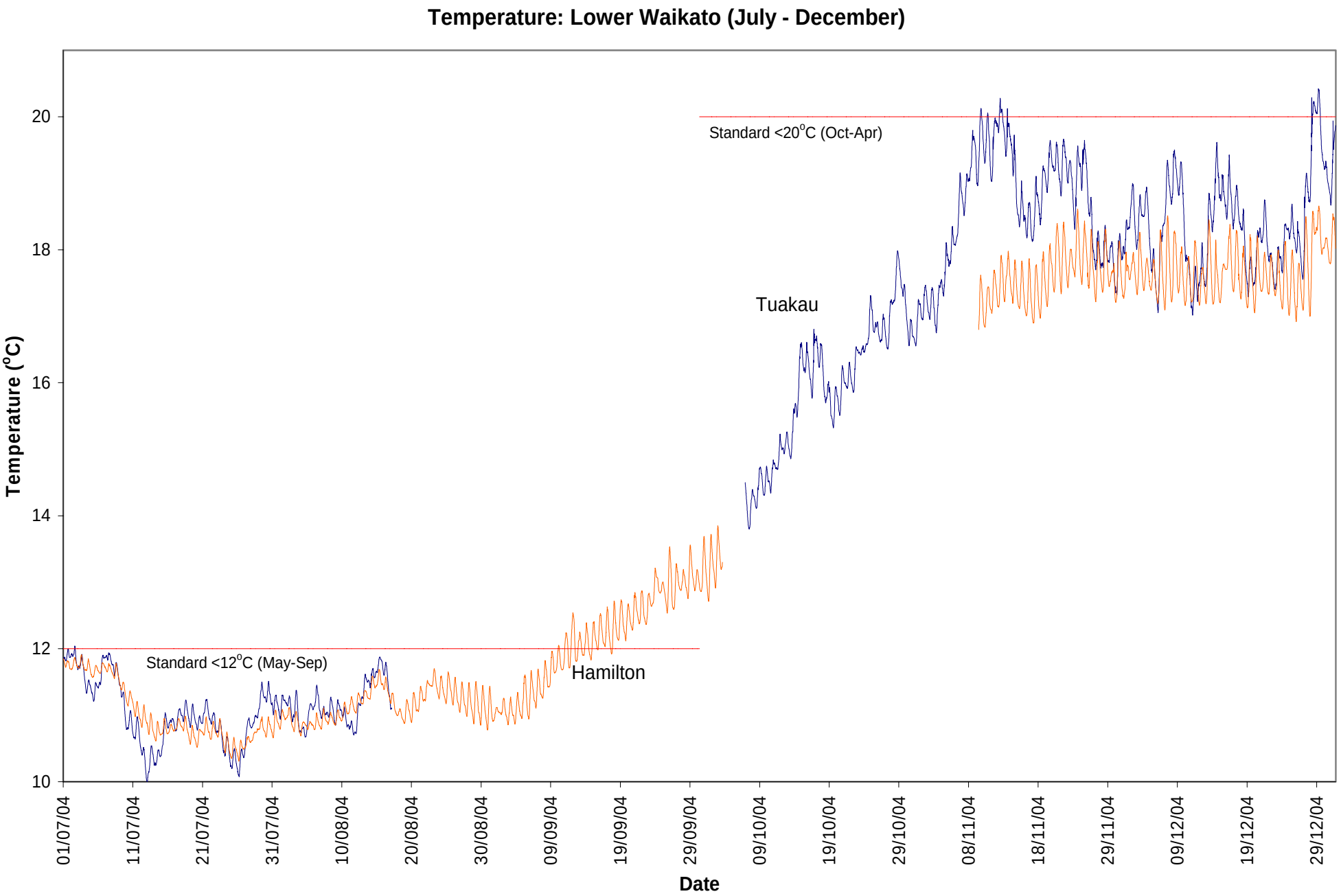

pH: Upper Waikato (November - December)
Standard <9.0
Standard
Taupo
Ohaaki
d/s Huka Falls
pH
9.0
8.5
8.0
7.5
7.0
6.5
12/11/04
14/11/04
16/11/04
18/11/04
20/11/04
22/11/04
24/11/04
26/11/04
28/11/04
30/11/04
2/12/04
4/12/04
6/12/04
8/12/04
10/12/04
12/12/04
14/12/04
16/12/04
18/12/04
20/12/04
Date

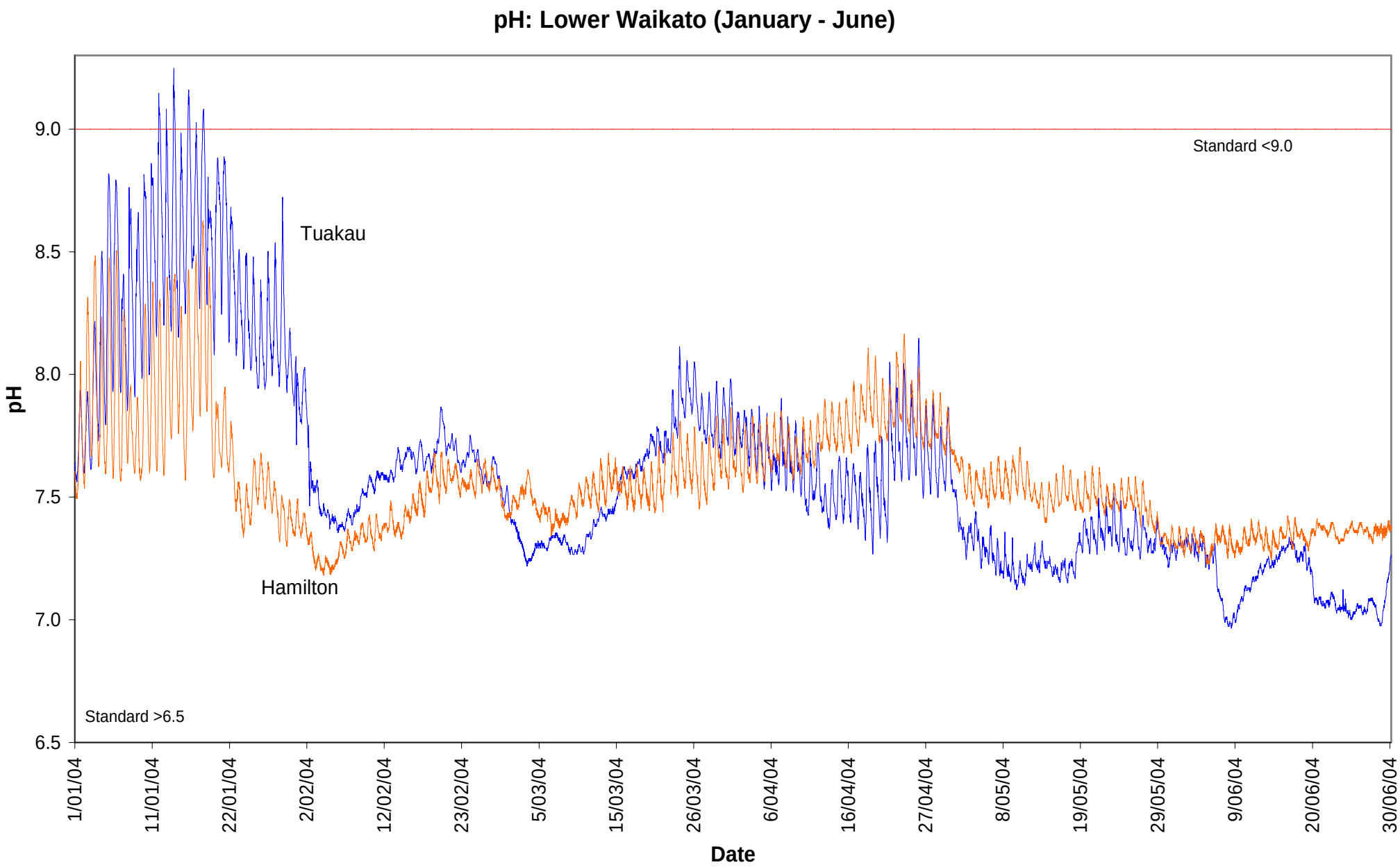

Dissolved oxygen (% saturation): Upper Waikato (March)
Dissolved Oxygen (% saturation)
130
120
110
100
90
80
Ohaaki
Taupo
Standard >80%
9/03/04
10/03/04
11/03/04
12/03/04
13/03/04
14/03/04
15/03/04
16/03/04
Date

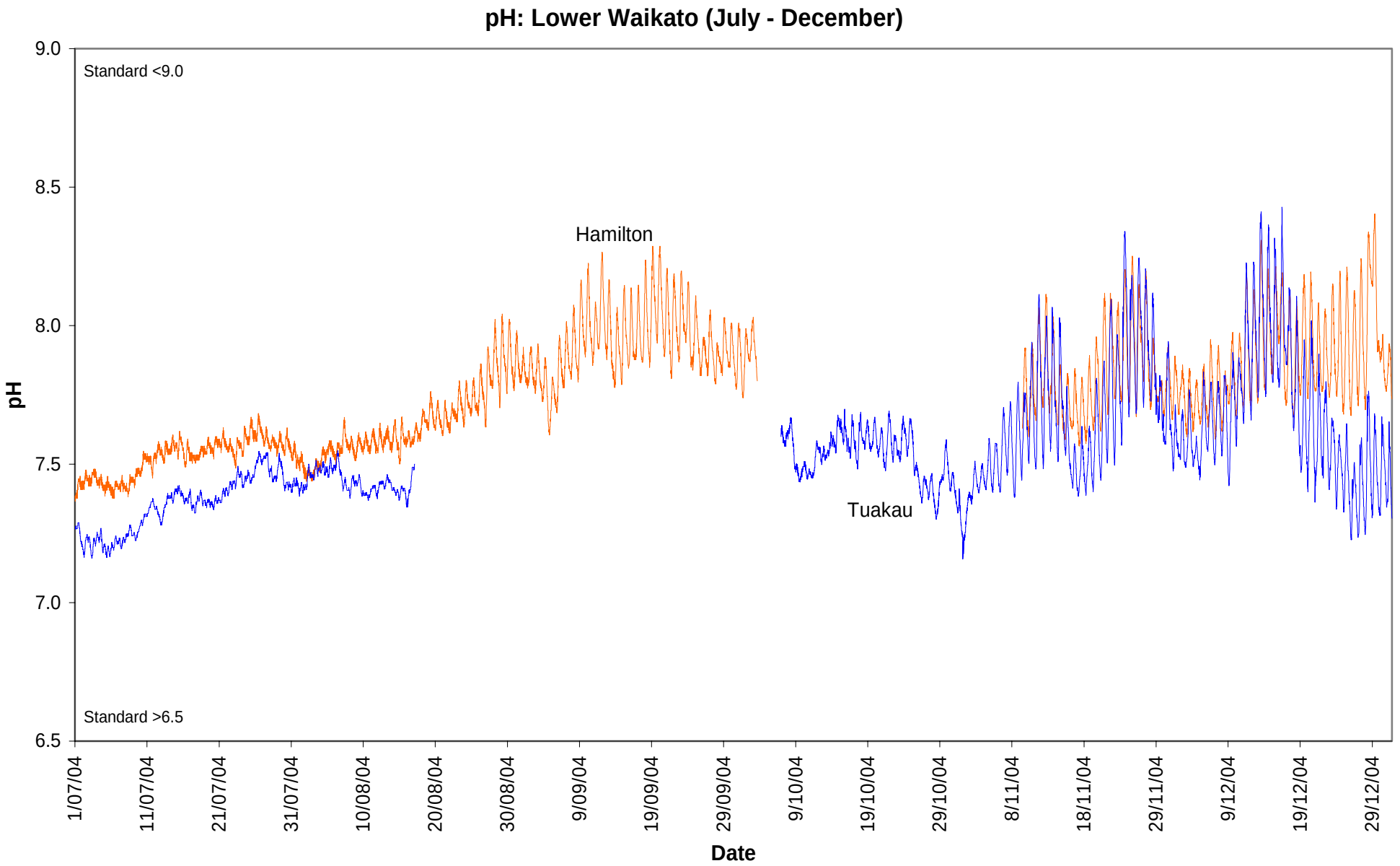
Dissolved Oxygen (% saturation): Upper Waikato (November - December)

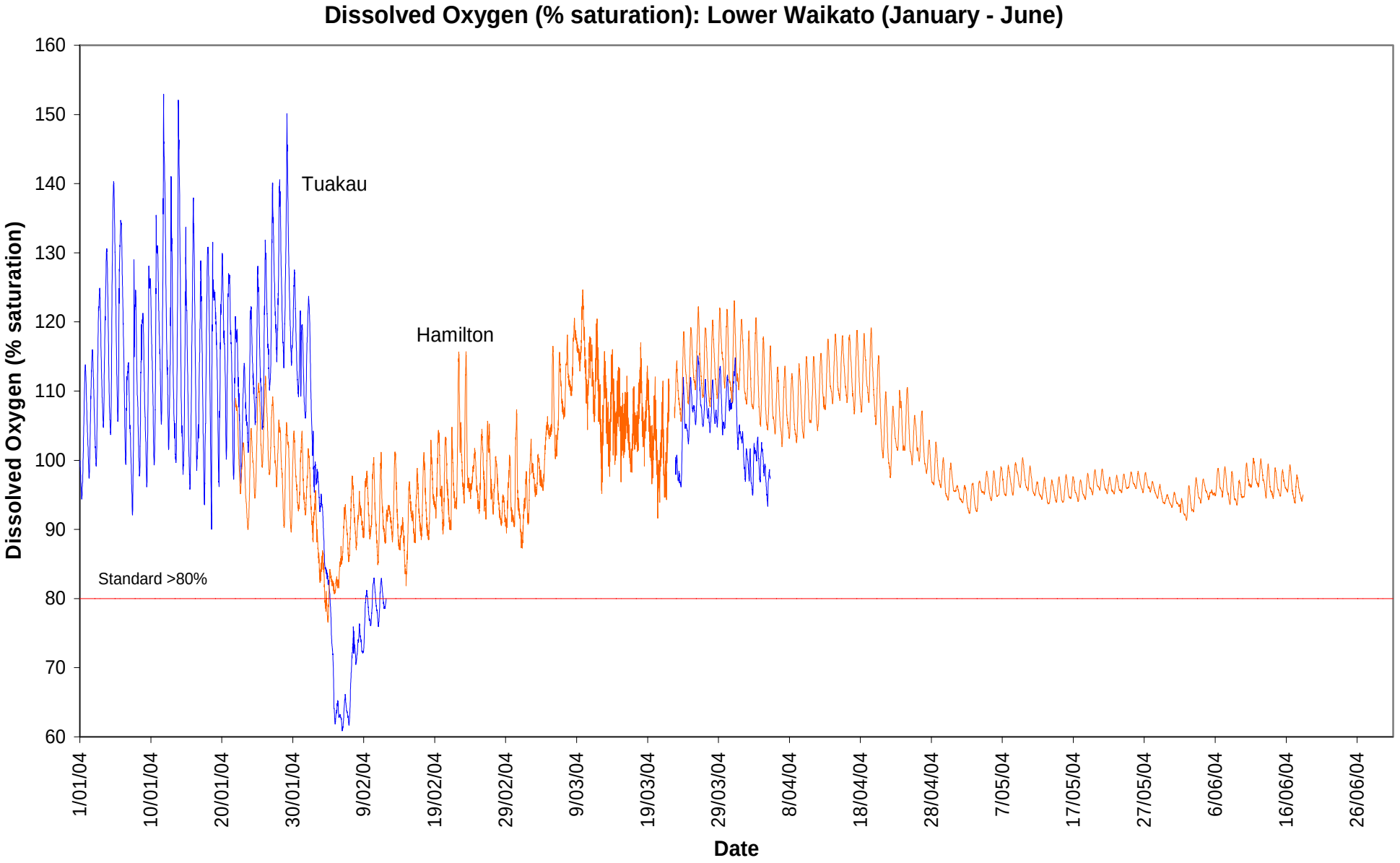


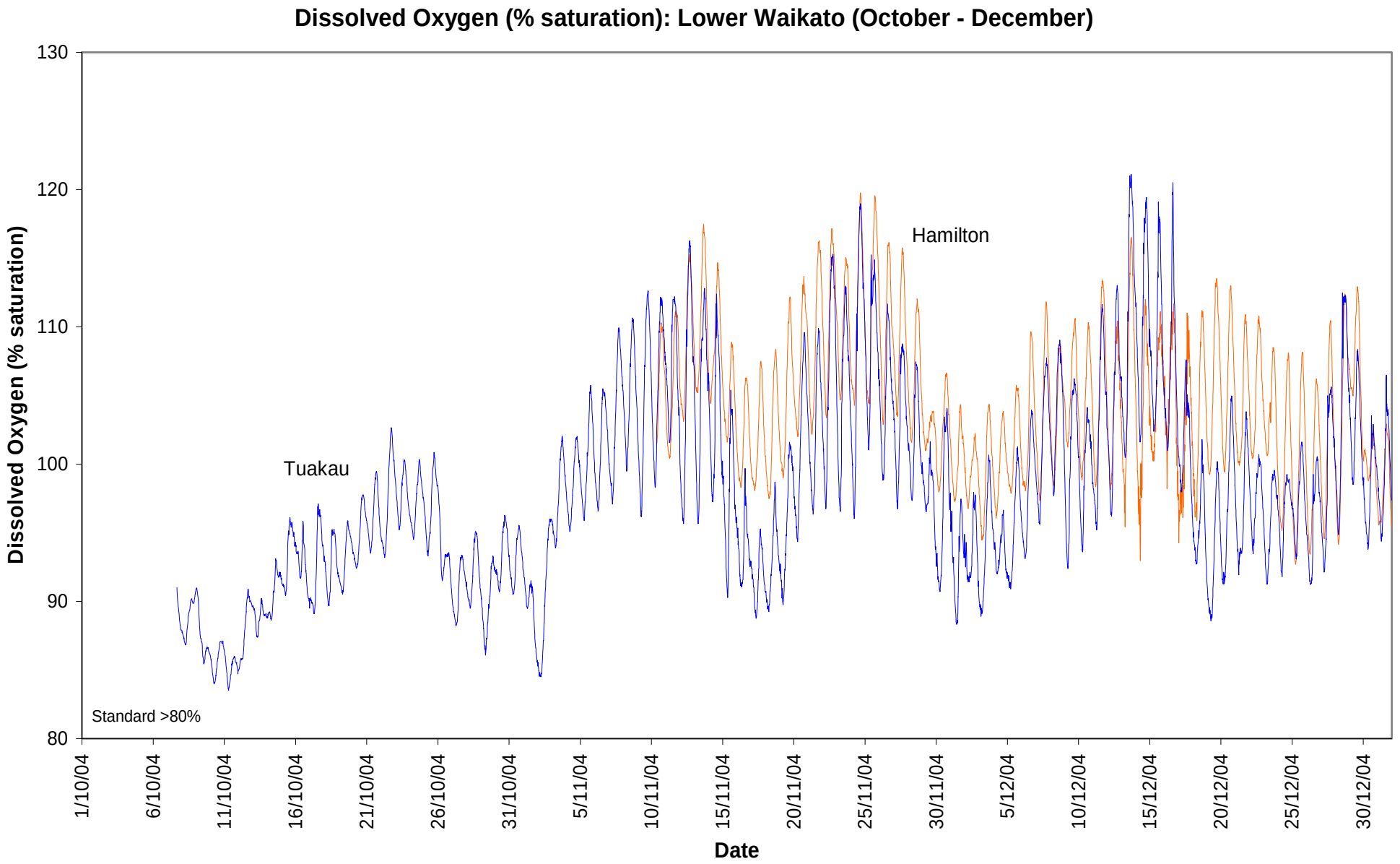

Temperature: Lower Waikato (January - June)
Tuakau
Hamilton
Standard <20°C (Oct-Apr)
Standard <12°C (May-Sep)
Temperature (°C)
26
24
22
20
18
16
14
12
10
01/01/04
11/01/04
21/01/04
31/01/04
10/02/04
20/02/04
01/03/04
11/03/04
21/03/04
31/03/04
10/04/04
20/04/04
30/04/04
10/05/04
20/05/04
31/05/04
10/06/04
20/06/04
30/06/04
Date

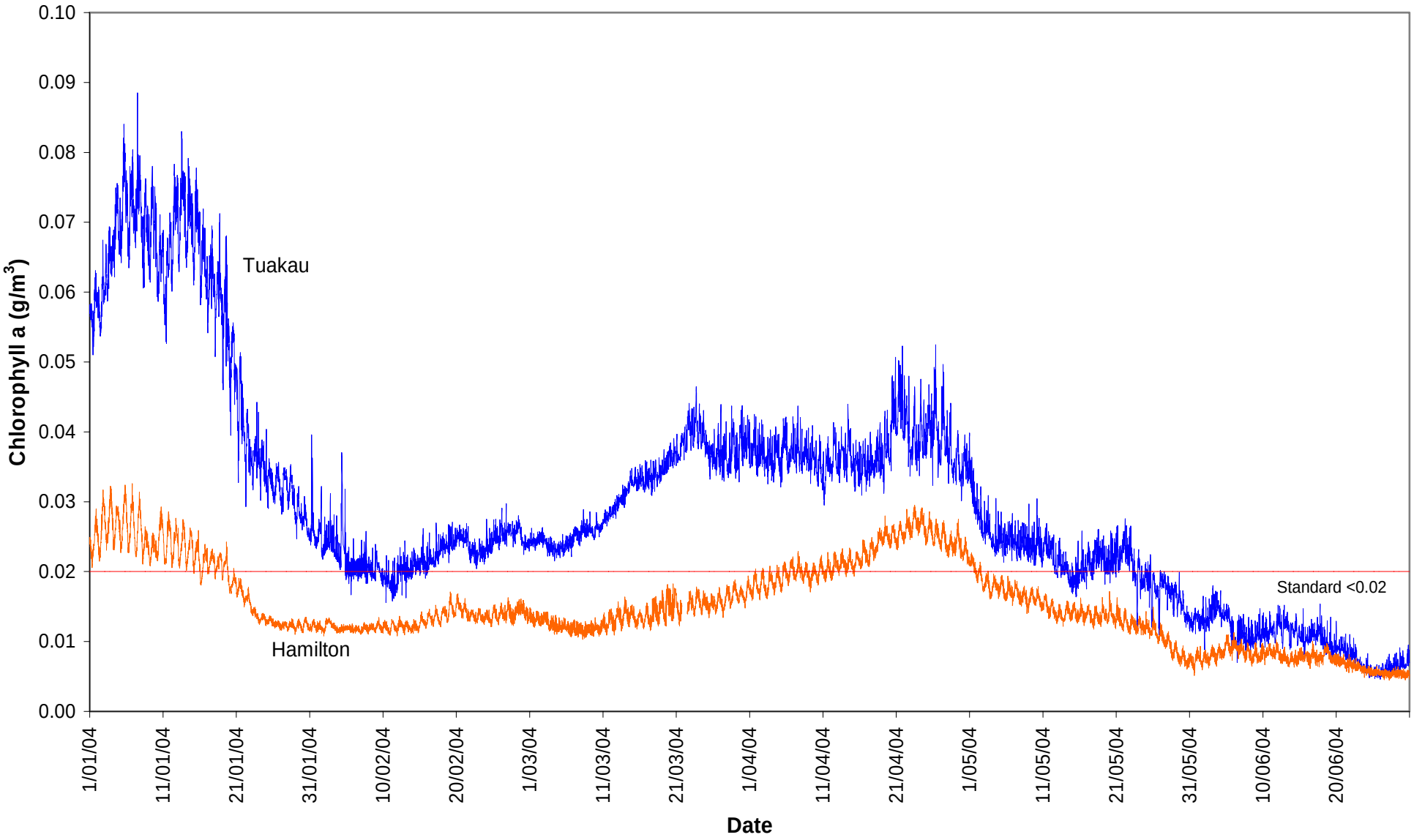

Temperature: Lower Waikato (July - December)
Temperature (°C)
20
18
16
14
12
10
Standard <20°C (Oct-Apr)
Standard <12°C (May-Sep)
Tuakau
Hamilton
01/07/04
11/07/04
21/07/04
31/07/04
10/08/04
20/08/04
30/08/04
09/09/04
19/09/04
29/09/04
09/10/04
19/10/04
29/10/04
08/11/04
18/11/04
29/11/04
09/12/04
19/12/04
29/12/04
Date

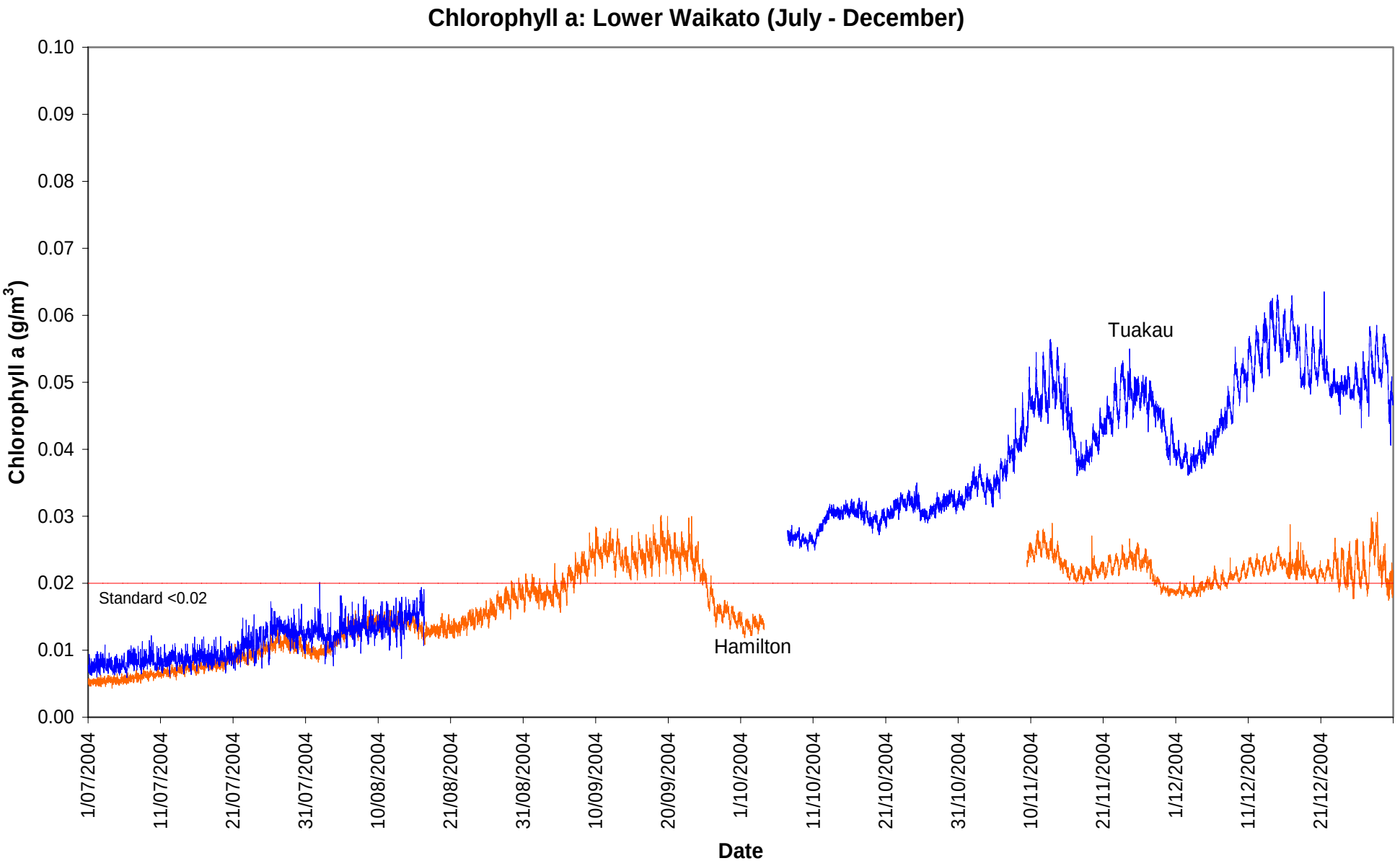

pH: Lower Waikato (January - June)
9.0
8.5
8.0
7.5
7.0
6.5
pH
Standard <9.0
Tuakau
Hamilton
Standard >6.5
1/01/04
11/01/04
22/01/04
2/02/04
12/02/04
23/02/04
5/03/04
15/03/04
26/03/04
6/04/04
16/04/04
27/04/04
8/05/04
19/05/04
29/05/04
9/06/04
20/06/04
30/06/04
Date


pH: Lower Waikato (July - December)
Standard <9.0
Standard >6.5
Hamilton
Tuakau
pH
9.0
8.5
8.0
7.5
7.0
6.5
1/07/04
11/07/04
21/07/04
31/07/04
10/08/04
20/08/04
30/08/04
9/09/04
19/09/04
29/09/04
9/10/04
19/10/04
29/10/04
8/11/04
18/11/04
29/11/04
9/12/04
19/12/04
29/12/04
Date


Dissolved Oxygen (% saturation): Lower Waikato (January - June)
Dissolved Oxygen (% saturation)
160
150
140
130
120
110
100
90
80
70
60
Tuakau
Hamilton
Standard >80%
1/01/04
10/01/04
20/01/04
30/01/04
9/02/04
19/02/04
29/02/04
9/03/04
19/03/04
29/03/04
8/04/04
18/04/04
28/04/04
7/05/04
17/05/04
27/05/04
6/06/04
16/06/04
26/06/04
Date


Dissolved Oxygen (% saturation): Lower Waikato (October - December)
Dissolved Oxygen (% saturation)
130
120
110
100
90
80
Tuakau
Hamilton
Standard >80%
1/10/04
6/10/04
11/10/04
16/10/04
21/10/04
26/10/04
31/10/04
5/11/04
10/11/04
15/11/04
20/11/04
25/11/04
30/11/04
5/12/04
10/12/04
15/12/04
20/12/04
25/12/04
30/12/04
Date


Chlorophyll a: Lower Waikato (January - June)
Chlorophyll a (g/m3)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Tuakau
Hamilton
Standard <0.02
1/01/04
11/01/04
21/01/04
31/01/04
10/02/04
20/02/04
1/03/04
11/03/04
21/03/04
1/04/04
11/04/04
21/04/04
1/05/04
11/05/04
21/05/04
31/05/04
10/06/04
20/06/04
Date


Chlorophyll a: Lower Waikato (July - December)
Chlorophyll a (g/m3)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Standard <0.02
Tuakau
Hamilton
1/07/2004
11/07/2004
21/07/2004
31/07/2004
10/08/2004
21/08/2004
31/08/2004
10/09/2004
20/09/2004
1/10/2004
11/10/2004
21/10/2004
31/10/2004
10/11/2004
21/11/2004
1/12/2004
11/12/2004
21/12/2004
Date

Appendix III

Inventory of other investigations carried out on the Waikato River since the last Report

The Effect on Waikato River Water Quality of Changes to River Flow and Catchment Land Use, including the December Addendum

Report: Technical Report 2005/03
Author: Kit Rutherford (National Institute of Water & Atmospheric Research Ltd)
http://www.ew.govt.nz/publications/technicalreports/documents/tr05-03.pdf

Abstract
Environment Waikato has requested NIWA to predict the likely effects on Waikato River water quality of:

1. reductions in the flow of the river at times of low flow; and

2. changes in nutrient loads to the river from dairy conversions;

by making use of an existing Waikato River water quality model (Rutherford et al. 2001). Results are provided in this report. Appendix 1 contains the contract details.

Originally 10 scenarios were detailed for modelling but subsequently an 11th scenario was requested (Appendix 2). Email correspondence to clarify assumptions made in these scenarios is attached (Appendix 2).

Subsequent to the presentation and acceptance of this report, EW requested that we run the model for 5 additional scenarios (cases 12-16). These are presented as an addendum in section 4.

Appendix IV

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 - indicator of organic pollution - indicator of photosynthesis (plant growth)	DO (conc.) DO (%sat.)	routine (field) routine (field)
Temperature	- indicator of biological activity - requirement for aquatic life - mixing processes - modelling studies (e.g. nutrient uptake)	Temperature	routine (field)
Conductivity	- indicator of total salts dissolved in water - indicator for geothermal input	Conductivity TDS	routine routine
pH	- aquatic life protection - indicator of industrial discharges, mining	pH	routine
Clarity **- turbidity** **- black disk** (visual clarity)	- aesthetic appearance - light availability for excessive plant growth - aquatic life protection - indicator of catchment condition, land use	Turbidity Black disk	routine routine (field)
Colour **- light absorption**	- aesthetic appearance - light availability for excessive plant growth - indicator of presence of organic matter	Munsell colour Absorbance at: 340,440,780nm	routine (field) routine
Nutrients (N and P) **Chlorophyll *a***	- enrichment, excessive plant growth - nutrient limitation for plant/algal growth	NO_3-N+NO_2-N NH_4-N,TKN DRP, TP, Chl *a*	routine
Geothermal Contaminants	- indicators of geothermal inflows - aquatic life protection (ecotoxicity) - drinking water (human health aspects)	Cl, Li, B, As	routine
Organic Carbon	- indicator of organic pollution - catchment characteristics	BOD_5 TOC/DOC	routine routine
Faecal Bacteria **- E. coli** **- enterococci** **- faecal coliforms**	- indicator of pollution with faecal matter - disease risk for swimming etc.	E. Coli ENT FC	routine routine routine

[1] see the page 50 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)	Environment Waikato 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 & 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 3125B
B	Boron	ICP-MS, APHA method 3125B
BDISK	Black Disk	Field measurement, horizontal water transparency (20mm, 60mm, 100mm, 200mm disk) in river or trough (20mm only)
BOD_5	Biochemical Oxygen Demand (5 day)	Incubation 5 days at 20°C , DO-meter, No nitrification inhibitor added, unseeded, APHA method 5210B
CHLA	Chlorophyll a	Acetone extraction. Spectroscopy. APHA method 10200H
Cl	Chloride	Filtered sample. Ion Chromatography APHA method 4110B
COLOUR	Colour	Field measurement, Munsell Colour Patches
COND	Conductivity	Lab Meter @ 25^{o}C. APHA method 2510B
DO	Dissolved Oxygen	Field measurement (WTW DO meter, model 340A)
DO (% Sat)	Dissolved Oxygen (percent saturation)	Field measurement (WTW DO meter, model 340A)
DOC	Dissolved Organic Carbon	Filtration, acidification, purging to remove inorganic C, catalytic oxidation, IR detection. APHA method 5310B (modified)
DRP	Dissolved Reactive Phosphorus	Molybdenum Blue Colorimetry. Flow injection analyser. APHA 4500 PG (proposed)
E. coli	Escherichia coli	Membrane Filtration (mFC Agar) confirmation by NA-MUG Agar. APHA method 9222G
ENT	Enterococci bacteria	Membrane Filtration (mE Agar) confirmation by EIA Agar. APHA method 9230C
FC	Faecal Coliforms	Membrane Filtration with resuscitation(mFC Agar). APHA method 9222D
Flow	Flow – Instantaneous	Calculated from rating curve ± 8%
Li	Lithium	ICP-MS, method APHA 3125B
NH_4-N	Ammoniacal Nitrogen (Total)	Phenol/Hypochlorite Colorimetry. Flow injection analyser. APHA method 4500-NH_3H
NNN	Nitrite/Nitrate Nitrogen	Automated Cadmium reduction. Flow injection analyser. APHA method 4500 – NO_3I (proposed).
NO_3-N	Nitrate Nitrogen	Calculation: (Nitrate-N + Nitrite –N) – Nitrite - N
pH	pH	Lab Meter @ 25^{o}C. APHA method 4500-H^{+}B
TDS	Total Dissolved Solids	Filtration, gravimetric. APHA 2540C (modified)
TEMP	Temperature	Field measurement (WTW DO meter, model 340A)
TKN	Total Kjeldahl-Nitrogen	Acid digestion. Phenol/Hypochlorite colorimetry. Flow injection analyser . APHA method 4500-N_{org}D (modified)
TOC	Total Organic Carbon	Acidification, purging to remove inorganic C, catalytic oxidation, IR detection. APHA method 5310B (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-PE (modified)
TURB	Turbidity	Turbidity Meter Hach 2100N. APHA method 2130B

[1] Water quality parameter identification code refers to Environment Waikato's water quality database (TimeStudio) parameter short name.

APHA = Standards Methods for the Examination of Water and Wastewater, 20th Edition, 1998, APHA, AWWA, WEF

ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy