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Waikato River water quality monitoring programme: Data report 2019

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Hydrological flow data were provided by Mercury Energy (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 two sites.

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1 Introduction

1.1 Background

This report covers the calendar year of 2019 and follows the format of the previous data report (Tulagi, 2018).

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 29th 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 and filling out the request for service form at: www.waikatoregion.govt.nz/request.

1.2 Report content

The report provides information on:

1. Routine monthly monitoring of water quality at 12 sites:
   - Year 2019 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 2019 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 2019.

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 median flow at some locations for the previous 10 years.
   - Continuous monitoring data via Datasonde (*Appendix II*).
     - Plots of the Hamilton and Tuakau deployments undertaken during 2019 showing the level of diurnal and seasonal variation of selected parameters.
   - Water quality criteria (*Appendix III*)
     - Identifying the water quality parameters, guidelines, standards, and analytical methods used in the Waikato River water quality monitoring programme.

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 2019. The standards mainly relate to either the protection of 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 2019 whose results do not comply with the "satisfactory" criteria (Table 1) are underlined in raw data summaries.

Adoption of updated water guidelines within council is currently under review. Including the National Policy Statement for Freshwater Management 2017 (NPSFM) and updated ANZECC (2018) guidelines.

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

Water quality measure	Relevance[1]	Satisfactory	Excellent
Ecological health			
Dissolved Oxygen (% sat.)	aquatic life (breathing)	>80	>90
pH	aquatic life (acidity)	6.5-9	7-8
Turbidity (NTU)	plant life (clarity)	<5	<2
Ammoniacal Nitrogen (g/m³)	aquatic life (toxicity)	<0.88	<0.1
Water Temperature (°C)(May-Sep)	fish (spawning)	<12	<10
(Oct-Apr)	fish health	<20	<16
Total Phosphorus (g/m³)	nuisance plant growth	<0.04	<0.01
Total Nitrogen (g/m³)	nuisance plant growth	<0.5	<0.1
Human uses - recreation			
Black Disk (m)	visibility	>1.6	>4
Escherichia coli (/100ml)	human health	<550	<55
Median *Escherichia coli* (/100ml)	human health	<126	<23
Human uses - water supply			
Chlorophyll *a* (g/m³)	filter blockage	<0.02	<0.005
Human uses - drinking water			
Arsenic (g/m³)	human health (toxicity)	<0.01	-
Boron (g/m³)	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/guidelines

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 Karapiro (at the Karapiro tailrace) 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 illustrated in *Figure 1* and summarised in *Table 2.*

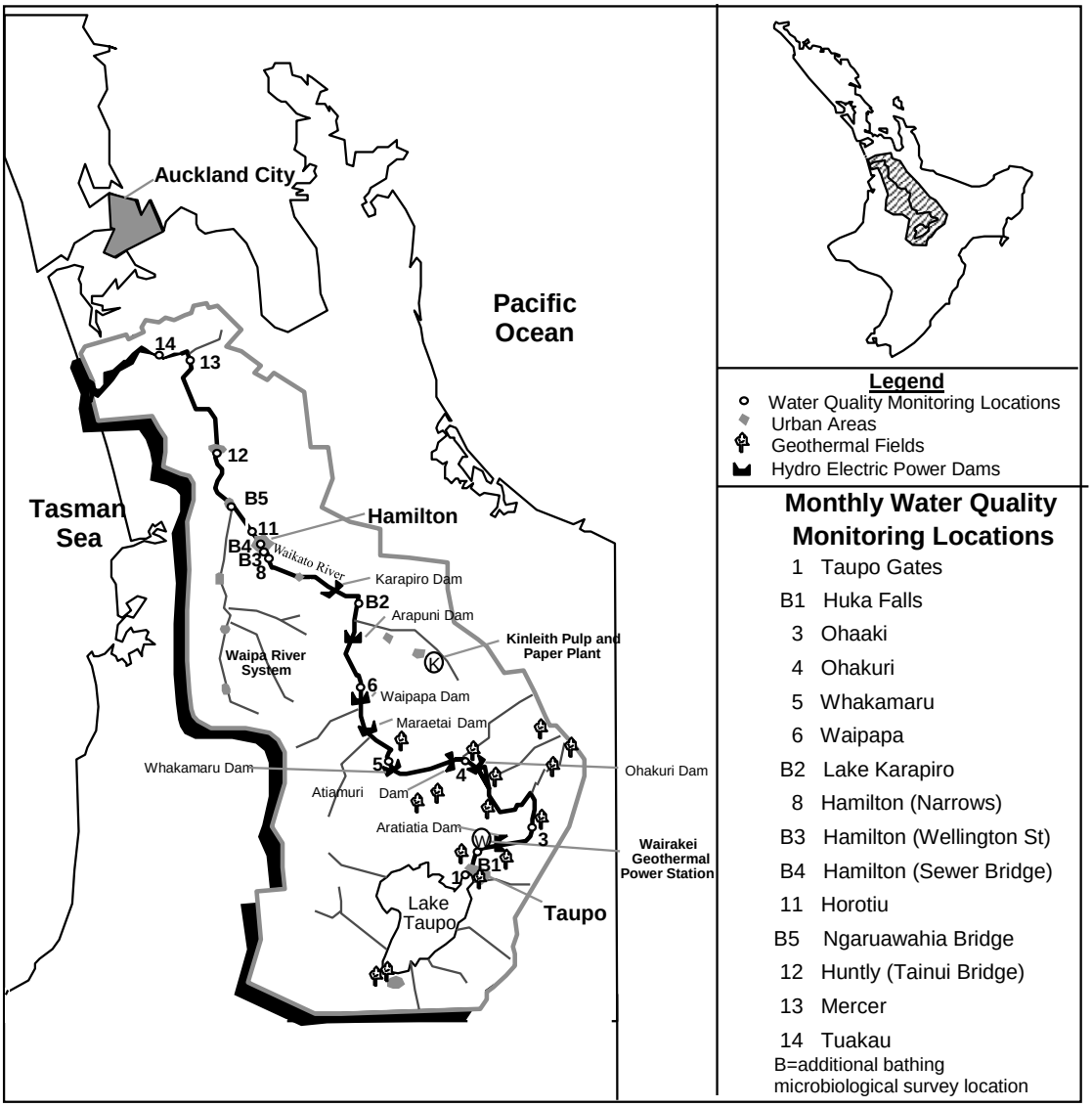


Figure 1: Waikato River water quality monitoring locations

Twelve locations along the river are visited monthly (Taupo, Ohaaki, Ohakuri, Whakamaru, Waipapa, Karapiro, Hamilton-Narrows, Hamilton-Horotiu, Huntly, Rangiriri, 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).

Table 2: Routine sampling and bathing water monitoring sites

Location number	Distance[1] (km)	Location name	Location coordinate (NZTM)
1131-127	0.1	Taupo Gates	1867049, 5714142
1131-649*[d]	2	Taupo Bungy at jetty, true right bank	1868453, 5714281
1131-219[d]	8.4	Downstream Huka Falls at river boat jetty[2]	1870167, 5719750
1131-105[d]	36.5	Ohaaki Bridge at bridge, true right bank	1887985, 5729892
1131-107	75.8	Ohakuri Tailrace Bridge [3]	1869480, 5744515
1131-147	105	Whakamaru Tailrace at boat ramp[4]	1845004, 5743996
1131-143	126.1	Waipapa Tailrace at boat ramp[5]	1834859, 5759095
1131-81[b]	166.7	Lake Karapiro Boat Ramp at Horahora domain	1833397, 5795413
1131-79	179.3	Karapiro Tailrace, true right bank	1823187, 5799700
1131-328	202.2	Hamilton – Narrows at boat ramp[6]	1806588, 5809381
1131-145*[b]	210.8	Hamilton – Wellington St Bch at jetty, true right bank	1801658, 5814272
1131-64[d]	211.5	Hamilton – Traffic Bridge true right bank	1801620, 5814821
1131-69	225.6	Horotiu Bridge d⁄s of bridge	1794554, 5825430
1131-102[b]	232.3	Ngaruawahia Bridge u⁄s of confluence[7]	1789439, 5829455
1131-77	246.5	Huntly – Tainui Bridge true left bank	1790260, 5840128
1131-117*[d]	262.3	Rangiriri Bridge true right bank	1788389, 5855059
1131-91	286.3	Mercer Bridge	1781445, 5871961
1131-133	296.8	Tuakau Bridge at boat ramp[8]	1772410, 5870516
1131-131[d]	306.5	Tuakau – Elbows Landing at NZ Steel Ltd pumping station	1764150, 5873515

[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 2018⁄19 summer.
[*] locations at Taupo (Taupo Bungy, 2 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: Mike Crump, NIWA, Hamilton.
[+] 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 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 database called WISKI.

Data analysis was performed using WQStats program. 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 Technical Report 2018/30, Trends in River Water Quality in the Waikato Region, 1993–2017 (Vant, 2018) 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:
Trends in river water quality in the Waikato region, 1993-2017 | Waikato Regional Council

The data contained in these Waikato River reports is updated to the Waikato Regional Council "Waikato River" Internet page:
Water quality monitoring - all rivers and streams | Waikato Regional Council

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.

This data is also supplied to the LAWA website:
https://www.lawa.org.nz/explore-data/waikato-region

3 Results

3.1 Waikato River monitoring programme

3.1.1 Routine water quality monitoring

- Summary statistics
- Key parameter graphs
- Comparison with water quality standards
- Raw data

Summary statistics

Table 3: Sample statistics for 2019

Absorbance (340nm) (/cm)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.002	0.001	0.001	0.004	0.001	1.95	0.001
Ohaaki Br	12	0.005	0.005	0.002	0.007	0.003	-0.08	0.003
Ohakuri Tailrace Br	12	0.007	0.007	0.005	0.009	0.003	0.50	0.006
Whakamaru Tailrace	12	0.007	0.008	0.005	0.011	0.002	0.72	0.007
Waipapa Tailrace	12	0.010	0.010	0.006	0.013	0.002	0.04	0.010
Karapiro Tailrace	12	0.010	0.010	0.006	0.014	0.003	0.05	0.010
Narrows Boat Ramp	12	0.011	0.011	0.005	0.016	0.004	-0.14	0.013
Horotiu Br	12	0.012	0.013	0.009	0.016	0.004	0.06	0.013
Huntly-Tainui Br	12	0.017	0.018	0.007	0.030	0.006	0.35	0.020
Rangiriri Br	12	0.019	0.018	0.006	0.030	0.010	-0.13	0.019
Mercer Bridge	12	0.020	0.019	0.010	0.036	0.013	0.68	0.023
Tuakau Br	12	0.021	0.021	0.008	0.036	0.016	0.29	0.027

Absorbance (440nm) (/cm)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.001	0.001	0.001	0.001	0.000	0.00	0.001
Ohaaki Br	12	0.001	0.001	0.001	0.001	0.000	0.00	0.001
Ohakuri Tailrace Br	12	0.001	0.001	0.001	0.002	0.001	1.33	0.001
Whakamaru Tailrace	12	0.001	0.001	0.001	0.002	0.001	1.33	0.001
Waipapa Tailrace	12	0.002	0.002	0.001	0.003	0.002	0.35	0.002
Karapiro Tailrace	12	0.002	0.002	0.001	0.004	0.002	0.21	0.002
Narrows Boat Ramp	12	0.002	0.002	0.001	0.004	0.002	0.76	0.002
Horotiu Br	12	0.002	0.003	0.001	0.003	0.001	-0.72	0.003
Huntly-Tainui Br	12	0.003	0.004	0.001	0.006	0.001	-0.42	0.004
Rangiriri Br	12	0.004	0.004	0.001	0.006	0.002	-0.46	0.004
Mercer Bridge	12	0.004	0.004	0.002	0.007	0.002	0.81	0.005
Tuakau Br	12	0.004	0.004	0.001	0.007	0.003	0.25	0.005

Arsenic (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.012	0.012	0.011	0.012	0.000	-0.08	0.012
Ohaaki Br	12	0.021	0.022	0.016	0.025	0.005	-0.45	0.021
Ohakuri Tailrace Br	12	0.028	0.027	0.021	0.037	0.011	0.23	0.027
Whakamaru Tailrace	12	0.027	0.026	0.022	0.035	0.008	0.52	0.027
Waipapa Tailrace	12	0.023	0.022	0.017	0.032	0.006	0.80	0.023
Karapiro Tailrace	12	0.021	0.023	0.015	0.029	0.007	0.07	0.021
Narrows Boat Ramp	12	0.021	0.023	0.014	0.027	0.008	-0.26	0.021
Horotiu Br	12	0.021	0.023	0.014	0.027	0.008	-0.22	0.020
Huntly-Tainui Br	12	0.016	0.018	0.007	0.025	0.009	-0.30	0.016
Rangiriri Br	12	0.017	0.018	0.011	0.024	0.008	-0.09	0.017
Mercer Bridge	12	0.016	0.016	0.009	0.023	0.007	0.01	0.015
Tuakau Br	12	0.016	0.017	0.009	0.023	0.008	-0.07	0.014

Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

Black Disk (m)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	0	-	-	-	-	-	-	-
Ohaaki Br	12	4.3	4.3	3.2	6.1	1.5	0.54	5.0
Ohakuri Tailrace Br	11	2.5	2.5	1.4	4.1	2.0	0.15	2.6
Whakamaru Tailrace	12	2.4	2.3	1.3	4.0	1.6	0.35	2.5
Waipapa Tailrace	12	2.1	2.1	1.3	2.8	0.7	-0.13	2.2
Karapiro Tailrace	12	2.1	2.0	1.7	2.7	0.5	0.54	1.9
Narrows Boat Ramp	12	2.0	2.1	1.3	2.4	0.5	-0.78	1.9
Horotiu Br	12	1.6	1.6	1.0	2.1	0.3	-0.31	1.5
Huntly-Tainui Br	12	1.1	1.0	0.6	1.5	0.4	0.15	0.9
Rangiriri Br	12	0.9	0.9	0.6	1.2	0.2	-0.01	0.9
Mercer Bridge	12	0.8	0.7	0.5	1.2	0.2	1.24	0.6
Tuakau Br	12	0.8	0.8	0.5	1.3	0.3	0.72	0.7

Conductivity at 25 DegC (mS/m)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	11.9	12.0	11.5	12.2	0.4	-0.68	12.0
Ohaaki Br	12	14.8	15.0	13.2	17.4	1.8	0.58	14.4
Ohakuri Tailrace Br	12	16.2	16.0	14.4	18.7	2.3	0.41	16.1
Whakamaru Tailrace	12	16.2	16.3	15.0	17.3	1.8	-0.14	15.9
Waipapa Tailrace	12	16.1	16.0	14.7	17.7	1.8	0.22	15.5
Karapiro Tailrace	12	15.4	15.4	14.0	16.9	1.8	0.06	15.0
Narrows Boat Ramp	12	15.5	15.4	14.3	17.0	1.9	0.23	15.1
Horotiu Br	12	15.8	15.8	14.6	17.3	1.8	0.21	15.3
Huntly-Tainui Br	12	15.2	15.2	12.8	16.9	1.9	-0.38	14.5
Rangiriri Br	12	15.7	15.6	14.3	16.9	1.7	0.01	15.0
Mercer Bridge	12	15.6	15.5	14.2	16.9	1.9	0.07	14.9
Tuakau Br	12	15.7	15.8	14.4	16.9	1.7	-0.12	15.2

Dissolved Oxygen (g/m^3)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	9.7	9.8	8.6	11.3	0.9	0.61	9.9
Ohaaki Br	12	9.9	9.6	8.4	11.9	2.3	0.30	10.1
Ohakuri Tailrace Br	12	9.6	9.6	7.8	11.0	2.0	-0.17	9.8
Whakamaru Tailrace	12	9.7	9.5	8.0	11.0	1.7	-0.15	9.9
Waipapa Tailrace	12	9.8	9.4	8.1	11.3	1.6	0.18	10.1
Karapiro Tailrace	12	9.6	9.5	7.0	11.4	1.9	-0.43	10.0
Narrows Boat Ramp	12	9.3	9.4	7.3	11.1	2.6	-0.16	9.7
Horotiu Br	12	9.4	9.5	7.6	10.9	2.6	-0.09	9.6
Huntly-Tainui Br	12	9.3	9.5	8.1	10.5	1.5	-0.02	9.4
Rangiriri Br	12	9.3	9.5	7.9	10.4	2.0	-0.13	9.5
Mercer Bridge	12	9.4	9.4	8.5	10.3	1.1	0.08	9.2
Tuakau Br	12	9.7	9.6	9.0	10.4	0.8	0.25	9.4

Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

Dissolved Oxygen (% sat.)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	100	101	96	105	6	0.05	102
Ohaaki Br	12	103	102	97	110	9	0.13	104
Ohakuri Tailrace Br	12	100	100	87	113	10	0.03	101
Whakamaru Tailrace	12	101	100	90	114	11	0.28	103
Waipapa Tailrace	12	100	100	90	108	12	-0.11	101
Karapiro Tailrace	12	97	98	81	110	9	-0.52	99
Narrows Boat Ramp	12	94	94	84	108	11	0.18	97
Horotiu Br	12	95	94	86	104	10	0.24	96
Huntly-Tainui Br	12	95	95	89	99	3	-0.83	95
Rangiriri Br	12	95	95	88	101	4	0.00	95
Mercer Bridge	12	97	97	92	106	4	0.78	94
Tuakau Br	12	101	98	92	125	8	1.81	96

Enterococci (/100ml)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	5	5	1	18	3	1.77	3
Ohaaki Br	11	32	10	1	170	36	2.45	10
Ohakuri Tailrace Br	11	4	5	1	10	4	0.71	3
Whakamaru Tailrace	12	100	8	1	1100	12	3.46	8
Waipapa Tailrace	12	11	5	1	60	7	2.90	5
Karapiro Tailrace	12	10	5	2	40	4	2.55	7
Narrows Boat Ramp	12	36	30	5	80	32	0.67	47
Horotiu Br	12	90	65	5	340	111	1.64	59
Huntly-Tainui Br	12	81	80	5	230	92	1.01	60
Rangiriri Br	12	68	45	5	160	103	0.84	55
Mercer Bridge	12	55	30	5	210	48	1.78	34
Tuakau Br	12	50	29	5	160	75	1.14	29

Escherichia coli (/100ml)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	7	5	1	20	5	1.55	5
Ohaaki Br	12	40	28	5	130	39	1.43	16
Ohakuri Tailrace Br	12	7	5	1	40	3	3.12	4
Whakamaru Tailrace	12	18	8	3	80	18	2.44	10
Waipapa Tailrace	12	12	6	2	30	15	0.86	8
Karapiro Tailrace	12	11	8	3	30	10	1.40	8
Narrows Boat Ramp	12	38	35	5	110	40	1.28	50
Horotiu Br	12	202	100	5	1200	115	3.05	110
Huntly-Tainui Br	12	258	125	30	1600	170	3.21	150
Rangiriri Br	12	184	120	50	480	145	1.34	150
Mercer Bridge	12	195	115	30	700	175	1.65	105
Tuakau Br	12	308	120	30	1300	290	1.82	110

Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

Faecal Coliforms (/100ml)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	8	5	1	20	7	1.06	5
Ohaaki Br	12	51	45	5	160	53	1.25	20
Ohakuri Tailrace Br	12	7	5	1	40	2	3.14	5
Whakamaru Tailrace	12	23	10	4	130	19	3.05	12
Waipapa Tailrace	12	13	6	2	40	15	1.19	10
Karapiro Tailrace	12	12	8	4	30	10	1.35	8
Narrows Boat Ramp	12	41	38	10	110	45	1.16	60
Horotiu Br	12	280	135	5	1700	115	3.01	145
Huntly-Tainui Br	12	318	180	40	1900	200	3.26	190
Rangiriri Br	12	207	170	70	480	170	1.08	180
Mercer Bridge	12	229	150	30	800	175	1.70	130
Tuakau Br	12	328	165	40	1300	305	1.76	120

Nitrate/Nitrite Nitrogen (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.00	0.00	0.00	0.00	0.00	3.46	0.00
Ohaaki Br	12	0.05	0.05	0.03	0.08	0.03	0.54	0.04
Ohakuri Tailrace Br	12	0.11	0.10	0.04	0.20	0.06	0.44	0.10
Whakamaru Tailrace	12	0.16	0.17	0.05	0.27	0.13	-0.19	0.15
Waipapa Tailrace	12	0.25	0.24	0.15	0.36	0.09	0.20	0.22
Karapiro Tailrace	12	0.31	0.30	0.11	0.47	0.19	-0.25	0.29
Narrows Boat Ramp	12	0.35	0.35	0.21	0.50	0.17	-0.01	0.34
Horotiu Br	12	0.37	0.36	0.24	0.50	0.13	0.04	0.34
Huntly-Tainui Br	12	0.50	0.45	0.30	0.82	0.31	0.57	0.44
Rangiriri Br	12	0.48	0.45	0.27	0.84	0.22	0.81	0.43
Mercer Bridge	12	0.47	0.44	0.22	0.97	0.35	0.96	0.44
Tuakau Br	12	0.44	0.44	0.13	1.03	0.35	1.05	0.44

Ammoniacal Nitrogen (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.006	0.005	0.005	0.016	0.000	3.46	0.005
Ohaaki Br	12	0.014	0.011	0.005	0.037	0.017	0.94	0.005
Ohakuri Tailrace Br	12	0.018	0.012	0.005	0.040	0.031	0.54	0.005
Whakamaru Tailrace	12	0.014	0.005	0.005	0.052	0.016	1.98	0.005
Waipapa Tailrace	12	0.024	0.021	0.005	0.063	0.030	0.84	0.013
Karapiro Tailrace	12	0.020	0.019	0.005	0.047	0.023	0.60	0.019
Narrows Boat Ramp	12	0.018	0.016	0.005	0.047	0.016	1.09	0.014
Horotiu Br	12	0.012	0.013	0.005	0.033	0.012	1.36	0.010
Huntly-Tainui Br	12	0.010	0.005	0.005	0.027	0.011	1.25	0.012
Rangiriri Br	12	0.010	0.005	0.005	0.022	0.012	0.98	0.005
Mercer Bridge	12	0.006	0.005	0.005	0.014	0.000	3.46	0.005
Tuakau Br	12	0.007	0.005	0.005	0.014	0.003	1.77	0.005

Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

Total Kjeldahl Nitrogen (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.07	0.07	0.05	0.09	0.02	0.19	0.07
Ohaaki Br	12	0.11	0.11	0.05	0.17	0.06	0.17	0.10
Ohakuri Tailrace Br	12	0.12	0.11	0.07	0.22	0.02	2.11	0.12
Whakamaru Tailrace	12	0.15	0.13	0.10	0.31	0.06	1.92	0.15
Waipapa Tailrace	12	0.15	0.15	0.08	0.26	0.07	0.73	0.15
Karapiro Tailrace	12	0.16	0.16	0.10	0.22	0.07	0.21	0.17
Narrows Boat Ramp	12	0.16	0.15	0.10	0.38	0.04	2.83	0.18
Horotiu Br	12	0.16	0.16	0.10	0.24	0.08	0.37	0.20
Huntly-Tainui Br	12	0.21	0.21	0.14	0.26	0.06	-0.62	0.25
Rangiriri Br	12	0.22	0.23	0.15	0.29	0.05	0.07	0.23
Mercer Bridge	12	0.23	0.22	0.13	0.37	0.10	0.63	0.28
Tuakau Br	12	0.27	0.26	0.15	0.47	0.15	0.82	0.33

Total Nitrogen (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.07	0.07	0.05	0.09	0.02	0.20	0.07
Ohaaki Br	12	0.16	0.15	0.08	0.22	0.08	-0.06	0.13
Ohakuri Tailrace Br	12	0.23	0.22	0.18	0.30	0.07	0.64	0.22
Whakamaru Tailrace	12	0.31	0.31	0.21	0.45	0.10	0.28	0.31
Waipapa Tailrace	12	0.40	0.39	0.32	0.49	0.08	0.33	0.38
Karapiro Tailrace	12	0.47	0.51	0.27	0.63	0.15	-0.62	0.48
Narrows Boat Ramp	12	0.52	0.51	0.33	0.80	0.16	0.75	0.53
Horotiu Br	12	0.54	0.56	0.37	0.70	0.17	0.00	0.55
Huntly-Tainui Br	12	0.71	0.65	0.48	1.05	0.34	0.64	0.73
Rangiriri Br	12	0.70	0.65	0.42	1.05	0.29	0.43	0.72
Mercer Bridge	12	0.70	0.66	0.38	1.25	0.33	0.89	0.73
Tuakau Br	12	0.71	0.67	0.38	1.34	0.36	1.18	0.75

pH								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	7.8	7.9	7.5	8.0	0.4	-0.28	7.7
Ohaaki Br	12	7.3	7.4	6.8	7.8	0.2	-0.24	7.3
Ohakuri Tailrace Br	12	7.4	7.4	7.3	7.7	0.1	1.07	7.4
Whakamaru Tailrace	12	7.5	7.5	7.2	7.9	0.2	0.39	7.4
Waipapa Tailrace	12	7.5	7.5	7.2	7.9	0.2	0.73	7.4
Karapiro Tailrace	12	7.6	7.6	7.4	7.8	0.2	0.00	7.6
Narrows Boat Ramp	12	7.5	7.5	7.1	7.8	0.1	-0.98	7.5
Horotiu Br	12	7.6	7.6	7.2	7.8	0.1	-1.07	7.5
Huntly-Tainui Br	12	7.6	7.6	7.4	7.8	0.2	0.25	7.4
Rangiriri Br	12	7.6	7.6	7.4	7.8	0.2	0.39	7.6
Mercer Bridge	12	7.6	7.6	7.4	7.8	0.3	0.32	7.5
Tuakau Br	12	7.7	7.7	7.4	8.1	0.2	0.86	7.5

Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

Dissolved Reactive Phosphorus (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.002	0.002	0.002	0.002	0.000	0.00	0.002
Ohaaki Br	12	0.005	0.005	0.002	0.007	0.003	-0.51	0.006
Ohakuri Tailrace Br	12	0.009	0.009	0.002	0.014	0.007	-0.24	0.008
Whakamaru Tailrace	12	0.007	0.007	0.002	0.014	0.009	0.17	0.010
Waipapa Tailrace	12	0.012	0.011	0.006	0.022	0.006	1.00	0.015
Karapiro Tailrace	12	0.010	0.011	0.002	0.026	0.014	0.48	0.008
Narrows Boat Ramp	12	0.014	0.012	0.006	0.027	0.008	0.85	0.016
Horotiu Br	12	0.016	0.014	0.009	0.030	0.008	1.26	0.019
Huntly-Tainui Br	12	0.016	0.015	0.009	0.029	0.009	1.11	0.022
Rangiriri Br	12	0.016	0.014	0.009	0.031	0.008	1.35	0.015
Mercer Bridge	12	0.013	0.011	0.004	0.024	0.011	0.49	0.018
Tuakau Br	12	0.011	0.009	0.002	0.024	0.009	0.83	0.016

Total Phosphorus (g/m³)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.005	0.005	0.002	0.013	0.003	1.60	0.004
Ohaaki Br	12	0.013	0.014	0.008	0.019	0.005	-0.11	0.010
Ohakuri Tailrace Br	12	0.021	0.021	0.015	0.031	0.008	0.61	0.019
Whakamaru Tailrace	12	0.023	0.024	0.019	0.026	0.004	-0.29	0.022
Waipapa Tailrace	12	0.029	0.029	0.018	0.036	0.005	-0.65	0.027
Karapiro Tailrace	12	0.026	0.027	0.014	0.036	0.011	-0.21	0.027
Narrows Boat Ramp	12	0.029	0.030	0.018	0.036	0.007	-0.63	0.030
Horotiu Br	12	0.033	0.033	0.026	0.041	0.009	0.25	0.034
Huntly-Tainui Br	12	0.042	0.042	0.028	0.056	0.011	0.03	0.043
Rangiriri Br	12	0.044	0.045	0.032	0.054	0.010	-0.44	0.046
Mercer Bridge	12	0.045	0.046	0.035	0.055	0.014	-0.15	0.049
Tuakau Br	12	0.046	0.045	0.033	0.073	0.010	1.73	0.050

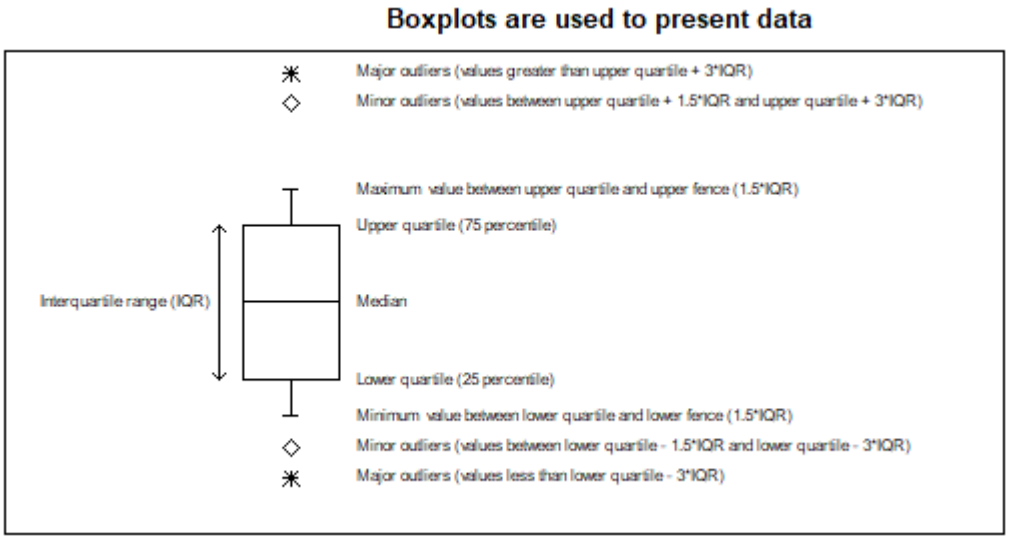
Water Temperature (°C)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	15.5	15.8	10.1	20.6	6.7	0.02	14.9
Ohaaki Br	12	16.3	17.3	10.5	21.0	7.3	-0.19	16.0
Ohakuri Tailrace Br	12	16.6	16.8	11.0	22.1	6.5	0.00	16.1
Whakamaru Tailrace	12	16.8	16.6	11.6	22.8	7.6	0.09	16.7
Waipapa Tailrace	12	16.6	16.3	11.7	22.7	7.8	0.19	16.3
Karapiro Tailrace	12	16.9	16.8	11.8	22.9	7.1	0.21	16.4
Narrows Boat Ramp	12	16.5	16.1	11.4	22.1	7.3	0.12	16.0
Horotiu Br	12	16.5	16.3	11.2	22.3	7.5	0.10	16.3
Huntly-Tainui Br	12	16.8	16.9	11.1	22.8	7.3	0.10	16.5
Rangiriri Br	12	17.0	16.6	11.5	23.3	7.1	0.19	16.6
Mercer Bridge	12	17.3	17.6	11.6	23.6	7.2	0.11	16.7
Tuakau Br	12	17.9	18.1	11.9	25.0	7.8	0.18	17.2

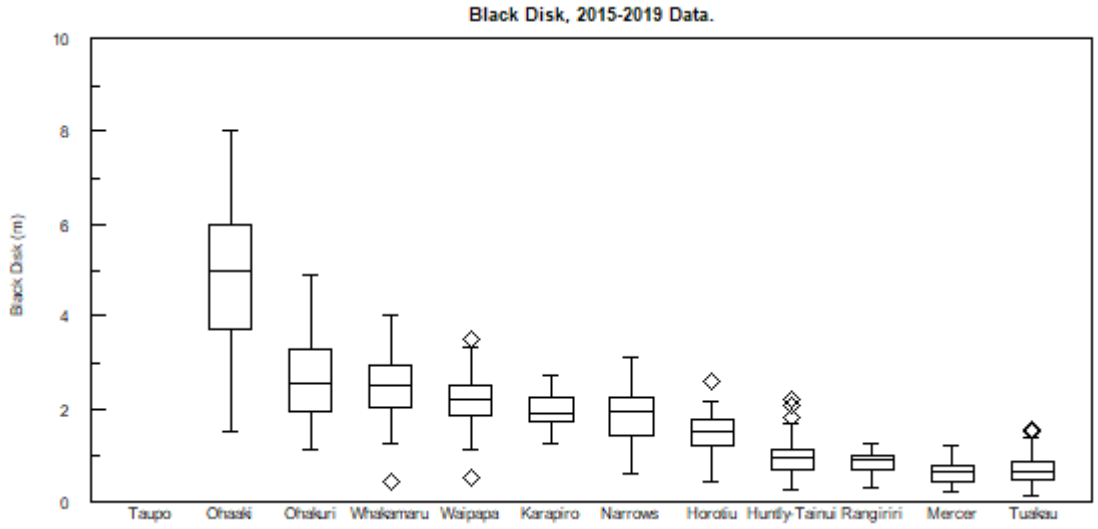
Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

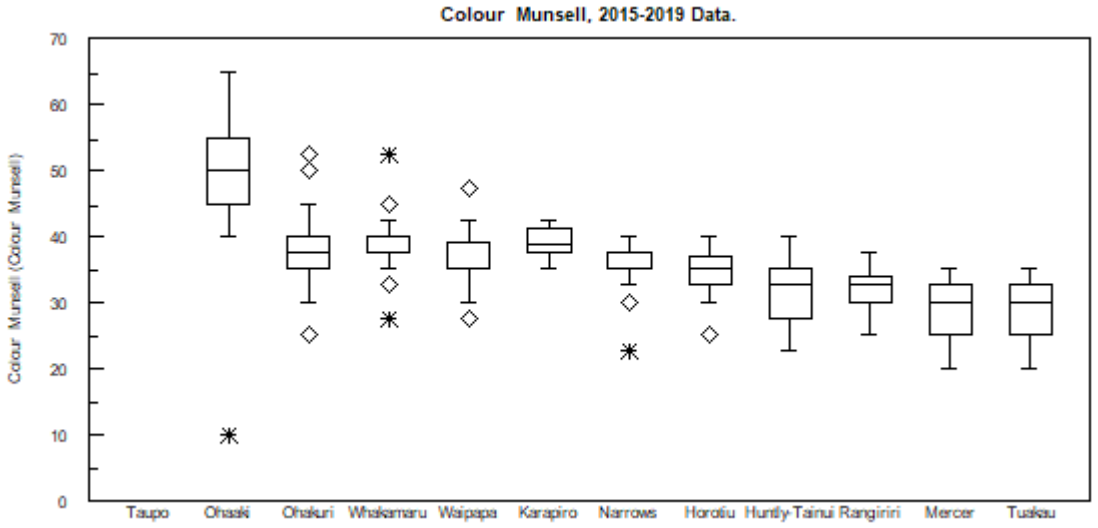
Turbidity (NTU)								
Location	**Count**	**Mean**	**Median**	**Min**	**Max**	**IQR**	**Skew**	**5 year median**
Taupo Gates	12	0.4	0.3	0.2	0.6	0.2	0.77	0.4
Ohaaki Br	12	0.7	0.7	0.5	1.1	0.2	0.80	0.8
Ohakuri Tailrace Br	12	0.9	0.8	0.4	1.7	0.5	0.90	1.1
Whakamaru Tailrace	12	1.1	1.1	0.6	1.9	0.4	0.72	1.1
Waipapa Tailrace	12	1.2	1.0	0.7	2.8	0.5	1.89	1.3
Karapiro Tailrace	12	1.3	1.3	0.9	2.0	0.4	0.72	1.3
Narrows Boat Ramp	12	1.4	1.3	0.7	2.1	0.7	0.14	1.9
Horotiu Br	12	2.0	1.8	1.5	2.7	0.5	0.98	2.4
Huntly-Tainui Br	12	4.6	3.5	2.3	11.1	3.8	1.31	5.9
Rangiriri Br	12	5.2	4.8	2.0	9.8	3.0	0.60	5.7
Mercer Bridge	12	6.8	5.7	3.2	11.5	5.1	0.42	8.9
Tuakau Br	12	7.1	6.0	2.3	17.5	5.7	1.32	9.3

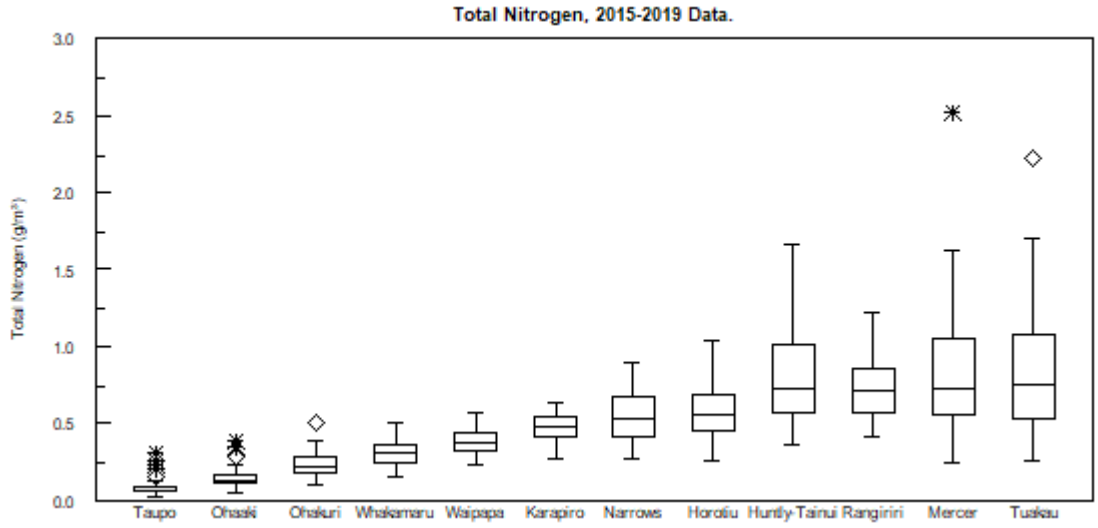
Skew = skewness (> 1 is lightly skewed, >2 is highly skewed; IQR = inter-quartile range)

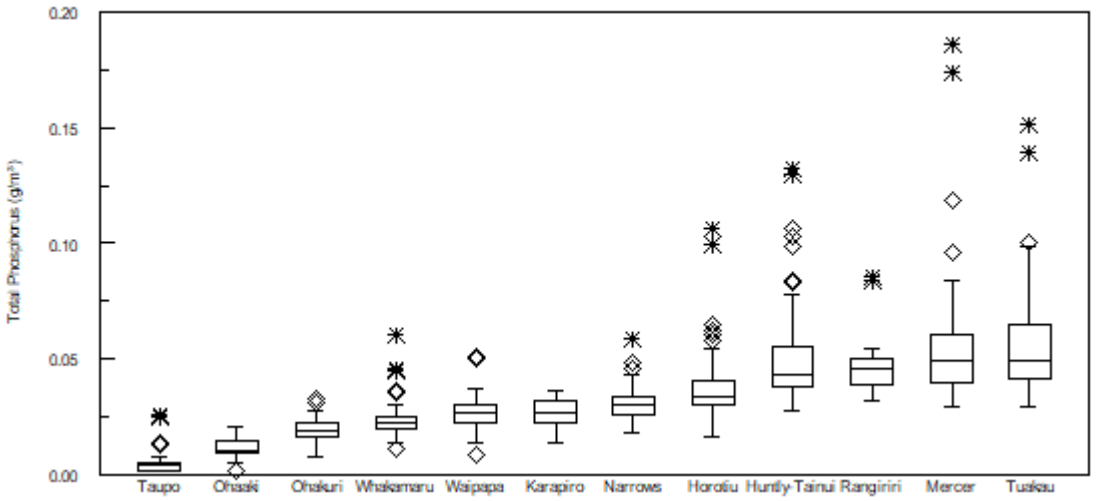
Key parameter graphs

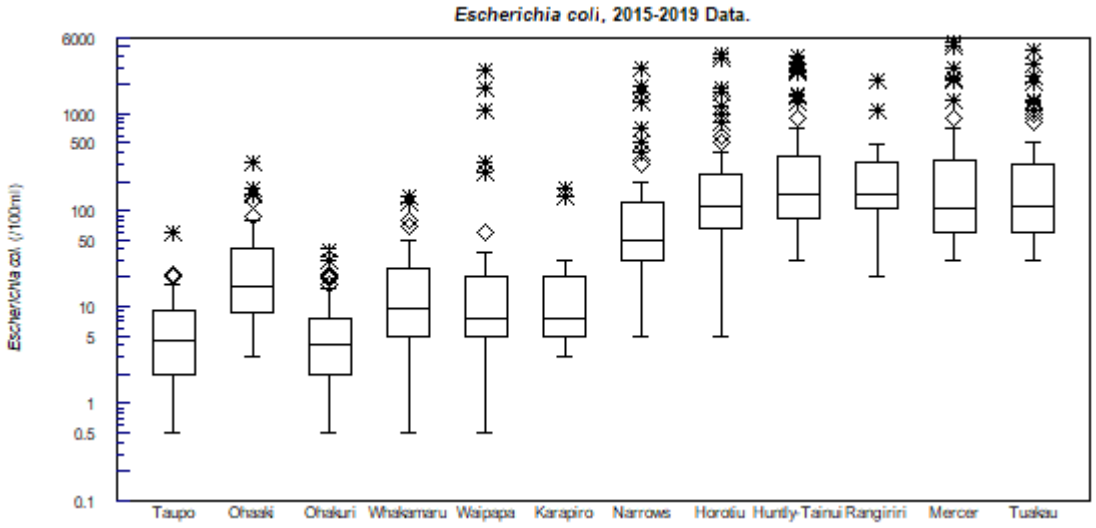


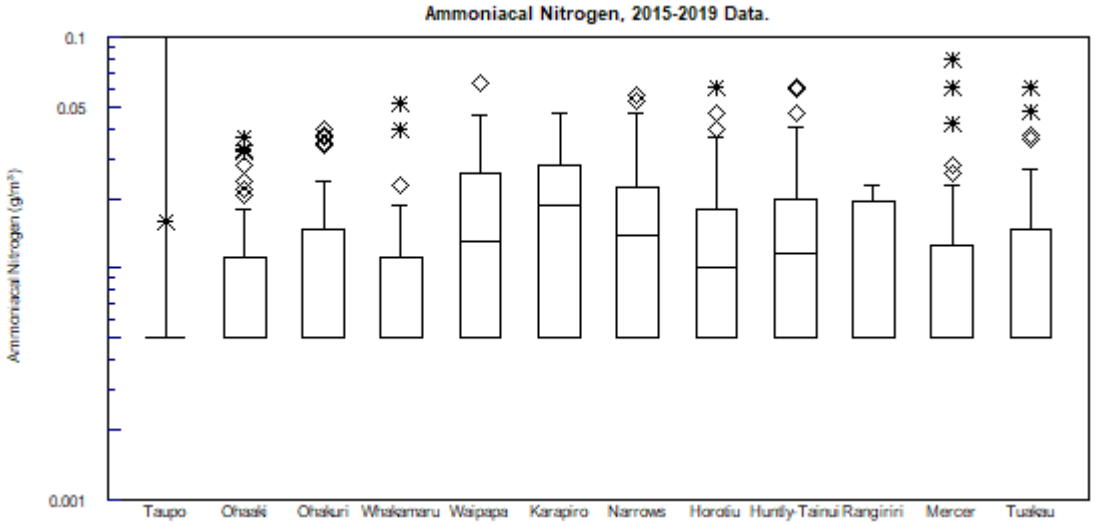


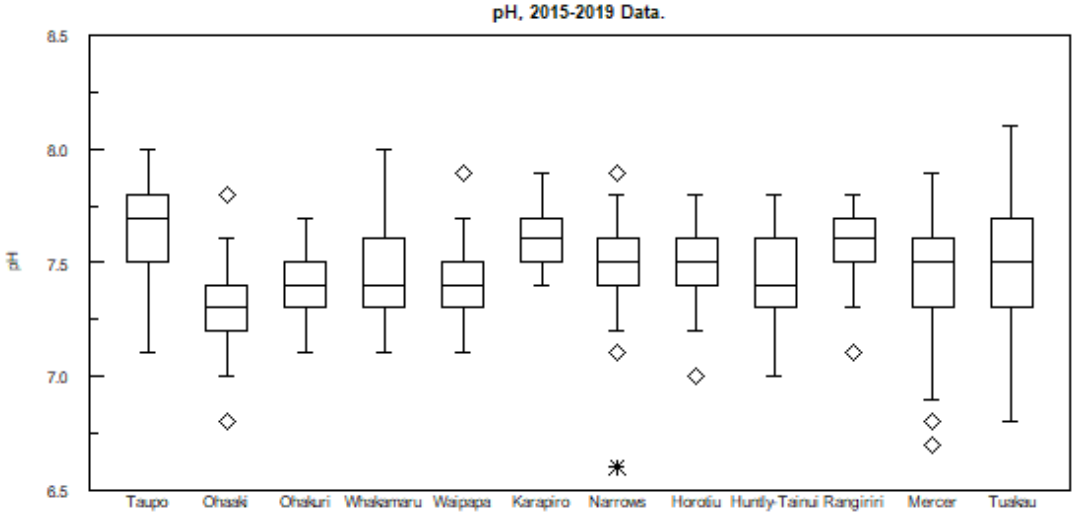


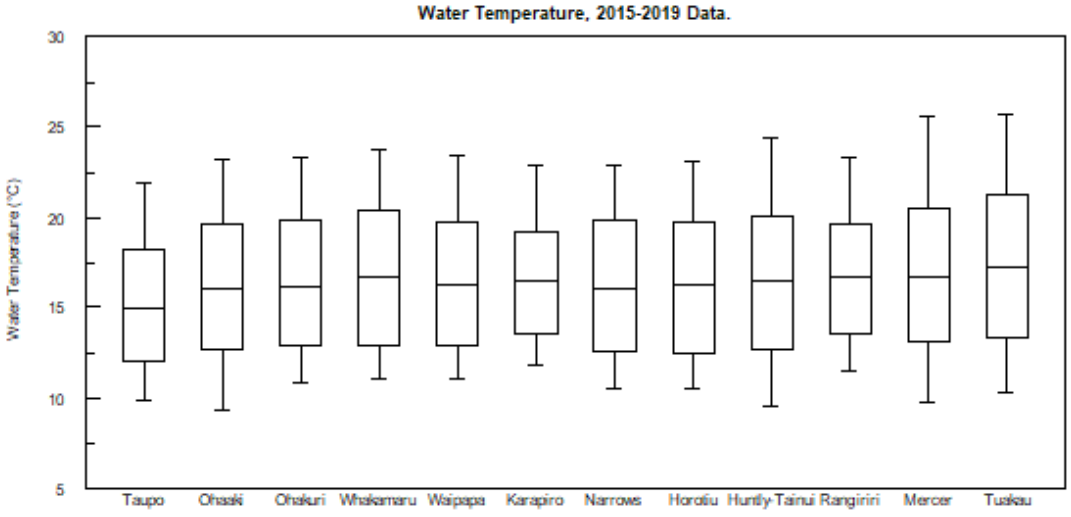

Total Nitrogen, 2015-2019 Data.
Total Nitrogen (g/m³)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly-Tainui
Rangiriri
Mercer
Tuakau

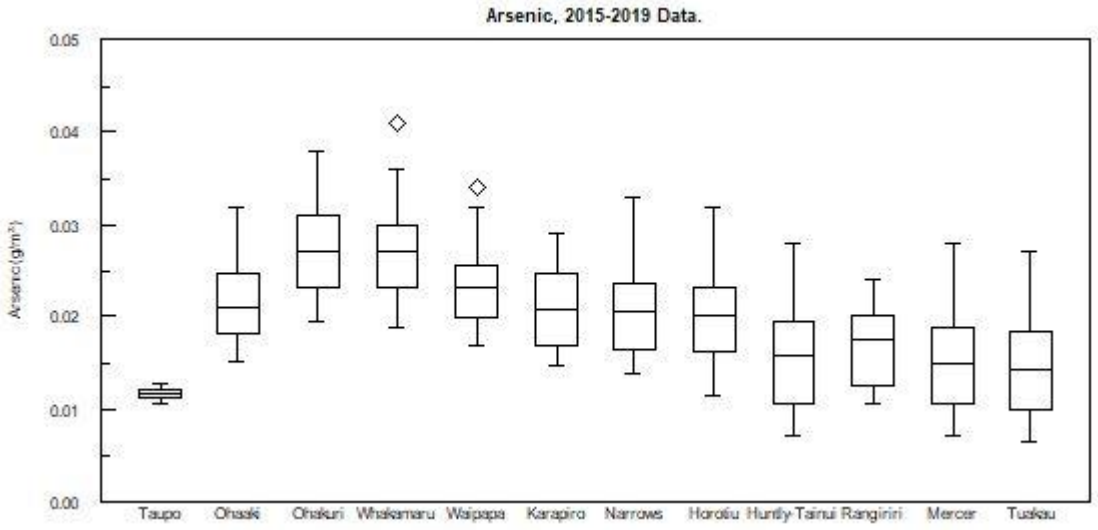

Total Phosphorus, 2015-2019 Data.
Total Phosphorus (g/m³)
0.20
0.15
0.10
0.05
0.00
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly-Tainui
Rangiriri
Mercer
Tuakau

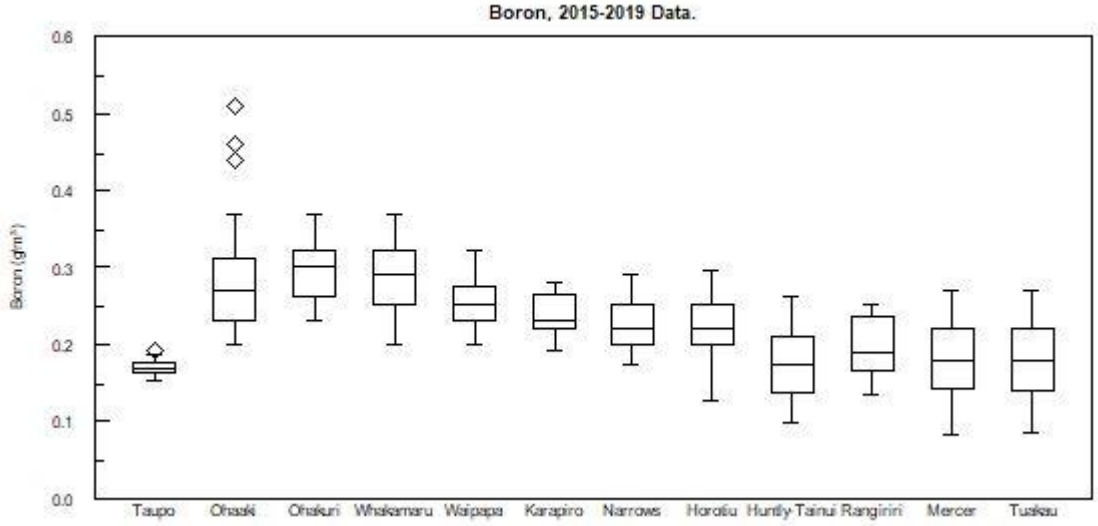

Escherichia coli, 2015-2019 Data.
Escherichia coli (/100ml)
6000
1000
500
100
50
10
5
1
0.5
0.1
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly-Tainui
Rangiriri
Mercer
Tuakau

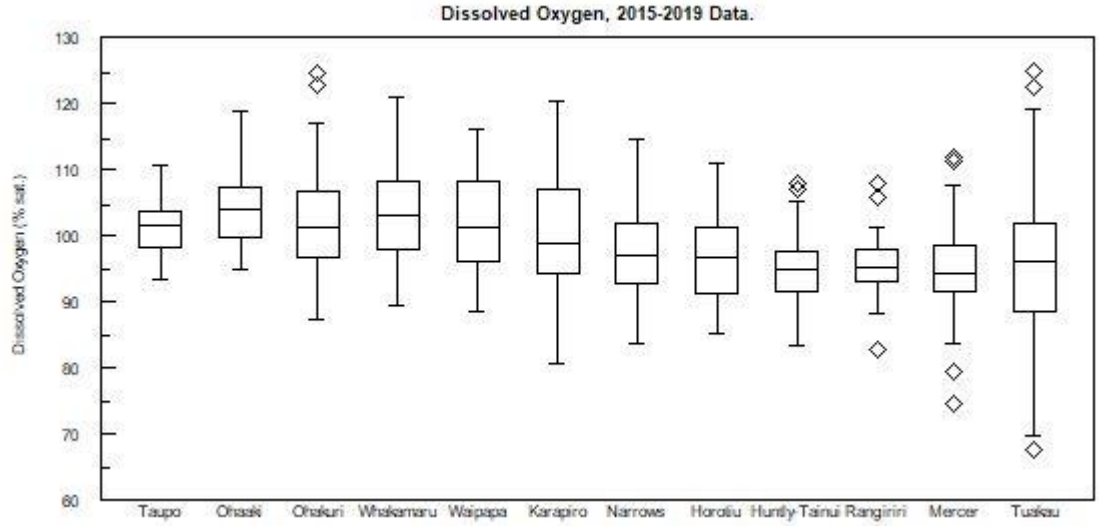

Ammoniacal Nitrogen, 2015-2019 Data.
Ammoniacal Nitrogen (g/m³)
0.1
0.05
0.001
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly-Tainui
Rangiriri
Mercer
Tuakau


pH, 2015-2019 Data.
pH
8.5
8.0
7.5
7.0
6.5
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly-Tainui
Rangiriri
Mercer
Tuakau


Water Temperature, 2015-2019 Data.
Water Temperature (°C)
30
25
20
15
10
5
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly-Tainui
Rangiriri
Mercer
Tuakau


Arsenic, 2015-2019 Data.
Arsenic (g/m³)
0.05
0.04
0.03
0.02
0.01
0.00
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly
Tainui
Rangiriri
Mercer
Tuakau


Boron, 2015-2019 Data.
Boron (g/m³)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly
Tainui
Rangiriri
Mercer
Tuakau


Dissolved Oxygen, 2015-2019 Data.
Dissolved Oxygen (% sat.)
130
120
110
100
90
80
70
60
Taupo
Ohaaki
Ohakuri
Whakamaru
Waipapa
Karapiro
Narrows
Horotiu
Huntly
Tainui
Rangiriri
Mercer
Tuakau

Comparison with water quality standards

Table 4: Number of monthly samples (2019) complying with the "satisfactory" water quality guidelines and standards.

	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			Water supply	Drinking water	
Location	DO	pH	Turb	NH_4N	Temp	TP	TN	BDisk	*E coli*	Median *E coli*	CHL*a*	As	B
Taupo Gates	12	12	12	12	7	12	12	-	12	Y	12	0	12
Ohaaki Br	12	12	12	12	5	12	12	12/12	12	Y	12	0	12
Ohakuri Tailrace Br	12	12	12	12	7	12	12	6/9[1]	12	Y	12	0	12
Whakamaru Tailrace	12	12	12	12	5	12	12	8/11	12	Y	12	0	12
Waipapa Tailrace	12	12	12	12	5	12	12	10/12	12	Y	12	0	12
Karapiro Tailrace	12	12	12	12	5	12	5	11/11	12	Y	12	0	12
Narrows Boat Ramp	12	12	12	12	4	12	5	9/11	12	Y	12	0	12
Horotiu Br	12	12	12	12	5	10	4	5/12	11	Y	12	0	12
Huntly-Tainui Br	12	12	8	12	5	4	1	0/12	11	Y	12	3	12
Rangiriri Br	12	12	6	12	5	3	2	0/12	12	Y	12	0	12
Mercer Bridge	12	12	5	12	5	3	3	0/12	10	Y	11	1	12
Tuakau Br	12	12	4	12	4	3	3	0/12	10	Y	10	1	12

Clarity samples excluded because flow exceeded the upper decile flow.
Superscripts denote the number of missing samples when there were fewer than 12 in the year.

Table 5: Number of monthly samples (2019) complying with the "excellent" water quality guidelines and standards.

	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			Water supply	Drinking water	
Location	DO	pH	Turb	NH_4N	Temp	TP	TN	BDisk	*E coli*	Median *E coli*	CHL*a*	As	B
Taupo Gates	12	12	12	12	2	11	12	-	12	Y	12	n/a	n/a
Ohaaki Br	12	11	12	12	1	2	2	7/12	10	N	12	n/a	n/a
Ohakuri Tailrace Br	11	12	12	12	1	0	0	1/9[1]	12	Y	8	n/a	n/a
Whakamaru Tailrace	12	12	12	12	1	0	0	0/11	11	Y	5	n/a	n/a
Waipapa Tailrace	12	12	10	12	1	0	0	0/12	12	Y	6	n/a	n/a
Karapiro Tailrace	10	12	11	12	1	0	0	0/11	12	Y	5	n/a	n/a
Narrows Boat Ramp	9	12	10	12	1	0	0	0/11	9	N	6	n/a	n/a
Horotiu Br	9	12	8	12	1	0	0	0/12	2	N	6	n/a	n/a
Huntly-Tainui Br	11	12	0	12	1	0	0	0/12	3	N	6	n/a	n/a
Rangiriri Br	11	12	0	12	1	0	0	0/12	1	N	5	n/a	n/a
Mercer Bridge	12	12	0	12	1	0	0	0/12	5	N	2	n/a	n/a
Tuakau Br	12	11	0	12	1	0	0	0/12	3	N	2	n/a	n/a

Clarity samples excluded because flow exceeded the upper decile flow.
Superscripts denote the number of missing samples when there were fewer than 12 in the year.

Raw data

Table 6: Raw data summary: Samples collected compared with the "satisfactory" water quality guidelines and standards in the year 2019.

Date	Time	Flow m^3/s	BDisk m	Colour	Cond mS/m	pH	Temp °C	DO g/m^3	DO% % sat.	BOD-5d g/m^3	Turb NTU	TDS g/m^3	NNN g/m^3	NO_3-N g/m^3	NH_4N g/m^3
Satisfactory Water Quality			>1.6	-	-	6.5-9.0	<12(May-Sep)		>80.0	-	<5.0	-	-	-	<0.88
Guideline/Standard							<20(Oct-Apr)+								
Taupo Gates upper decile flow = 262 m^3/s															
8/1/19	07:57	95	-	-	12.2	8.0	**20.6**	8.9	102.8	0.7	0.53	84	0.001	0.001	0.02
4/2/19	08:00	193	-	-	12.2	8.0	**20.2**	9.0	102.9	0.2	0.32	88	0.001	0.001	0.01
5/3/19	08:15	156	-	-	12.1	7.8	19.9	8.6	96.8	0.5	0.24	93	0.001	0.001	0.01
2/4/19	08:13	95	-	-	12.1	7.6	18.1	9.4	103.0	0.2	0.24	88	0.001	0.001	0.01
7/5/19	09:05	173	-	-	11.9	7.9	**15.8**	9.5	98.2	0.4	0.32	91	0.003	0.003	0.01
4/6/19	08:55	93	-	-	12.0	7.9	**13.1**	9.9	98.4	0.4	0.26	97	0.001	0.001	0.01
2/7/19	09:34	203	-	-	12.1	7.5	11.9	10.2	96.1	0.2	0.60	85	0.001	0.001	0.01
6/8/19	09:13	226	-	-	11.8	7.7	10.8	10.3	96.7	0.5	0.32	88	0.001	0.001	0.01
4/9/19	09:03	189	-	-	11.6	7.6	**12.7**	9.7	96.2	0.6	0.46	79	0.001	0.001	0.01
3/10/19	08:36	61	-	-	12.0	7.6	10.1	11.3	104.6	0.7	0.43	99	0.001	0.001	0.01
4/11/19	08:52	203	-	-	11.7	8.0	15.8	9.9	102.7	0.6	0.34	87	0.001	0.001	0.01
3/12/19	09:19	211	-	-	11.5	7.9	16.7	9.8	105.3	0.8	0.39	71	0.001	0.001	0.01
Ohaaki Br upper decile flow = 259 m^3/s															
8/1/19	08:50	103	3.3	45.0	15.8	7.2	**20.8**	8.4	97.2	1.4	0.98	105	0.062	0.061	0.02
4/2/19	08:50	194	3.9	55.0	15.1	7.2	**21.0**	8.5	97.6	0.6	0.67	108	0.047	0.046	0.01
5/3/19	09:10	157	3.7	47.5	15.3	7.3	**20.4**	8.6	97.2	0.2	0.58	116	0.054	0.053	0.02
2/4/19	08:58	94	4.5	10.0	15.6	7.4	19.6	8.8	98.9	0.6	0.50	107	0.078	0.078	0.02
7/5/19	09:46	147	6.1	57.5	17.4	6.8	**17.0**	9.4	98.6	0.5	0.76	137	0.081	0.080	0.04
4/6/19	09:39	93	4.2	50.0	14.9	7.2	**12.6**	10.5	102.3	0.6	0.74	115	0.075	0.074	0.02
2/7/19	10:04	202	4.9	57.5	14.6	7.4	**12.8**	11.2	107.4	0.2	0.87	96	0.033	0.033	0.01
6/8/19	09:55	226	5.0	52.5	13.7	7.4	10.5	11.9	109.6	0.7	0.67	93	0.035	0.034	0.01
4/9/19	09:39	188	3.3	55.0	13.6	7.3	**13.0**	10.8	107.2	0.6	0.62	88	0.038	0.038	0.01
3/10/19	09:33	60	5.0	62.5	13.2	7.8	11.9	11.4	108.7	0.6	1.12	98	0.039	0.039	0.01
4/11/19	09:32	206	4.4	50.0	15.0	7.4	17.5	9.6	102.1	0.9	0.78	113	0.049	0.049	0.02
3/12/19	10:24	210	3.2	60.0	13.4	7.4	18.8	9.6	106.8	0.8	0.52	70	0.030	0.030	0.01
Ohakuri Tailrace Br upper decile flow = 328 m^3/s															
8/1/19	09:38	262	1.7	35.0	18.7	7.5	**21.8**	8.7	101.2	1.2	1.46	133	0.075	0.073	0.04
4/2/19	09:37	317	1.8	35.0	16.5	7.4	**22.1**	7.8	93.1	0.7	0.97	118	0.079	0.079	0.04
5/3/19	10:01	175	**1.4**	37.5	17.3	7.7	19.7	9.6	103.0	0.6	0.85	160	0.042	0.042	0.02
2/4/19	09:44	156	3.1	35.0	16.6	7.4	19.7	8.0	90.3	0.5	0.41	123	0.141	0.140	0.01
7/5/19	10:33	193	3.5	37.5	17.6	7.3	**15.8**	8.6	87.3	0.2	0.64	139	0.177	0.175	0.04
4/6/19	10:24	280	4.1	40.0	17.3	7.4	**13.6**	9.6	94.6	0.5	0.64	140	0.195	0.191	0.01
2/7/19	10:49	334	(3.7)	40.0	14.8	7.4	11.8	10.7	99.7	0.2	0.83	107	0.109	0.107	0.01
6/8/19	10:43	347	(3.4)	42.5	14.4	7.4	11.0	10.9	101.2	0.6	0.65	109	0.131	0.130	0.01
4/9/19	10:27	259	2.5	40.0	15.5	7.4	**13.3**	10.6	105.1	0.6	1.27	104	0.135	0.133	0.01
3/10/19	10:22	184	-	-	14.8	7.5	13.2	11.0	107.7	0.8	0.78	108	0.094	0.093	0.01
4/11/19	10:17	290	**1.4**	32.5	15.3	7.6	17.8	10.6	112.8	1.1	0.94	123	0.069	0.068	0.01
3/12/19	12:00	305	**1.4**	42.5	15.4	7.3	19.6	8.7	98.2	0.9	1.70	102	0.095	0.092	0.04
Whakamaru Tailrace upper decile flow = 313 m^3/s															
8/1/19	10:13	185	1.7	37.5	17.1	7.6	**21.9**	8.6	99.6	1.3	1.53	132	0.141	0.138	0.05
4/2/19	10:20	230	1.6	35.0	17.2	7.6	**22.8**	9.3	109.6	0.8	1.69	125	0.056	0.055	0.02
5/3/19	10:34	238	3.1	37.5	17.1	7.6	**20.6**	8.9	99.9	0.6	0.99	137	0.045	0.044	0.02
2/4/19	10:29	158	2.1	40.0	16.7	7.2	**20.4**	8.0	90.3	0.5	0.90	117	0.165	0.164	0.02
7/5/19	11:15	249	2.9	40.0	17.3	7.4	**16.0**	9.3	94.8	0.5	0.72	136	0.240	0.240	0.01
4/6/19	11:01	246	3.3	40.0	16.7	7.4	**13.7**	9.5	93.4	0.5	0.58	143	0.270	0.270	0.01
2/7/19	11:34	318	(4.0)	37.5	15.7	7.5	11.7	10.4	95.7	0.2	1.12	120	0.210	0.210	0.01
6/8/19	11:20	273	3.3	37.5	15.1	7.5	11.6	10.7	99.5	0.7	1.11	119	0.250	0.240	0.01
4/9/19	11:08	258	**1.6**	37.5	15.0	7.6	**12.8**	11.0	107.6	0.8	1.93	108	0.180	0.179	0.01
3/10/19	11:20	257	2.5	40.0	15.5	7.5	13.1	10.8	104.2	0.7	1.13	105	0.186	0.184	0.01
4/11/19	11:06	169	**1.5**	32.5	15.9	7.9	17.2	10.9	114.2	1.2	0.94	133	0.110	0.107	0.01
3/12/19	13:10	285	**1.3**	37.5	15.0	7.5	19.9	9.4	105.8	1.1	1.15	124	0.089	0.087	0.02

Time is New Zealand standard time 24 h clock. < means less than value stated. Underlined bold values do not comply with "satisfactory" water quality guidelines and standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed 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. /100ml	F coli /100ml	*E coli* /100ml	CHL*a* g/m³	DOC g/m³	TOC g/m³
-	<0.1	-	<0.04	-	<0.01	<1.4	-	-	-	<77	-	<550	<0.02	-	-
Taupo Gates															
0.07	**0.1**	0.002	0.005	8.3	**0.012**	0.17	0.039	0.002	0.001	1	6	5	0.002	1.0	1.1
0.08	**0.1**	0.002	0.008	8.1	**0.011**	0.17	0.041	0.001	0.001	4	14	9	0.002	0.8	1.5
0.07	**0.1**	0.002	0.002	8.4	**0.012**	0.18	0.041	0.001	0.001	6	10	10	0.002	0.4	0.5
0.07	**0.1**	0.002	0.004	8.4	**0.012**	0.19	0.042	0.001	0.001	18	15	11	0.002	0.4	0.6
0.08	**0.1**	0.002	0.002	8.4	**0.012**	0.16	0.040	0.001	0.001	5	5	5	0.002	0.8	1.1
0.06	**0.1**	0.002	0.004	8.2	**0.011**	0.18	0.042	0.002	0.001	1	2	1	0.002	0.7	1.0
0.05	**0.1**	0.002	0.006	8.3	**0.011**	0.17	0.043	0.001	0.001	1	1	1	0.002	0.1	0.9
0.07	**0.1**	0.002	0.002	8.1	**0.012**	0.16	0.041	0.001	0.001	5	5	5	0.002	0.1	0.9
0.06	**0.1**	0.002	0.006	8.1	**0.012**	0.17	0.040	0.002	0.001	5	5	5	0.002	1.2	1.2
0.09	**0.1**	0.002	0.004	8.0	**0.012**	0.17	0.042	0.001	0.001	5	5	5	0.002	0.1	0.7
0.06	**0.1**	0.002	0.013	7.6	**0.012**	0.16	0.038	0.002	0.001	10	5	5	0.002	0.6	0.8
0.07	**0.1**	0.002	0.005	8.0	**0.012**	0.18	0.041	0.004	0.001	5	20	20	0.002	0.4	1.7
Ohaaki Br															
0.15	**0.2**	0.002	0.019	15.5	**0.023**	0.34	0.078	0.006	0.001	45	70	20	0.002	1.0	1.7
0.08	**0.1**	0.006	0.016	14.0	**0.022**	0.30	0.075	0.005	0.001	67	50	50	0.002	0.8	1.7
0.13	**0.2**	0.005	0.014	14.5	**0.023**	0.37	0.079	0.005	0.001	-	120	90	0.002	0.3	1.2
0.12	**0.2**	0.006	0.016	16.5	**0.025**	0.32	0.088	0.006	0.001	**170**	160	130	0.002	0.5	0.7
0.14	**0.2**	0.006	0.014	19.3	**0.024**	0.51	0.100	0.007	0.001	30	20	20	0.002	0.7	1.1
0.08	**0.2**	0.007	0.014	14.1	**0.022**	0.33	0.074	0.005	0.001	9	39	35	0.002	1.1	3.1
0.12	**0.2**	0.005	0.008	11.3	**0.016**	0.22	0.057	0.002	0.001	1	15	12	0.002	0.1	0.8
0.08	**0.1**	0.004	0.010	11.9	**0.018**	0.23	0.063	0.003	0.001	5	5	5	0.002	0.1	0.8
0.09	**0.1**	0.002	0.012	11.6	**0.017**	0.25	0.062	0.003	0.001	5	60	50	0.002	0.8	0.9
0.06	**0.1**	0.004	0.009	10.9	**0.018**	0.23	0.059	0.003	0.001	10	10	10	0.002	0.1	0.7
0.17	**0.2**	0.006	0.016	15.7	**0.023**	0.34	0.078	0.006	0.001	10	5	5	0.002	0.8	1.1
0.05	**0.1**	0.002	0.012	11.8	**0.021**	0.23	0.064	0.003	0.001	5	60	50	0.002	1.0	1.1
Ohakuri Tailrace Br															
0.22	**0.3**	0.005	0.025	19.8	**0.034**	0.37	0.115	0.009	0.002	3	2	1	0.006	1.4	1.6
0.12	**0.2**	0.011	0.026	15.9	**0.034**	0.29	0.098	0.009	0.002	10	5	5	0.004	0.9	1.6
0.14	**0.2**	0.002	0.016	19.1	**0.034**	0.35	0.112	0.007	0.001	-	10	10	0.007	0.6	1.4
0.10	**0.2**	0.013	0.024	16.6	**0.031**	0.31	0.103	0.006	0.001	1	1	1	0.002	0.6	0.8
0.11	**0.3**	0.014	0.022	19.4	**0.037**	0.35	0.113	0.006	0.001	5	5	5	0.002	0.9	1.0
0.10	**0.3**	0.012	0.022	18.0	**0.026**	0.35	0.111	0.007	0.001	1	5	5	0.004	0.8	0.9
0.07	**0.2**	0.010	0.016	13.4	**0.021**	0.25	0.078	0.005	0.001	1	4	4	0.002	0.1	0.8
0.10	**0.2**	0.007	0.018	12.8	**0.021**	0.24	0.073	0.005	0.001	5	5	5	0.002	0.1	0.9
0.09	**0.2**	0.008	0.020	15.2	**0.023**	0.29	0.088	0.006	0.001	5	5	5	0.002	0.7	1.1
0.12	**0.2**	0.005	0.015	13.6	**0.023**	0.27	0.080	0.005	0.001	1	1	1	0.006	0.1	0.9
0.12	**0.2**	0.005	0.018	14.4	**0.024**	0.27	0.081	0.007	0.001	5	5	5	0.010	0.7	1.3
0.11	**0.2**	0.012	0.031	14.2	**0.028**	0.26	0.090	0.009	0.002	5	40	40	0.002	0.9	1.3
Whakamaru Tailrace															
0.31	**0.5**	0.004	0.024	17.9	**0.030**	0.30	0.101	0.011	0.002	21	5	5	0.006	1.6	1.8
0.22	**0.3**	0.002	0.020	17.9	**0.035**	0.33	0.111	0.008	0.001	6	10	5	0.006	1.0	1.8
0.17	**0.2**	0.002	0.020	18.5	**0.033**	0.34	0.116	0.007	0.001	13	10	10	0.005	1.0	1.0
0.11	**0.3**	0.011	0.026	17.5	**0.028**	0.30	0.104	0.006	0.001	26	25	23	0.002	0.6	0.9
0.14	**0.4**	0.013	0.024	18.9	**0.030**	0.34	0.117	0.006	0.001	5	5	5	0.002	0.8	1.1
0.11	**0.4**	0.014	0.023	17.0	**0.023**	0.32	0.107	0.006	0.001	10	20	20	0.003	0.8	1.8
0.10	**0.3**	0.011	0.022	15.1	**0.022**	0.28	0.092	0.005	0.001	1	4	3	0.002	0.1	1.0
0.11	**0.4**	0.011	0.024	14.3	**0.022**	0.24	0.087	0.009	0.002	5	30	30	0.003	0.6	1.1
0.16	**0.3**	0.006	0.024	14.3	**0.022**	0.26	0.082	0.008	0.001	5	5	5	0.008	1.7	1.1
0.12	**0.3**	0.007	0.019	13.8	**0.022**	0.24	0.081	0.007	0.001	3	23	23	0.006	0.7	1.7
0.15	**0.3**	0.002	0.020	15.6	**0.024**	0.27	0.090	0.008	0.001	10	5	5	0.013	0.9	1.4
0.12	**0.2**	0.002	0.024	14.7	**0.028**	0.28	0.092	0.008	0.002	**1100**	130	80	0.010	1.1	1.6

Time is New Zealand standard time 24 h clock. < means less than value stated. Underlined bold values do not comply with "satisfactory" water quality guidelines and standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed for compliance.

Date	Time	Flow m^3/s	BDisk m	Colour	Cond mS/m	pH	Temp °C	DO g/m^3	DO% % sat.	BOD-5d g/m^3	Turb NTU	TDS g/m^3	NNN g/m^3	NO_3-N g/m^3	NH_4N g/m^3
Satisfactory Water Quality			>1.6	-	-	6.5-9.0	<12(May-Sep)		>80.0	-	<5.0	-	-	-	<0.88
Guideline/Standard							<20(Oct-Apr)+								
Waipapa Tailrace upper decile flow = 358 m^3/s															
8/1/19	11:00	198	1.7	35.0	15.7	7.5	**21.7**	8.9	101.8	1.1	2.10	114	0.220	0.200	0.05
4/2/19	11:14	183	1.8	35.0	17.3	7.6	**22.7**	9.2	107.1	0.8	1.07	130	0.165	0.161	0.04
5/3/19	11:27	142	2.0	37.5	16.4	7.6	**20.8**	9.1	101.6	0.6	0.67	128	0.152	0.149	0.02
2/4/19	11:07	195	2.3	40.0	17.0	7.2	**20.4**	8.1	90.4	0.4	0.76	116	0.250	0.240	0.03
7/5/19	11:47	196	2.3	40.0	17.7	7.3	**16.0**	9.0	91.2	0.2	0.83	139	0.330	0.330	0.03
4/6/19	11:39	218	2.5	40.0	16.3	7.4	**13.5**	9.6	93.7	0.5	0.76	120	0.360	0.350	0.01
2/7/19	12:27	295	2.7	37.5	15.4	7.4	11.9	10.5	96.0	0.2	1.06	121	0.280	0.280	0.01
6/8/19	11:48	277	2.8	42.5	14.7	7.4	11.7	10.6	98.4	0.6	0.97	112	0.300	0.300	0.01
4/9/19	11:37	300	**1.5**	35.0	14.9	7.5	**12.4**	11.3	108.4	0.9	1.42	105	0.270	0.270	0.01
3/10/19	11:48	270	2.4	37.5	15.3	7.9	13.2	11.2	107.0	0.6	1.05	103	0.220	0.220	0.01
4/11/19	11:49	304	1.9	32.5	16.9	7.7	16.5	10.5	107.3	0.8	1.01	134	0.230	0.230	0.02
3/12/19	14:18	277	**1.3**	37.5	15.1	7.4	18.6	9.0	97.6	1.0	2.80	100	0.171	0.165	0.06
Karapiro Tailrace upper decile flow = 369 m^3/s															
9/1/19	07:15	160	1.7	42.5	14.5	7.5	**21.6**	8.6	96.6	1.4	2.00	115	0.300	0.270	0.02
5/2/19	07:00	243	1.8	35.0	16.6	7.4	**22.9**	7.0	80.5	0.6	1.19	115	0.110	0.108	0.03
6/3/19	07:07	156	1.9	35.0	16.0	7.8	**21.3**	8.8	98.6	0.8	0.89	131	0.156	0.152	0.02
3/4/19	06:57	154	1.9	37.5	16.9	7.4	19.9	7.8	84.4	0.8	0.91	117	0.290	0.280	0.04
8/5/19	08:25	153	2.3	37.5	16.1	7.5	**17.0**	9.3	95.1	0.8	1.32	131	0.360	0.360	0.02
5/6/19	08:32	226	2.3	37.5	16.6	7.7	**14.7**	9.4	93.2	0.6	1.11	137	0.470	0.470	0.01
3/7/19	08:24	271	2.5	42.5	15.7	7.6	**12.5**	10.5	97.2	0.2	1.33	119	0.430	0.430	0.01
7/8/19	08:17	387	(2.7)	40.0	15.1	7.5	11.8	10.7	98.5	0.9	1.08	121	0.440	0.440	0.01
5/9/19	08:38	292	2.1	40.0	14.0	7.7	**13.6**	11.2	109.9	0.7	1.47	105	0.390	0.390	0.01
2/10/19	07:12	190	1.7	37.5	14.9	7.7	13.4	11.4	109.0	1.5	1.76	115	0.270	0.270	0.01
4/11/19	07:53	248	2.2	40.0	14.6	7.8	16.5	10.3	105.2	0.8	1.14	111	0.280	0.270	0.02
4/12/19	06:55	244	1.7	42.5	14.3	7.6	18.1	9.6	101.5	0.8	1.61	83	0.174	0.168	0.05
Narrows Boat Ramp upper decile flow = 369 m^3/s															
9/1/19	07:39	160	2.2	37.5	14.5	7.5	**20.7**	7.7	85.7	0.7	1.98	140	0.360	0.340	0.04
5/2/19	07:23	244	2.2	35.0	16.8	7.5	**22.1**	7.3	83.6	0.4	0.72	129	0.240	0.240	0.02
6/3/19	07:34	156	1.9	35.0	16.1	7.7	**20.6**	8.3	91.8	0.5	1.16	123	0.220	0.210	0.02
3/4/19	07:20	154	1.9	35.0	17.0	7.1	**20.0**	7.8	84.7	0.5	0.74	122	0.330	0.330	0.03
8/5/19	08:49	154	2.4	37.5	16.3	7.5	**16.2**	9.2	92.3	0.7	1.15	134	0.390	0.390	0.01
5/6/19	08:55	227	2.3	37.5	16.7	7.5	**13.8**	9.6	93.7	0.6	1.25	136	0.500	0.500	0.01
3/7/19	08:47	276	2.3	40.0	15.8	7.6	**12.0**	10.6	96.9	0.2	1.26	127	0.460	0.460	0.01
7/8/19	08:41	374	(2.2)	40.0	14.7	7.5	11.4	10.7	97.3	0.9	1.57	115	0.470	0.460	0.01
5/9/19	09:06	302	**1.3**	37.5	14.6	7.5	**13.1**	11.1	107.8	0.9	2.10	99	0.420	0.420	0.01
2/10/19	07:39	224	**1.6**	37.5	14.9	7.6	12.9	10.9	102.6	1.0	1.81	111	0.320	0.320	0.01
4/11/19	08:23	248	1.6	35.0	14.7	7.8	16.0	10.2	102.8	0.8	1.22	120	0.300	0.300	0.02
4/12/19	07:22	244	1.8	37.5	14.3	7.4	18.8	8.7	93.6	0.8	2.10	118	0.210	0.210	0.05
Horotiu Br upper decile flow = 571 m^3/s															
9/1/19	08:16	187	**1.6**	37.5	14.8	7.5	**21.2**	8.1	90.6	0.8	2.70	108	0.340	0.320	0.01
5/2/19	08:12	187	1.9	32.5	16.9	7.6	**22.3**	7.6	87.1	0.6	1.73	125	0.320	0.300	0.01
6/3/19	08:17	160	1.7	35.0	16.3	7.7	**20.7**	8.1	88.8	0.6	1.50	130	0.260	0.260	0.02
3/4/19	08:14	160	**1.6**	35.0	17.3	7.2	19.8	8.0	86.1	0.5	1.80	122	0.370	0.360	0.02
8/5/19	09:29	165	1.9	35.0	16.5	7.6	**16.1**	9.3	93.6	0.9	1.71	136	0.410	0.410	0.01
5/6/19	09:37	231	1.6	35.0	16.9	7.5	**13.8**	9.6	93.6	0.6	1.55	133	0.500	0.500	0.01
3/7/19	09:23	227	**1.6**	37.5	15.9	7.6	**12.1**	10.6	97.1	0.2	1.91	115	0.440	0.440	0.01
7/8/19	09:36	297	2.1	40.0	14.9	7.5	11.2	10.7	96.6	1.0	1.81	122	0.490	0.490	0.01
5/9/19	09:46	244	**1.0**	37.5	14.6	7.6	**13.2**	10.7	104.4	0.8	2.60	80	0.460	0.460	0.01
2/10/19	08:21	177	**1.5**	37.5	15.6	7.6	12.4	10.9	102.1	1.2	2.00	125	0.320	0.320	0.01
4/11/19	09:01	194	**1.4**	32.5	15.2	7.8	16.4	10.0	101.4	0.9	1.76	117	0.340	0.340	0.02
4/12/19	08:24	239	**1.5**	37.5	14.9	7.5	19.0	8.7	93.2	0.2	2.40	113	0.240	0.230	0.03

Time is New Zealand standard time 24 h clock. < means less than value stated. Underlined bold values do not comply with "satisfactory" water quality guidelines and standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed 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. /100ml	F coli /100ml	*E coli* /100ml	CHL*a* g/m³	DOC g/m³	TOC g/m³
-	<0.1	-	<0.04	-	<0.01	<1.4	-	-	-	<77	-	<550	<0.02	-	-
Waipapa Tailrace															
0.23	**0.5**	0.009	0.036	14.9	**0.023**	0.24	0.076	0.013	0.003	8	7	6	0.008	1.7	1.6
0.26	**0.4**	0.012	0.030	17.7	**0.032**	0.29	0.103	0.012	0.003	60	30	30	0.003	1.2	1.8
0.18	**0.3**	0.009	0.024	17.2	**0.026**	0.30	0.094	0.008	0.001	1	5	5	0.005	0.7	0.8
0.13	**0.4**	0.014	0.034	17.3	**0.024**	0.30	0.096	0.009	0.002	20	17	15	0.002	1.3	1.3
0.16	**0.5**	0.020	0.030	19.4	**0.027**	0.29	0.105	0.009	0.001	5	5	5	0.002	1.1	1.4
0.12	**0.5**	0.022	0.033	14.9	**0.020**	0.28	0.091	0.010	0.001	11	20	20	0.002	0.9	1.2
0.10	**0.4**	0.014	0.028	14.9	**0.020**	0.27	0.091	0.006	0.001	2	5	5	0.002	0.6	1.0
0.08	**0.4**	0.013	0.028	13.8	**0.019**	0.22	0.076	0.009	0.002	5	20	20	0.003	0.6	1.4
0.14	**0.4**	0.008	0.028	13.6	**0.017**	0.23	0.073	0.010	0.002	5	5	5	0.008	1.7	1.4
0.10	**0.3**	0.008	0.018	13.8	**0.018**	0.24	0.075	0.008	0.001	3	2	2	0.006	0.9	1.5
0.16	**0.4**	0.006	0.025	15.6	**0.021**	0.26	0.084	0.011	0.003	5	5	5	0.008	1.1	1.7
0.17	**0.3**	0.009	0.029	14.6	**0.025**	0.26	0.080	0.010	0.002	10	40	30	0.007	0.9	1.4
Karapiro Tailrace															
0.21	**0.5**	0.002	0.027	13.6	**0.023**	0.19	0.064	0.014	0.003	5	20	20	0.007	1.2	2.3
0.17	**0.3**	0.002	0.026	16.8	**0.029**	0.27	0.096	0.013	0.003	5	5	5	0.006	1.3	1.6
0.22	**0.4**	0.002	0.014	15.4	**0.027**	0.26	0.083	0.009	0.001	8	4	3	0.008	1.0	0.9
0.22	**0.5**	0.014	0.036	17.6	**0.025**	0.27	0.098	0.010	0.003	10	5	5	0.002	0.8	1.3
0.18	**0.5**	0.017	0.031	16.1	**0.023**	0.25	0.093	0.008	0.001	8	5	5	0.002	1.2	1.7
0.16	**0.6**	0.026	0.034	16.6	**0.022**	0.27	0.095	0.010	0.002	40	30	30	0.004	0.9	1.4
0.12	**0.6**	0.018	0.028	15.8	**0.018**	0.28	0.090	0.006	0.002	2	10	10	0.004	1.1	1.4
0.12	**0.6**	0.014	0.034	13.8	**0.016**	0.22	0.073	0.011	0.004	5	5	5	0.004	1.3	1.3
0.15	**0.5**	0.007	0.023	13.1	**0.015**	0.21	0.068	0.010	0.001	5	5	5	0.009	1.0	2.0
0.14	**0.4**	0.002	0.020	12.9	**0.017**	0.22	0.069	0.008	0.001	5	10	10	0.012	0.6	1.4
0.15	**0.4**	0.005	0.022	14.0	**0.018**	0.26	0.078	0.012	0.003	5	10	10	0.005	1.1	2.4
0.10	**0.3**	0.015	0.022	13.9	**0.024**	0.23	0.075	0.010	0.002	20	30	20	0.006	1.2	1.3
Narrows Boat Ramp															
0.19	**0.6**	0.010	0.030	13.8	**0.023**	0.20	0.064	0.016	0.004	53	30	30	0.002	1.2	1.8
0.15	**0.4**	0.006	0.026	17.0	**0.027**	0.26	0.091	0.013	0.003	30	60	60	0.004	1.2	1.5
0.16	**0.4**	0.006	0.018	16.8	**0.026**	0.26	0.083	0.009	0.001	21	36	23	0.005	0.9	1.3
0.17	**0.5**	0.016	0.036	17.7	**0.024**	0.27	0.098	0.009	0.001	70	110	110	0.002	1.4	1.3
0.13	**0.5**	0.018	0.032	16.4	**0.023**	0.26	0.094	0.008	0.001	29	40	40	0.002	1.0	1.6
0.14	**0.6**	0.027	0.036	16.2	**0.022**	0.26	0.092	0.010	0.002	50	60	50	0.002	1.1	1.3
0.10	**0.6**	0.021	0.031	16.0	**0.017**	0.27	0.090	0.005	0.001	**80**	40	40	0.012	1.1	1.4
0.13	**0.6**	0.015	0.032	14.0	**0.016**	0.21	0.067	0.011	0.002	10	10	10	0.004	1.1	1.5
0.38	**0.8**	0.012	0.028	13.2	**0.014**	0.20	0.065	0.012	0.002	20	20	20	0.007	1.1	6.2
0.14	**0.5**	0.011	0.024	13.2	**0.016**	0.21	0.066	0.013	0.002	5	10	10	0.008	0.8	1.9
0.15	**0.5**	0.008	0.025	14.2	**0.018**	0.25	0.079	0.012	0.003	20	10	5	0.006	1.2	1.6
0.12	**0.3**	0.012	0.030	14.1	**0.025**	0.24	0.075	0.010	0.002	40	60	60	0.006	1.1	1.5
Horotiu Br															
0.21	**0.6**	0.009	0.034	13.9	**0.023**	0.20	0.065	0.016	0.003	**340**	1700	**1200**	0.006	1.5	2.1
0.10	**0.4**	0.012	0.028	17.0	**0.027**	0.27	0.090	0.013	0.003	**90**	230	210	0.004	1.3	1.7
0.14	**0.4**	0.010	0.026	16.2	**0.026**	0.26	0.081	0.010	0.002	**90**	150	90	0.005	1.0	1.4
0.20	**0.6**	0.018	0.038	18.0	**0.025**	0.26	0.092	0.011	0.002	**170**	170	110	0.002	1.3	1.5
0.17	**0.6**	0.018	0.034	16.8	**0.022**	0.25	0.093	0.009	0.001	40	90	60	0.002	1.2	1.4
0.20	**0.7**	0.030	**0.041**	17.0	**0.023**	0.25	0.084	0.010	0.002	**180**	530	330	0.002	1.0	1.5
0.14	**0.6**	0.026	**0.040**	15.8	**0.018**	0.27	0.093	0.009	0.001	29	30	20	0.004	1.2	1.6
0.12	**0.6**	0.016	0.038	14.0	**0.016**	0.22	0.067	0.014	0.003	30	5	5	0.004	1.2	1.4
0.24	**0.7**	0.013	0.031	13.4	**0.014**	0.21	0.061	0.014	0.002	5	120	120	0.008	1.3	5.0
0.12	**0.4**	0.010	0.030	14.3	**0.015**	0.21	0.065	0.015	0.003	10	80	60	0.007	1.2	2.1
0.17	**0.5**	0.010	0.030	14.4	**0.017**	0.25	0.079	0.013	0.003	5	90	80	0.005	1.1	1.6
0.13	**0.4**	0.014	0.028	14.0	**0.023**	0.23	0.073	0.012	0.003	**90**	160	140	0.006	1.2	1.5

Time is New Zealand standard time 24 h clock. < means less than value stated. Underlined bold values do not comply with "satisfactory" water quality guidelines and standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed for compliance.

Date	Time	Flow m^3/s	BDisk m	Colour	Cond mS/m	pH	Temp °C	DO g/m^3	DO% % sat.	BOD-5d g/m^3	Turb NTU	TDS g/m^3	NNN g/m^3	NO_3-N g/m^3	NH_4N g/m^3
Satisfactory Water Quality			>1.6	-	-	6.5-9.0	<12(May-Sep)		>80.0	-	<5.0	-	-	-	<0.88
Guideline/Standard							<20(Oct-Apr)+								
Huntly-Tainui Br upper decile flow = 652 m^3/s															
9/1/19	08:50	237	**1.2**	32.5	14.6	7.7	**21.8**	8.5	96.6	1.1	**5.20**	111	0.380	0.370	0.01
5/2/19	08:46	222	**1.5**	35.0	16.9	7.7	**22.8**	8.1	93.4	0.5	2.60	131	0.330	0.320	0.01
6/3/19	08:48	174	**1.3**	37.5	16.5	7.8	**20.7**	8.6	94.5	0.7	2.40	127	0.310	0.300	0.01
3/4/19	08:44	192	**1.1**	35.0	16.7	7.5	18.4	8.4	88.8	0.8	3.20	129	0.420	0.420	0.01
8/5/19	10:02	203	**1.5**	35.0	16.2	7.5	**15.7**	9.5	94.5	0.9	2.30	124	0.440	0.440	0.01
5/6/19	10:12	298	**0.9**	32.5	16.0	7.5	**13.1**	9.7	93.2	0.6	4.80	129	0.820	0.810	0.02
3/7/19	09:56	323	**1.0**	32.5	15.7	7.6	**12.6**	10.4	96.7	0.2	2.40	111	0.520	0.520	0.01
7/8/19	10:08	453	**0.7**	37.5	13.7	7.4	11.1	10.5	95.0	1.1	**8.20**	105	0.730	0.720	0.02
5/9/19	10:25	392	**0.8**	35.0	14.7	7.5	**14.5**	9.8	98.5	0.6	**7.30**	83	0.690	0.690	0.01
2/10/19	08:55	370	**0.6**	35.0	12.8	7.4	12.9	10.2	96.4	1.0	**11.10**	98	0.640	0.630	0.01
4/11/19	09:33	216	**1.0**	30.0	14.5	7.7	18.0	9.5	99.2	0.7	2.50	116	0.460	0.450	0.03
4/12/19	08:57	288	**1.1**	35.0	14.4	7.6	19.9	8.7	94.9	0.9	3.70	127	0.300	0.300	0.01
Rangiriri Br upper decile flow = 652 m^3/s															
9/1/19	09:20	244	**0.8**	32.5	15.0	7.6	**22.0**	8.2	93.5	0.8	**7.00**	119	0.400	0.390	0.01
5/2/19	09:15	227	**1.1**	32.5	16.9	7.7	**23.3**	7.9	92.1	0.5	4.50	133	0.320	0.310	0.01
6/3/19	09:17	179	**1.1**	35.0	16.5	7.8	**21.3**	8.4	94.0	0.6	4.20	122	0.290	0.280	0.01
3/4/19	09:11	200	**1.0**	30.0	16.9	7.6	19.4	8.2	88.2	0.6	2.00	131	0.420	0.410	0.01
8/5/19	10:32	215	**1.2**	35.0	16.3	7.5	**15.9**	9.5	95.0	0.7	2.80	129	0.440	0.440	0.01
5/6/19	10:39	309	**1.0**	32.5	16.6	7.5	**13.6**	9.5	92.4	0.5	**5.00**	129	0.840	0.830	0.02
3/7/19	10:24	338	**0.9**	32.5	16.2	7.7	**12.4**	10.4	96.1	0.2	3.80	124	0.530	0.520	0.01
7/8/19	10:36	472	**0.9**	37.5	14.9	7.4	11.5	10.3	94.2	1.2	**6.80**	114	0.680	0.670	0.01
5/9/19	10:57	407	**0.7**	35.0	15.0	7.5	**13.9**	10.2	101.2	0.9	**7.30**	112	0.630	0.630	0.02
2/10/19	09:25	396	**0.6**	30.0	14.3	7.5	13.4	10.3	97.9	1.4	**9.80**	117	0.510	0.500	0.01
4/11/19	10:21	229	**0.9**	27.5	14.9	7.6	17.3	9.4	97.7	0.7	4.00	124	0.450	0.450	0.02
4/12/19	09:30	299	**0.9**	32.5	14.8	7.6	19.9	8.8	95.1	0.9	**5.70**	80	0.270	0.270	0.01
Mercer Bridge upper decile flow = 652 m^3/s															
9/1/19	09:46	233	**0.6**	30.0	14.9	7.8	**22.5**	9.2	105.5	1.5	**10.70**	112	0.270	0.260	0.01
5/2/19	09:44	207	**0.8**	32.5	16.8	7.8	**23.6**	8.6	101.3	0.7	4.60	138	0.220	0.220	0.01
6/3/19	09:45	177	**0.9**	35.0	16.6	7.8	**21.3**	8.7	97.0	1.0	3.80	123	0.240	0.230	0.01
3/4/19	09:35	201	**0.9**	30.0	16.9	7.6	19.5	8.5	91.9	0.8	**5.00**	134	0.390	0.390	0.01
8/5/19	10:55	195	**1.2**	32.5	16.2	7.6	**16.5**	9.5	95.6	0.8	3.20	125	0.440	0.440	0.01
5/6/19	11:02	271	**0.6**	30.0	16.4	7.4	**13.5**	9.5	92.2	0.6	**8.00**	118	0.970	0.960	0.01
3/7/19	10:48	297	**0.8**	35.0	16.0	7.6	**12.8**	10.3	95.7	0.2	4.90	125	0.560	0.560	0.01
7/8/19	10:59	479	**0.7**	32.5	14.6	7.5	11.6	10.3	94.3	1.2	**9.30**	125	0.670	0.660	0.01
5/9/19	11:23	420	**0.7**	32.5	14.5	7.5	**14.2**	9.9	98.6	0.9	**10.10**	112	0.660	0.660	0.01
2/10/19	09:48	426	**0.5**	30.0	14.2	7.5	13.2	10.1	96.2	1.1	**11.50**	113	0.500	0.500	0.01
4/11/19	10:55	236	**0.7**	25.0	14.9	7.7	18.7	9.2	97.5	0.8	4.60	121	0.440	0.440	0.01
4/12/19	10:00	283	**0.7**	30.0	14.7	7.5	19.8	9.1	99.4	1.0	**6.40**	90	0.250	0.240	0.01
Tuakau Br upper decile flow = 652 m^3/s															
9/1/19	10:17	233	**0.5**	25.0	15.2	7.8	**23.5**	9.1	106.2	1.9	**17.50**	110	0.230	0.220	0.01
5/2/19	10:12	207	**0.8**	30.0	16.9	8.1	**25.0**	10.4	124.9	1.0	**5.80**	128	0.130	0.127	0.01
6/3/19	10:10	178	**1.0**	32.5	16.7	7.8	**21.9**	9.2	103.3	1.0	3.00	124	0.210	0.210	0.01
3/4/19	10:01	210	**1.0**	30.0	16.8	7.7	19.8	9.0	96.9	0.8	3.40	128	0.350	0.350	0.01
8/5/19	11:21	194	**1.3**	32.5	16.4	7.6	**16.7**	9.6	97.2	0.7	2.30	124	0.450	0.450	0.01
5/6/19	11:27	271	**0.7**	30.0	16.5	7.6	**13.5**	9.4	91.8	0.7	**6.80**	130	1.030	1.020	0.01
3/7/19	11:15	303	**0.8**	30.0	16.2	7.6	**13.2**	10.4	97.3	0.5	4.50	118	0.510	0.510	0.01
7/8/19	11:27	477	**0.6**	32.5	14.9	7.5	11.9	10.1	92.9	1.3	**9.20**	110	0.660	0.660	0.01
5/9/19	11:51	419	**0.5**	32.5	15.0	7.4	**14.7**	9.8	98.5	1.0	**10.10**	103	0.630	0.630	0.01
2/10/19	10:15	424	**0.5**	30.0	14.5	7.6	13.9	10.0	95.8	1.3	**11.30**	117	0.480	0.480	0.01
4/11/19	11:16	236	**0.8**	25.0	15.3	7.7	19.5	9.6	103.3	0.8	**5.10**	131	0.420	0.420	0.01
4/12/19	10:30	285	**0.8**	30.0	14.4	7.8	**21.1**	9.5	106.9	1.0	**6.10**	99	0.200	0.198	0.01

Time is New Zealand standard time 24 h clock. < means less than value stated. Underlined bold values do not comply with "satisfactory" water quality guidelines and standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed 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. /100ml	F coli /100ml	*E coli* /100ml	CHL*a* g/m³	DOC g/m³	TOC g/m³
-	<0.1	-	<0.04	-	<0.01	<1.4	-	-	-	<77	-	<550	<0.02	-	-
Huntly-Tainui Br															
0.24	**0.6**	0.010	**0.048**	14.1	**0.019**	0.18	0.056	0.022	0.004	26	140	110	0.007	1.5	2.5
0.20	**0.5**	0.014	0.032	17.0	**0.025**	0.26	0.088	0.015	0.003	30	180	140	0.006	1.4	1.8
0.19	**0.5**	0.012	0.028	16.7	**0.023**	0.24	0.078	0.013	0.003	35	70	30	0.006	1.2	1.9
0.24	**0.7**	0.019	**0.046**	17.0	**0.019**	0.22	0.076	0.018	0.004	**230**	100	80	0.002	1.6	1.8
0.20	**0.6**	0.021	**0.041**	16.3	**0.020**	0.24	0.084	0.011	0.001	**90**	180	110	0.002	1.2	1.9
0.23	**1.1**	0.029	**0.045**	15.0	**0.016**	0.20	0.067	0.018	0.004	**140**	300	240	0.003	1.5	2.2
0.14	**0.7**	0.021	**0.041**	15.7	**0.016**	0.25	0.083	0.007	0.001	5	80	50	0.004	1.2	1.2
0.24	**1.0**	0.015	**0.056**	13.0	0.010	0.14	0.041	0.020	0.004	**90**	320	320	0.003	1.4	2.5
0.26	**0.9**	0.015	**0.043**	12.4	0.009	0.13	0.040	0.019	0.004	70	230	230	0.005	1.8	2.9
0.22	**0.9**	0.011	**0.055**	12.0	0.007	0.10	0.029	0.030	0.006	**130**	1900	**1600**	0.005	1.9	3.7
0.14	**0.6**	0.013	0.039	13.9	**0.012**	0.17	0.052	0.020	0.004	20	40	40	0.003	1.3	2.0
0.18	**0.5**	0.009	0.034	14.7	**0.019**	0.20	0.062	0.016	0.003	**110**	280	150	0.006	1.3	1.7
Rangiriri Br															
0.23	**0.6**	0.009	**0.050**	14.4	**0.018**	0.18	0.056	0.025	0.005	23	130	100	0.007	1.7	2.8
0.23	**0.6**	0.014	0.034	17.4	**0.024**	0.25	0.086	0.017	0.004	30	130	110	0.007	1.3	1.9
0.20	**0.5**	0.012	0.032	16.7	**0.023**	0.25	0.076	0.013	0.003	22	160	110	0.006	0.6	1.7
0.17	**0.6**	0.020	**0.046**	17.4	**0.020**	0.23	0.070	0.018	0.004	**160**	200	130	0.004	1.2	1.9
0.18	**0.6**	0.019	**0.044**	16.5	**0.020**	0.24	0.082	0.012	0.003	**90**	110	110	0.004	0.5	1.6
0.21	**1.1**	0.031	**0.050**	15.7	**0.016**	0.20	0.069	0.017	0.003	**160**	340	280	0.003	2.2	2.3
0.23	**0.8**	0.022	**0.040**	16.0	**0.017**	0.25	0.083	0.006	0.001	20	70	50	0.007	1.3	1.9
0.25	**0.9**	0.016	**0.046**	14.1	**0.012**	0.16	0.048	0.022	0.004	60	240	220	0.004	2.0	2.4
0.29	**0.9**	0.014	**0.044**	13.6	**0.011**	0.16	0.050	0.025	0.005	60	180	180	0.010	2.0	3.3
0.28	**0.8**	0.010	**0.054**	13.0	**0.011**	0.15	0.046	0.030	0.006	30	480	480	0.010	2.1	3.7
0.22	**0.7**	0.012	**0.047**	14.6	**0.013**	0.19	0.058	0.023	0.005	5	80	80	0.004	1.9	2.6
0.15	**0.4**	0.014	0.038	14.5	**0.020**	0.21	0.067	0.015	0.003	**160**	360	360	0.014	1.3	2.1
Mercer Bridge															
0.37	**0.6**	0.004	**0.055**	14.4	**0.016**	0.17	0.050	0.028	0.005	10	110	40	**0.021**	1.8	2.9
0.21	**0.4**	0.005	0.037	17.2	**0.023**	0.25	0.080	0.017	0.004	10	50	50	0.016	1.4	2.1
0.21	**0.5**	0.009	0.035	16.8	**0.022**	0.24	0.080	0.012	0.003	18	60	60	0.010	1.0	1.5
0.16	**0.6**	0.016	**0.040**	17.4	**0.020**	0.24	0.079	0.016	0.003	70	230	180	0.004	1.4	1.9
0.23	**0.7**	0.021	**0.046**	16.3	**0.019**	0.24	0.078	0.012	0.003	20	30	30	0.004	0.4	1.7
0.28	**1.3**	0.024	**0.046**	15.8	**0.014**	0.18	0.058	0.020	0.003	**170**	220	200	0.005	2.5	2.8
0.16	**0.7**	0.021	**0.041**	15.9	**0.015**	0.24	0.080	0.010	0.002	15	90	40	0.005	1.5	1.9
0.22	**0.9**	0.014	**0.052**	14.0	**0.011**	0.14	0.044	0.022	0.004	40	230	230	0.005	1.8	2.3
0.33	**1.0**	0.010	**0.052**	14.0	0.009	0.15	0.044	0.032	0.006	**210**	700	**700**	0.009	2.4	9.7
0.27	**0.8**	0.007	**0.053**	13.5	**0.010**	0.14	0.044	0.036	0.007	50	800	**600**	0.010	2.5	4.2
0.20	**0.6**	0.011	**0.050**	14.3	**0.013**	0.18	0.053	0.023	0.005	5	40	40	0.005	1.8	3.0
0.13	**0.4**	0.010	0.036	14.3	**0.020**	0.22	0.066	0.013	0.003	40	190	170	0.011	1.2	2.0
Tuakau Br															
0.47	**0.7**	0.002	**0.073**	14.7	**0.019**	0.17	0.053	0.034	0.007	7	60	40	**0.020**	2.3	4.4
0.35	**0.5**	0.002	**0.042**	17.3	**0.022**	0.25	0.078	0.017	0.004	10	90	70	**0.020**	1.4	2.3
0.26	**0.5**	0.008	0.033	16.7	**0.023**	0.26	0.073	0.013	0.003	37	70	70	0.013	1.4	2.1
0.15	**0.5**	0.013	0.039	17.0	**0.019**	0.23	0.080	0.016	0.003	**90**	280	230	0.012	1.2	1.9
0.18	**0.6**	0.024	**0.045**	16.1	**0.019**	0.22	0.080	0.012	0.002	10	80	70	0.005	0.5	2.0
0.31	**1.3**	0.023	**0.050**	15.8	**0.013**	0.18	0.056	0.024	0.004	**130**	280	220	0.004	2.7	2.9
0.19	**0.7**	0.018	**0.043**	16.2	**0.015**	0.25	0.081	0.008	0.001	10	40	40	0.007	1.3	1.9
0.26	**0.9**	0.007	**0.052**	14.5	**0.010**	0.15	0.046	0.024	0.004	40	240	170	0.006	2.2	3.4
0.35	**1.0**	0.008	**0.050**	14.0	0.009	0.15	0.042	0.033	0.006	**160**	1300	**1300**	0.002	2.6	3.8
0.29	**0.8**	0.006	**0.046**	13.6	**0.010**	0.14	0.042	0.036	0.007	20	460	460	0.009	2.5	3.9
0.22	**0.6**	0.009	**0.044**	14.3	**0.013**	0.18	0.054	0.026	0.005	5	40	30	0.007	1.8	2.6
0.18	**0.4**	0.009	0.038	14.6	**0.018**	0.22	0.064	0.014	0.003	**80**	1000	**1000**	0.014	1.4	1.9

Time is New Zealand standard time 24 h clock. < means less than value stated. Underlined bold values do not comply with "satisfactory" water quality guidelines and standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed for compliance.

References

Tulagi A 2018. Waikato River water quality monitoring programme: data report 2017. Waikato Regional Council Technical Report 2018/24. Hamilton, Waikato Regional Council

Vant B 2013. Trends in river water quality in the Waikato region, 1993-2012. Waikato Regional Council Technical Report 2013/20, Hamilton, Waikato Regional Council

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Appendix I

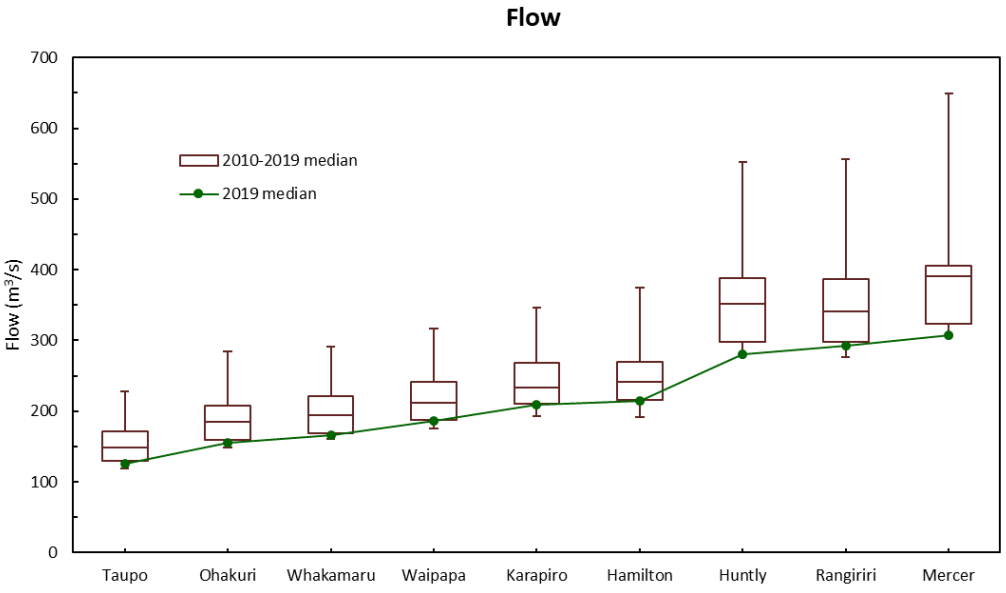
Flow information

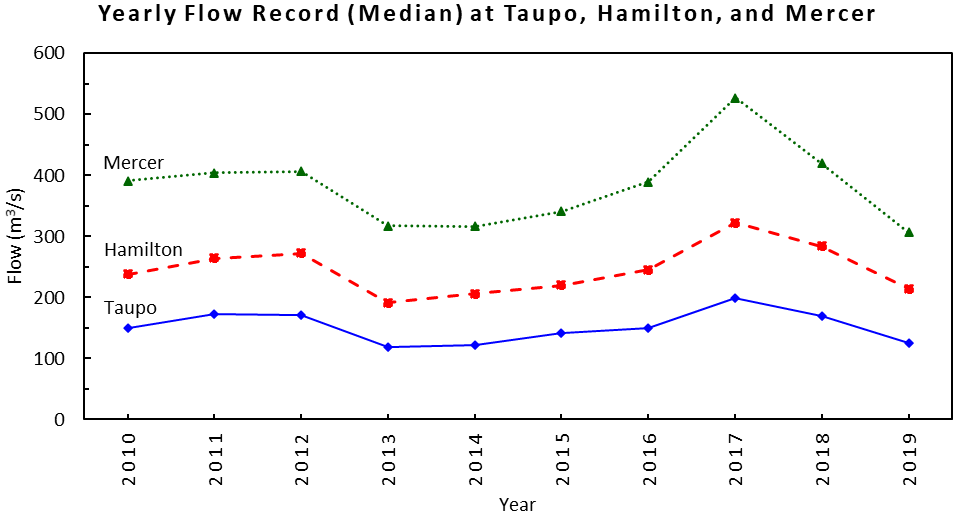
Median Flows of the Waikato River and Main Tributaries

	DISTANCE	FLOW RATE+ (m^3/s)										10 YEAR
Location	km	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	MEDIAN
Taupo	4.2	149	173	171	119	123	142	149	199	169	125	149
Ohakuri	75.8	185	209	205	149	152	172	183	246	214	155	184
Whakamaru	105.0	196	231	222	160	160	180	192	257	222	165	194
Waipapa	126.1	217	246	242	177	176	194	206	280	242	186	212
Karapiro	166.7									266	209	238
Hamilton	211.5	238	264	272	191	206	220	245	323	284	214	242
Huntly	246.5	359	394	391	292	284	317	345	470	381	280	352
Rangiriri	262.3									396	292	344
Mercer	286.3	392	404	407	317	317	341	389	527	420	307	390
Waiotapu Stm	46.6	3.8	4.5	3.8	2.8	2.6	2.8	3.3	5.2	4.4	3.0	3.6
Waipa River	232.7	86	92	95	69	69	75	86	113	84	57	85

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

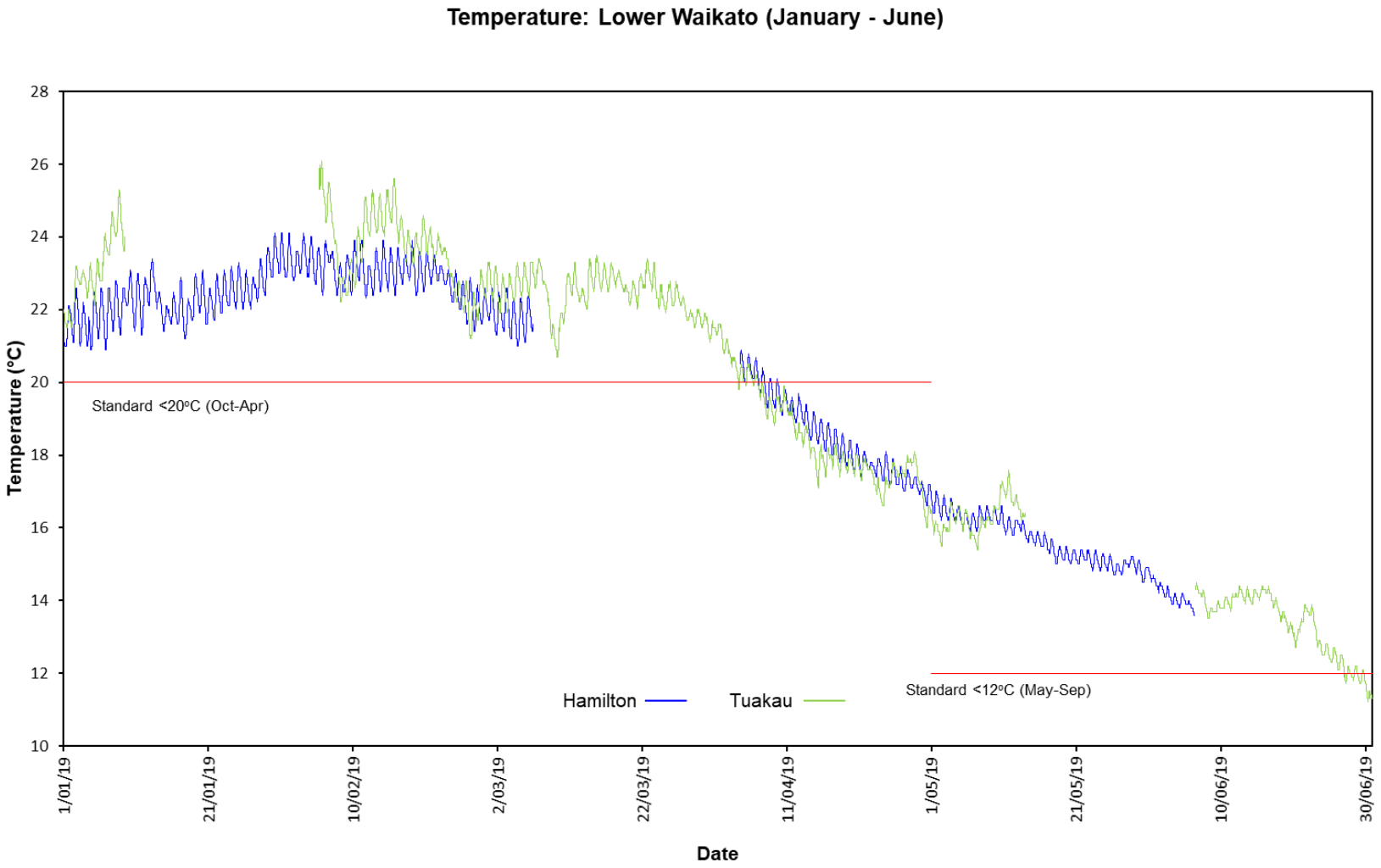
[+]Historical flow data updated due to rating changes from updated data received



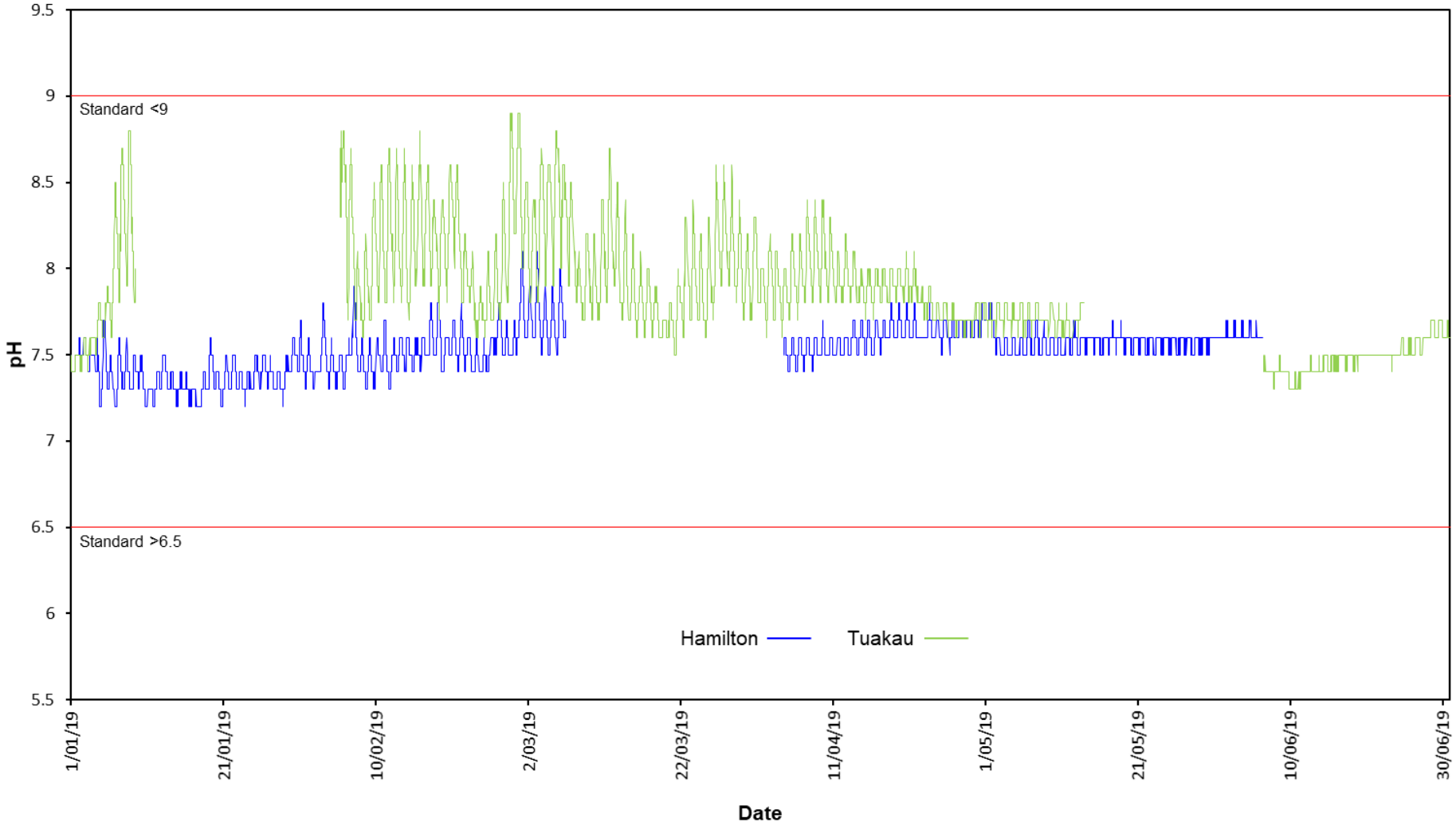


Appendix II

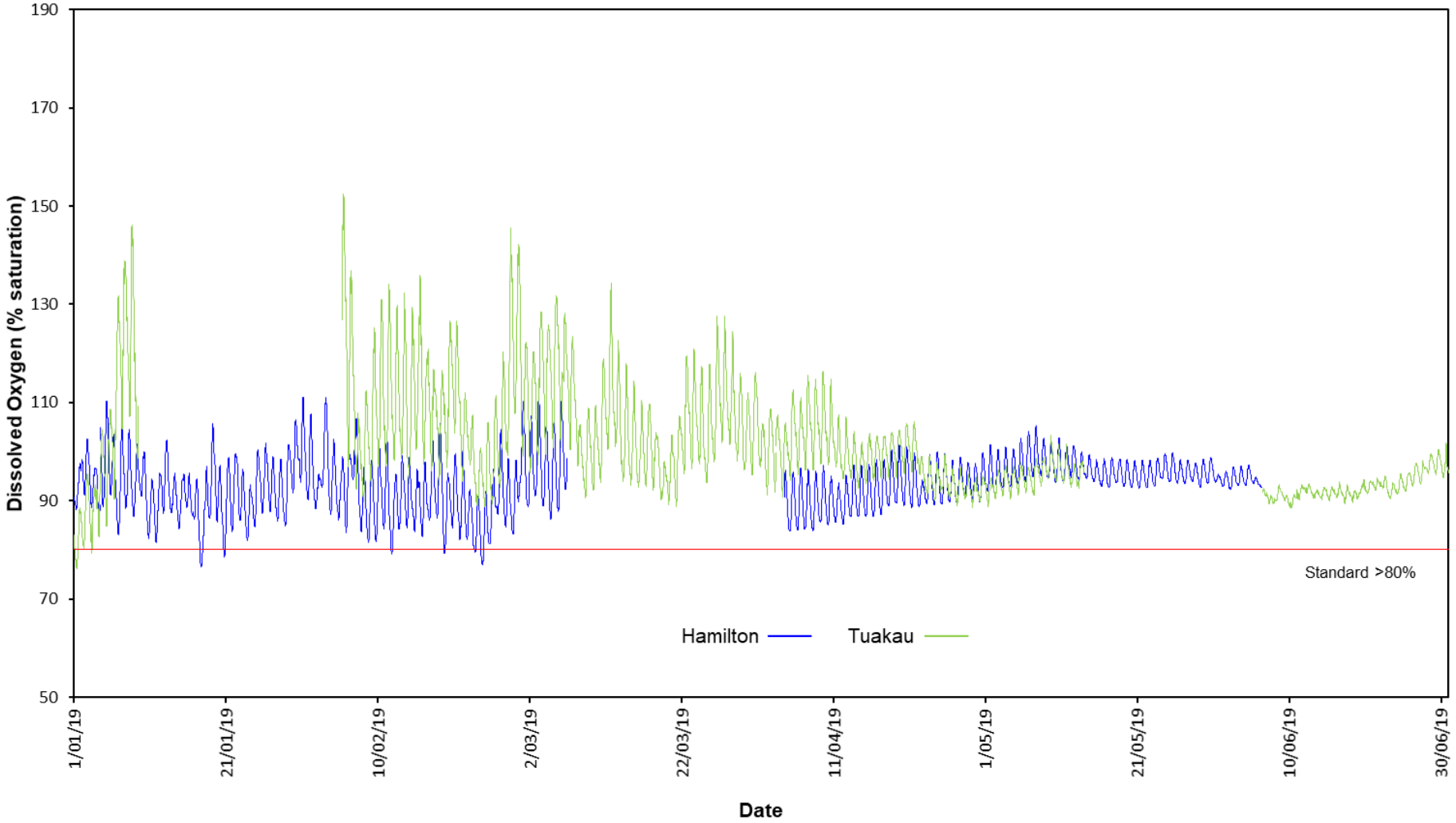
Datasonde deployments: selected water quality parameters



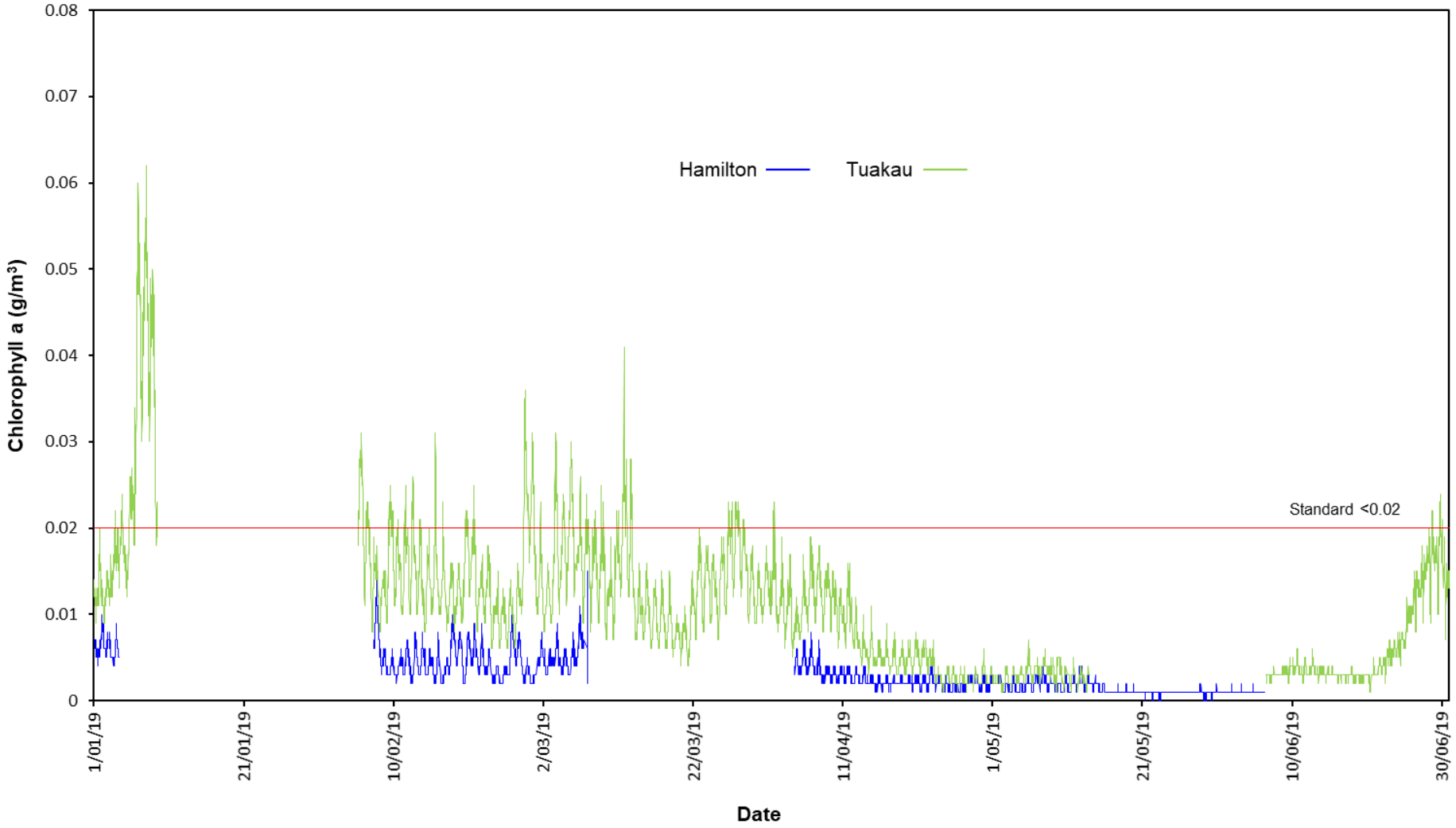
pH: Lower Waikato (January - June)



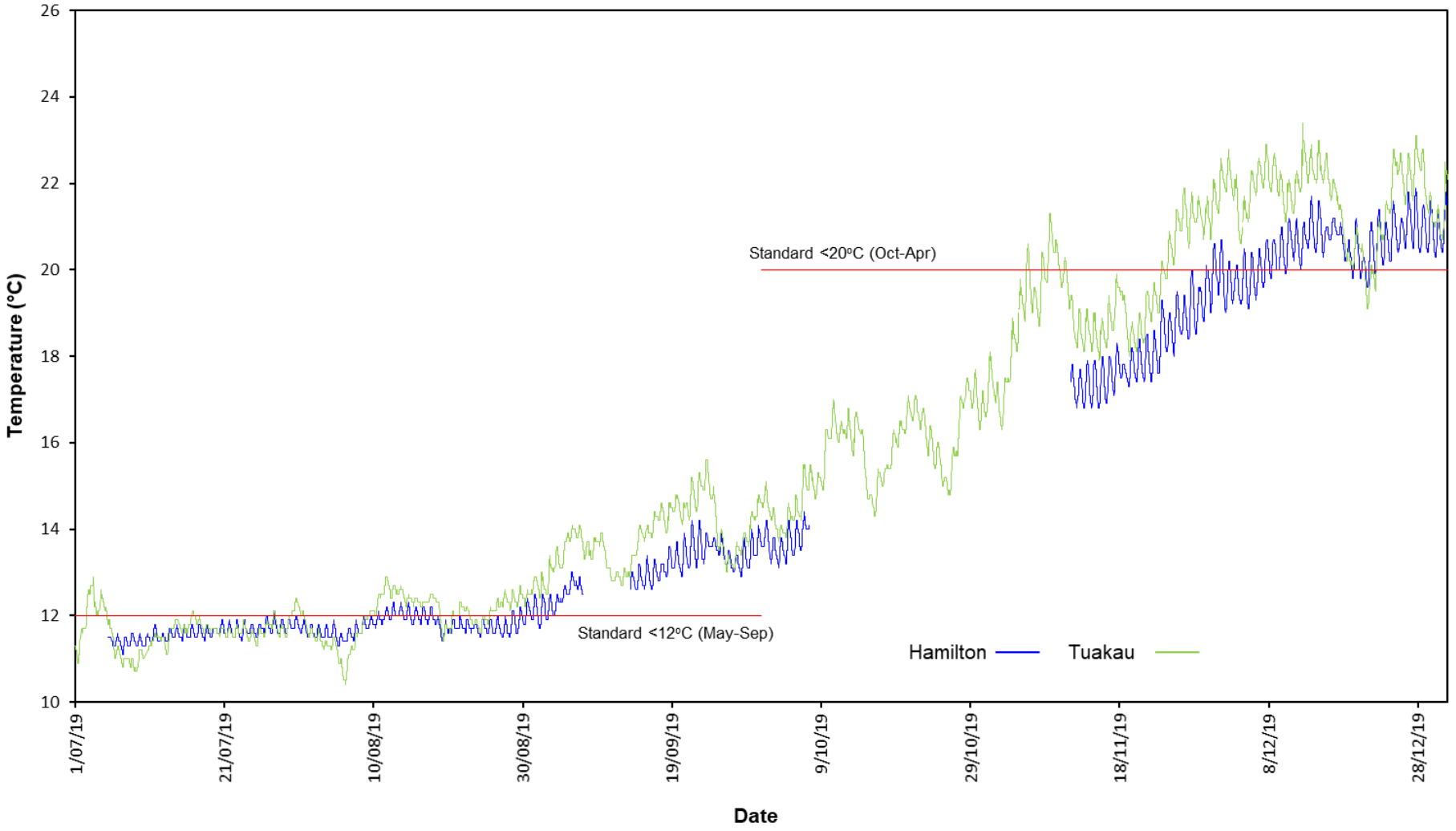
Dissolved Oxygen (% saturation): Lower Waikato (January - June)



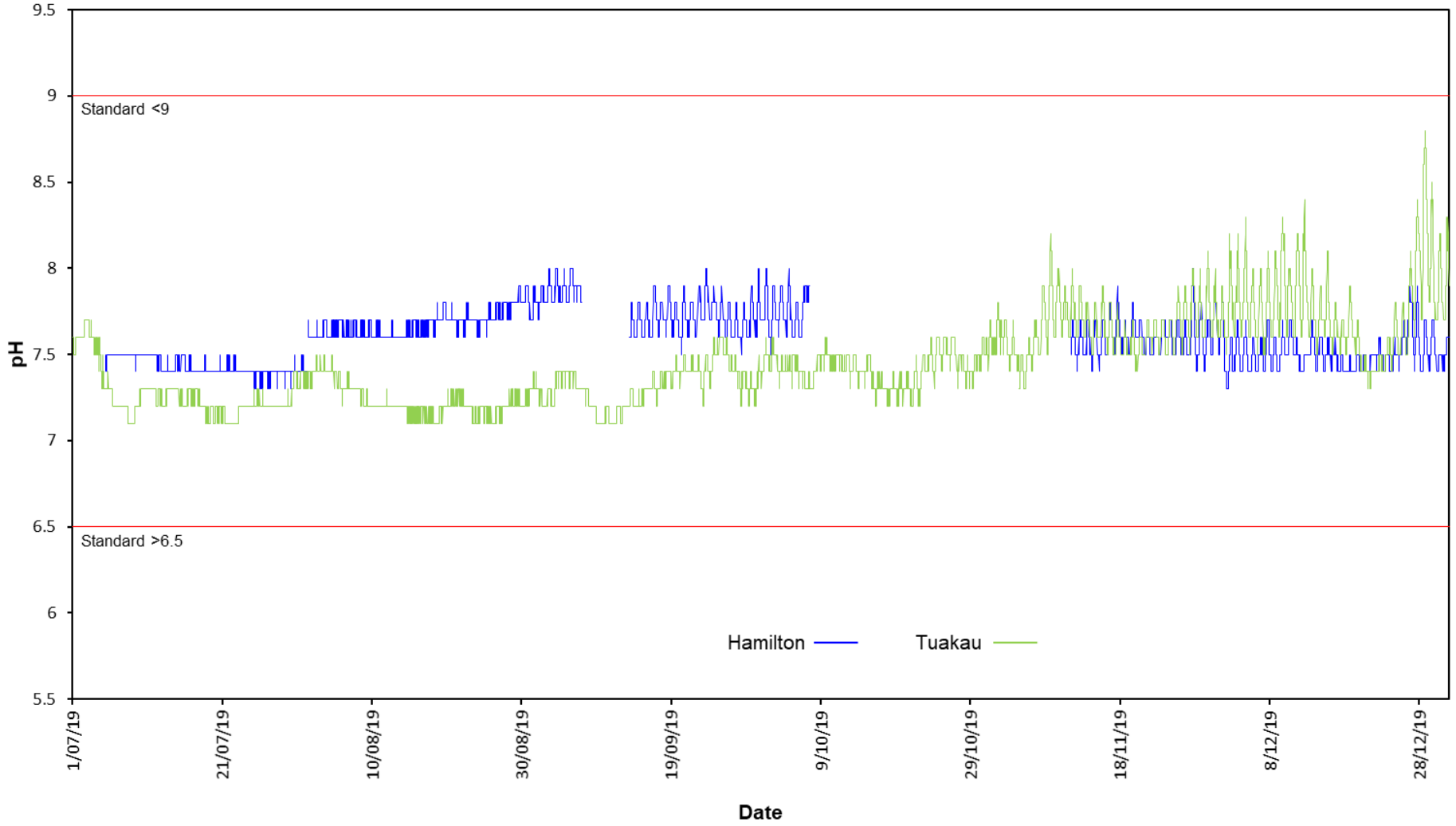
Chlorophyll a: Lower Waikato (January - June)

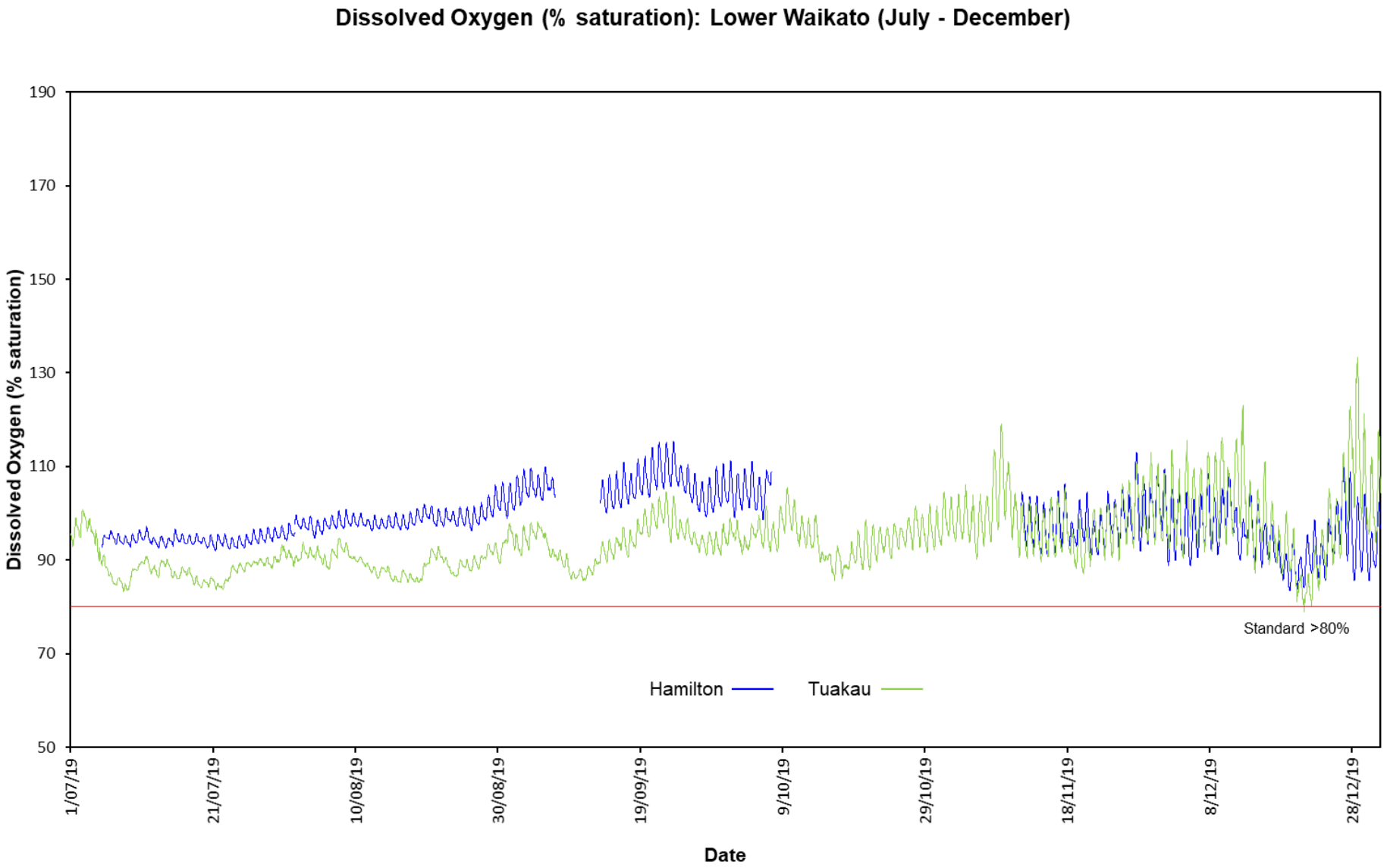


Temperature: Lower Waikato (July - December)

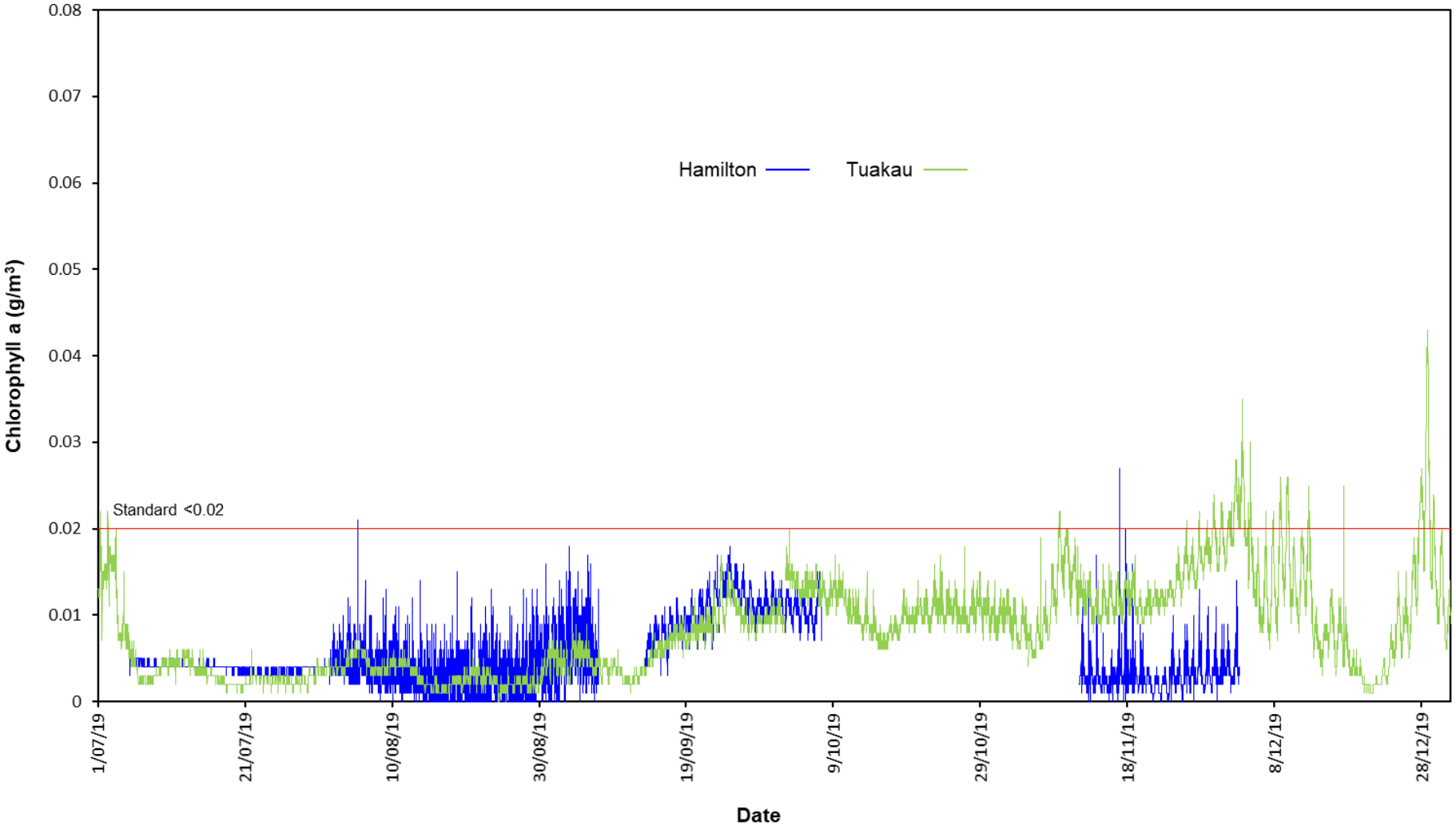


pH: Lower Waikato (July - December)




Dissolved Oxygen (% saturation): Lower Waikato (July - December)
Dissolved Oxygen (% saturation)
190
170
150
130
110
90
70
50
1/07/19
21/07/19
10/08/19
30/08/19
19/09/19
9/10/19
29/10/19
18/11/19
8/12/19
28/12/19
Date
Standard >80%
Hamilton
Tuakau

Chlorophyll a: Lower Waikato (July - December)



Appendix III

Water quality parameters

Guidelines and standards

Analytical methods

Waikato River water quality 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	- aesthetic appearance	Turbidity	routine
- turbidity	- light availability for excessive plant growth	Black disk	routine (field)
- black disk (visual clarity)	- aquatic life protection		
	- indicator of catchment condition, land use		
Colour	- aesthetic appearance	Munsell colour	routine (field)
- light absorption	- light availability for excessive plant growth	Absorbance at:	routine
	- indicator of presence of organic matter	340,440,780nm	
Nutrients (N and P)	- enrichment, excessive plant growth	NO_3-N+NO_2-N	routine
chlorophyll *a*	- 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	- indicator of pollution with faecal matter	E. Coli	routine
- E. coli	- disease risk for swimming etc.	ENT	routine
- enterococci		FC	routine
- faecal coliforms			

[1] see last page of Appendix III for the meaning of the abbreviations.
[2] routine means sampled monthly.

Guidelines and standards

Details of water quality guidelines and standards 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).

Analytical methods

Waikato River monitoring programme - water quality parameters and analytical methods

Id[1]	Parameter	Short name[2]	Method
A340F	Absorbance (340nm)	A340F	Spectrophotometer, 1 cm path length, APHA method 5910B
A440F	Absorbance (440nm)	A440F	Spectrophotometer, 1 cm path length, APHA method 5910B
A780F	Absorbance (780nm)	A780F	Spectrophotometer, 1 cm path length, APHA method 5910B
Arsenic	Arsenic	As	Nitric acid digestion, ICP-MS, APHA method 3125 B / USEPA 200B, uses Tt or TR if Tr not available or average if both available
BDisk	Black Disk	BDisk	Field measurement, horizontal water transparency (20mm, 60mm, 100mm, 200mm disk) in river or trough (20mm only)
BOD5Dil	Biochemical Oxygen Demand 5 day	BOD-5d	Incubation 5 days at 20°C , DO-meter, No nitrification inhibitor added, unseeded, APHA method 5210 B
Boron	Boron	B	ICP-MS, APHA method 3125 B. Uses either TR or Tt or average if both available
CHLA	Chlorophyll *a*	CHL*a*	Acetone extraction. Spectroscopy. APHA method 10200 H (modified)
Cl Diss	Chloride Dissolved	CL	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed.
Colour Munsell	Colour (Munsell)	Colour	Field measurement, Munsell colour patches
DO	Dissolved Oxygen	DO	Field measurement (Hach DO meter, model HQ 30d)
DO_Percent	Dissolved Oxygen	DO%	Field measurement (Hach DO meter, model HQ 30d)
DOC	Dissolved Organic Carbon	DOC	Filtration, acidification, purging to remove inorganic C, persulphate oxidation, IR detection. APHA method 5310 C (modified)
DRP	Dissolved Reactive Phosphorus	DRP	Filtration, Molybdenum Blue Colorimetry. Discrete analyser. APHA 4500 PE (modified)
EC25	Conductivity at 25 DegC	Cond	ab Meter @ 25°C. APHA method 2510B
EColi	*Escherichia coli*	*E coli*	Membrane Filtration (mFC Agar) confirmation by MUG Agar. APHA method 9222 G
ENT	Enterococci	ENT.	Membrane Filtration (mE Agar) confirmation by EIA Agar. APHA method 9230 C
FColi	Faecal Coliforms	F coli	Membrane Filtration (mFC Agar). APHA method 9222 D
Flow	Flow	Flow	Calculated from rating curve ± 8%
Li	Lithium	Li	ICP-MS, method APHA 3125 B
NH4	Ammoniacal Nitrogen	NH_4N	Filtration, Phenol/Hypochlorite Colorimetry. Discrete analyser. APHA method 4500-NH3 F (modified).
NitriteNitrogen	Nitrite Nitrogen	NO_3-N	Calculation: (Nitrate-N + Nitrite - N) - Nitrite - N
NNN	Nitrate/Nitrite Nitrogen	NNN	Automated Cadmium reduction. Flow injection analyser. APHA method 4500 - NO3-I (modified).
pH	pH	pH	Lab Meter @ 25°C. APHA method 4500-H^+ B
TDSMisc	Total Dissolved Solids	TDS	Filtration, gravimetric. APHA 2540 C (modified)
TKN	Total Kjeldahl Nitrogen	TKN	Acid digestion. Phenol/Hypochlorite colorimetry. Discrete analyser. APHA method 4500-Norg D
TN	Total Nitrogen	TN	Calculated from NNN + TKN (Nitrite/Nitrate Nitrogen + Total Kjeldahl-Nitrogen)
TOC	Total Organic Carbon	TOC	Acidification, purging to remove inorganic C, persulphate oxidation, IR detection. APHA method 5310 C (modified)
TP	Total Phosphorus	TP	Acid persulphate digestion, Colorimetry. Discrete Analyser. APHA method 4500-P B E (modified). Also modified to include the use of reductant to eliminate interference from arsenic present in the sample. NAWASCA Pub 38, 1982
Turb_NTU	Turbidity	Turb	Turbidity Meter Hach 2100N. APHA method 2130 B
WT	Water Temperature	Temp	Field measurement (Hach DO meter, model HQ 30d)

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

[2]Water quality parameter short name used in this report

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

ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy