

Waikato River water quality monitoring programme: Data report 2020

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1 Introduction

1.1 Background

This report covers the calendar year of 2020 and follows the format of the previous data report (Bates & Tulagi, 2019).

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 30th 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 2020 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 2020 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 2020.
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 2020 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 2020. 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 2020 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
Dissolved Oxygen (mg/L)	aquatic life (stress)	>5	>8
pH	aquatic life (acidity)	6.5-9	7-8
Turbidity (NTU)	plant life (clarity)	<5	<2
Ammoniacal Nitrogen (g/m ³)	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/m ³)	nuisance plant growth	<0.04	<0.01
Total Nitrogen (g/m ³)	nuisance plant growth	<0.5	<0.1
Human uses - recreation			
Black Disk (m)	visibility	>1.6	>4
<i>Escherichia coli</i> (✓100ml)	human health	<550	<55
Median <i>Escherichia coli</i> (✓100ml)	human health	<126	<23
Human uses - water supply			
Chlorophyll <i>a</i> (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	-

¹Refer 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, the daytime samples are generally collected at higher than median flows. One month of data was missed due to Covid-19 lockdown measures (April 2020).

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*.

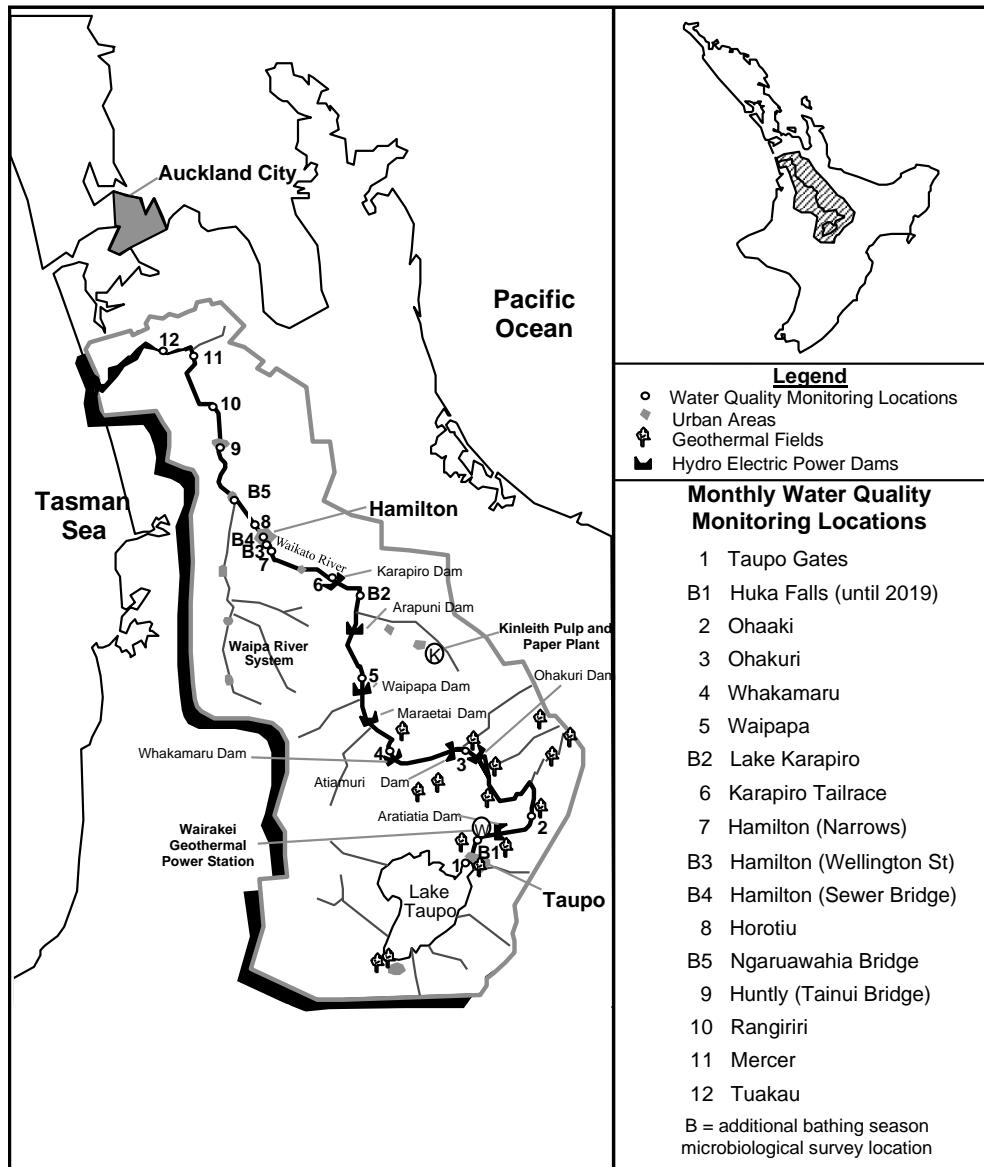


Figure 1: Waikato River water quality monitoring locations

Twelve locations along the river are visited monthly (Taupo, Ohaaki, Ohakuri, Whakamaru, Waipapa, Karapiro, Hamilton-Narrows, Hamilton-Horotiu, Huntly, Rangiriri, Mercer and Tuakau). An additional four locations are included for the summer intensive microbiological survey (see Figure 1 and Table 2), the results of which are reported to LAWA for public access. 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 beach water quality monitoring sites

Location number	Distance ¹ (km)	Location name	Location coordinate (NZTM)
1131-127	0.1	Taupo Gates	1867049, 5714142
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 2019/20 summer.

^d datasonde deployment sites.

* 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).

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 them are analysed in a laboratory using standard analytical methods. Details of field measurements and analytical methods used are included in *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 2020

Absorbance (340nm) (/cm)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.001	0.001	0.001	0.003	0.000	3.32	0.001
Ohaaki Br	11	0.004	0.004	0.002	0.007	0.001	1.20	0.004
Ohakuri Tailrace Br	11	0.006	0.005	0.004	0.010	0.002	1.64	0.006
Whakamaru Tailrace	11	0.007	0.007	0.005	0.011	0.003	0.76	0.007
Waipapa Tailrace	11	0.010	0.009	0.005	0.017	0.005	0.83	0.010
Karapiro Tailrace	11	0.010	0.010	0.006	0.012	0.002	-0.72	0.010
Narrows Boat Ramp	11	0.011	0.010	0.006	0.014	0.003	-0.37	0.012
Horotiu Br	11	0.012	0.012	0.007	0.016	0.002	-0.07	0.012
Huntly-Tainui Br	11	0.016	0.016	0.010	0.028	0.008	0.90	0.019
Rangiriri Br	11	0.017	0.017	0.011	0.024	0.006	0.34	0.018
Mercer Br	11	0.017	0.016	0.010	0.025	0.008	0.11	0.021
Tuakau Br	11	0.021	0.019	0.010	0.032	0.017	0.09	0.024

Absorbance (440nm) (/cm)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.001	0.001	0.001	0.001	0.000	0.00	0.001
Ohaaki Br	11	0.001	0.001	0.001	0.001	0.000	0.00	0.001
Ohakuri Tailrace Br	11	0.001	0.001	0.001	0.002	0.000	3.32	0.001
Whakamaru Tailrace	11	0.001	0.001	0.001	0.002	0.001	0.66	0.001
Waipapa Tailrace	11	0.002	0.001	0.001	0.004	0.001	1.37	0.002
Karapiro Tailrace	11	0.002	0.002	0.001	0.003	0.001	0.59	0.002
Narrows Boat Ramp	11	0.002	0.002	0.001	0.003	0.002	-0.19	0.002
Horotiu Br	11	0.002	0.002	0.001	0.004	0.002	0.05	0.003
Huntly-Tainui Br	11	0.003	0.003	0.001	0.006	0.003	0.17	0.004
Rangiriri Br	11	0.003	0.003	0.001	0.005	0.001	-0.61	0.004
Mercer Br	11	0.003	0.004	0.001	0.005	0.002	-0.48	0.004
Tuakau Br	11	0.004	0.004	0.001	0.006	0.003	-0.32	0.005

Arsenic (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.012	0.012	0.012	0.013	0.001	0.22	0.012
Ohaaki Br	11	0.024	0.022	0.016	0.034	0.009	0.63	0.020
Ohakuri Tailrace Br	11	0.027	0.026	0.024	0.035	0.004	0.88	0.026
Whakamaru Tailrace	11	0.026	0.027	0.022	0.028	0.003	-1.19	0.027
Waipapa Tailrace	11	0.022	0.023	0.019	0.026	0.003	0.23	0.022
Karapiro Tailrace	11	0.021	0.021	0.016	0.028	0.007	0.47	0.021
Narrows Boat Ramp	11	0.021	0.021	0.017	0.028	0.007	0.52	0.020
Horotiu Br	11	0.020	0.020	0.016	0.026	0.007	0.30	0.020
Huntly-Tainui Br	11	0.016	0.016	0.011	0.023	0.007	0.52	0.016
Rangiriri Br	11	0.017	0.017	0.012	0.021	0.005	0.27	0.017
Mercer Br	11	0.016	0.016	0.011	0.023	0.006	0.56	0.015
Tuakau Br	11	0.015	0.016	0.012	0.024	0.006	0.93	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 Control Gates	11	0.0	0.0	0.0	0.0	0.0	0.00	0.0
Ohaaki Br	11	5.4	5.4	3.5	6.4	1.0	-1.07	5.1
Ohakuri Tailrace Br	11	2.7	2.5	1.9	3.8	1.1	0.48	2.5
Whakamaru Tailrace	11	2.7	2.7	1.3	3.9	1.5	0.06	2.4
Waipapa Tailrace	11	2.2	2.2	0.0	3.9	0.8	-0.52	2.2
Karapiro Tailrace	11	1.9	1.9	1.5	2.5	0.5	0.37	1.9
Narrows Boat Ramp	11	2.0	1.9	1.0	2.9	0.5	0.18	1.8
Horotiu Br	11	1.6	1.4	1.0	2.3	0.6	0.53	1.5
Huntly-Tainui Br	11	1.1	1.0	0.7	1.5	0.5	0.31	0.9
Rangiriri Br	11	1.0	0.9	0.5	1.4	0.3	0.34	0.9
Mercer Br	11	0.8	0.8	0.5	1.1	0.4	0.19	0.2
Tuakau Br	11	0.8	0.8	0.5	1.2	0.3	0.66	0.7

Conductivity at 25 DegC (mS/m)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	11.9	11.9	11.5	12.3	0.5	0.10	12.0
Ohaaki Br	11	15.0	14.2	12.9	18.3	2.8	0.93	14.2
Ohakuri Tailrace Br	11	16.2	15.8	15.3	18.1	1.5	0.96	15.7
Whakamaru Tailrace	11	16.3	16.4	15.0	17.6	1.6	0.01	15.8
Waipapa Tailrace	11	15.5	15.7	14.5	16.8	1.4	0.16	15.4
Karapiro Tailrace	11	15.4	15.2	14.3	17.0	1.1	0.77	15.1
Narrows Boat Ramp	11	15.6	15.6	14.2	17.2	1.0	0.21	15.0
Horotiu Br	11	16.2	15.4	14.8	22.9	1.2	2.78	15.2
Huntly-Tainui Br	11	15.0	14.5	13.2	16.8	1.9	0.40	14.4
Rangiriri Br	11	15.5	15.3	14.0	17.1	1.8	0.29	15.0
Mercer Br	11	15.6	15.5	14.4	17.2	1.9	0.40	14.9
Tuakau Br	11	16.1	16.2	14.2	18.4	1.9	0.26	15.2

Dissolved Oxygen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	9.8	9.8	8.8	10.4	0.9	-0.41	9.9
Ohaaki Br	11	9.7	9.6	8.5	11.4	1.3	0.56	10.0
Ohakuri Tailrace Br	11	10.0	10.1	9.0	11.3	1.4	0.28	9.9
Whakamaru Tailrace	11	9.8	9.8	8.4	11.1	1.5	0.02	9.8
Waipapa Tailrace	11	9.7	9.8	8.5	11.0	1.7	0.23	9.9
Karapiro Tailrace	11	9.7	9.8	8.2	11.3	1.4	0.07	9.8
Narrows Boat Ramp	11	9.5	9.9	7.8	11.2	2.0	-0.43	9.7
Horotiu Br	11	9.5	9.6	7.7	11.2	1.5	-0.40	9.6
Huntly-Tainui Br	11	9.5	9.7	8.3	10.8	1.3	-0.19	9.5
Rangiriri Br	11	9.5	9.7	8.5	10.9	1.3	0.14	9.5
Mercer Br	11	9.7	9.8	8.8	10.7	0.8	0.16	9.4
Tuakau Br	11	9.8	9.8	9.0	10.3	0.2	-0.81	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 Control Gates	11	101.6	101.8	98.2	106.9	3.6	0.52	102.0
Ohaaki Br	11	102.8	102.3	97.4	110.7	5.9	0.53	104.0
Ohakuri Tailrace Br	11	104.9	105.8	93.6	114.8	8.0	-0.36	103.0
Whakamaru Tailrace	11	102.6	100.6	92.7	113.8	9.6	0.24	103.0
Waipapa Tailrace	11	99.9	98.8	91.6	107.1	8.4	-0.17	102.0
Karapiro Tailrace	11	98.1	96.2	90.3	109.5	8.8	0.67	97.0
Narrows Boat Ramp	11	95.6	95.3	85.7	104.3	10.7	0.13	97.0
Horotiu Br	11	96.0	95.5	88.8	103.6	8.8	0.06	96.0
Huntly-Tainui Br	11	96.9	94.9	93.3	100.9	5.5	0.23	95.0
Rangiriri Br	11	96.4	94.2	92.0	101.5	8.0	0.34	95.0
Mercer Br	11	99.2	97.5	93.0	109.9	8.4	0.76	95.0
Tuakau Br	11	100.8	98.9	91.3	115.4	13.1	0.53	96.0

Enterococci (/100ml)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	6	5	1	10	5	-0.21	4
Ohaaki Br	11	36	10	5	150	33	1.82	10
Ohakuri Tailrace Br	11	5	5	1	7	0	-1.65	5
Whakamaru Tailrace	11	9	10	1	20	5	0.89	9
Waipapa Tailrace	11	10	5	5	30	3	1.86	5
Karapiro Tailrace	11	13	10	5	40	13	1.89	8
Narrows Boat Ramp	11	61	50	5	170	70	0.93	47
Horotiu Br	11	109	80	20	440	109	2.42	80
Huntly-Tainui Br	11	57	40	5	130	67	0.60	60
Rangiriri Br	11	204	40	5	1500	98	3.02	50
Mercer Br	11	49	12	5	170	72	1.42	35
Tuakau Br	11	59	40	5	190	30	1.68	40

Escherichia coli (/100ml)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	7	5	4	20	1	2.02	5
Ohaaki Br	11	61	40	10	250	40	2.47	27
Ohakuri Tailrace Br	11	8	5	2	20	5	1.33	5
Whakamaru Tailrace	11	60	10	5	490	16	3.19	10
Waipapa Tailrace	11	15	10	5	42	20	1.31	10
Karapiro Tailrace	11	31	10	5	200	14	3.04	10
Narrows Boat Ramp	11	108	50	20	420	45	1.88	50
Horotiu Br	11	165	100	30	800	143	2.76	110
Huntly-Tainui Br	11	155	120	40	370	218	0.89	140
Rangiriri Br	11	250	130	50	1200	150	2.70	130
Mercer Br	11	117	70	10	350	133	1.30	100
Tuakau Br	11	126	70	30	320	132	1.19	130

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 Control Gates	11	8	5	5	23	1	1.96	5
Ohaaki Br	11	68	42	10	250	51	2.06	37
Ohakuri Tailrace Br	11	8	5	2	20	5	1.35	5
Whakamaru Tailrace	11	62	10	5	500	20	3.19	13
Waipapa Tailrace	11	19	10	5	42	24	0.62	11
Karapiro Tailrace	11	34	10	5	220	21	3.06	10
Narrows Boat Ramp	11	149	70	20	570	83	1.87	60
Horotiu Br	11	201	110	30	900	170	2.65	150
Huntly-Tainui Br	11	214	130	40	580	265	1.17	190
Rangiriri Br	11	294	230	50	1200	180	2.28	180
Mercer Br	11	145	100	10	430	138	1.37	130
Tuakau Br	11	160	80	30	430	195	1.19	150

Nitrite Nitrogen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.001	0.001	0.001	0.001	0.000	0.00	0.001
Ohaaki Br	11	0.001	0.001	0.001	0.001	0.000	0.00	0.001
Ohakuri Tailrace Br	11	0.001	0.001	0.001	0.003	0.001	1.32	0.001
Whakamaru Tailrace	11	0.002	0.002	0.001	0.004	0.001	1.20	0.001
Waipapa Tailrace	11	0.003	0.003	0.001	0.005	0.002	-0.35	0.003
Karapiro Tailrace	11	0.005	0.004	0.002	0.011	0.004	1.35	0.004
Narrows Boat Ramp	11	0.005	0.004	0.002	0.013	0.004	1.70	0.004
Horotiu Br	11	0.005	0.004	0.003	0.012	0.001	2.15	0.004
Huntly-Tainui Br	11	0.004	0.005	0.003	0.006	0.002	0.04	0.005
Rangiriri Br	11	0.004	0.004	0.002	0.005	0.001	-0.18	0.004
Mercer Br	11	0.003	0.003	0.001	0.004	0.001	-0.34	0.003
Tuakau Br	11	0.003	0.003	0.001	0.006	0.001	0.68	0.003

Ammoniacal Nitrogen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.01	0.01	0.01	0.01	0.00	3.32	0.01
Ohaaki Br	11	0.01	0.01	0.01	0.05	0.01	1.64	0.01
Ohakuri Tailrace Br	11	0.01	0.01	0.01	0.02	0.00	1.99	0.01
Whakamaru Tailrace	11	0.01	0.01	0.01	0.03	0.01	1.25	0.01
Waipapa Tailrace	11	0.02	0.03	0.01	0.05	0.02	0.41	0.02
Karapiro Tailrace	11	0.02	0.02	0.01	0.06	0.02	1.33	0.02
Narrows Boat Ramp	11	0.02	0.02	0.01	0.05	0.02	1.46	0.02
Horotiu Br	11	0.01	0.01	0.01	0.04	0.01	1.42	0.01
Huntly-Tainui Br	11	0.01	0.01	0.01	0.02	0.01	1.33	0.01
Rangiriri Br	11	0.01	0.01	0.01	0.03	0.01	1.64	0.01
Mercer Br	11	0.01	0.01	0.01	0.01	0.00	3.32	0.01
Tuakau Br	11	0.01	0.01	0.01	0.03	0.00	3.09	0.01

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

Total Kjeldahl Nitrogen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.05	0.06	0.03	0.10	0.04	0.21	0.07
Ohaaki Br	11	0.08	0.08	0.03	0.15	0.07	0.31	0.10
Ohakuri Tailrace Br	11	0.11	0.11	0.07	0.16	0.05	0.28	0.12
Whakamaru Tailrace	11	0.15	0.12	0.07	0.31	0.10	1.35	0.15
Waipapa Tailrace	11	0.13	0.14	0.06	0.17	0.02	-1.43	0.15
Karapiro Tailrace	11	0.17	0.17	0.10	0.22	0.03	-0.48	0.17
Narrows Boat Ramp	11	0.17	0.16	0.13	0.23	0.03	0.86	0.17
Horotiu Br	11	0.16	0.14	0.11	0.24	0.06	0.70	0.18
Huntly-Tainui Br	11	0.18	0.17	0.13	0.24	0.06	0.49	0.23
Rangiriri Br	11	0.20	0.18	0.14	0.29	0.08	0.65	0.22
Mercer Br	11	0.21	0.21	0.14	0.29	0.08	0.01	0.27
Tuakau Br	11	0.24	0.23	0.13	0.33	0.08	-0.29	0.31

Total Nitrogen (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.06	0.06	0.03	0.11	0.04	0.33	0.07
Ohaaki Br	11	0.13	0.12	0.06	0.24	0.10	0.70	0.14
Ohakuri Tailrace Br	11	0.20	0.21	0.11	0.26	0.08	-0.56	0.23
Whakamaru Tailrace	11	0.32	0.29	0.19	0.52	0.07	1.07	0.33
Waipapa Tailrace	11	0.39	0.39	0.27	0.54	0.10	0.28	0.39
Karapiro Tailrace	11	0.46	0.47	0.27	0.60	0.16	-0.45	0.47
Narrows Boat Ramp	11	0.50	0.50	0.31	0.66	0.20	-0.07	0.54
Horotiu Br	11	0.50	0.53	0.31	0.63	0.11	-0.77	0.55
Huntly-Tainui Br	11	0.61	0.63	0.34	0.84	0.23	-0.53	0.68
Rangiriri Br	11	0.61	0.59	0.29	0.94	0.28	0.14	0.63
Mercer Br	11	0.61	0.63	0.22	0.91	0.23	-0.34	0.70
Tuakau Br	11	0.64	0.65	0.18	1.05	0.28	-0.22	0.70

pH								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	7.6	7.7	7.0	7.9	0.3	-1.09	7.7
Ohaaki Br	11	7.3	7.3	7.0	8.0	0.4	1.18	7.3
Ohakuri Tailrace Br	11	7.4	7.4	7.0	7.7	0.2	-0.77	7.4
Whakamaru Tailrace	11	7.5	7.5	7.1	7.9	0.3	0.03	7.5
Waipapa Tailrace	11	7.5	7.5	7.1	7.7	0.1	-0.85	7.4
Karapiro Tailrace	11	7.5	7.4	7.2	8.1	0.1	1.90	7.5
Narrows Boat Ramp	11	7.6	7.6	7.3	7.9	0.3	0.04	7.5
Horotiu Br	11	7.6	7.5	7.1	8.1	0.1	0.51	7.5
Huntly-Tainui Br	11	7.4	7.4	7.2	7.7	0.2	0.32	7.4
Rangiriri Br	11	7.5	7.5	7.3	7.7	0.2	-0.42	7.6
Mercer Br	11	7.5	7.4	6.9	8.1	0.4	-0.11	7.5
Tuakau Br	11	7.5	7.5	7.0	8.2	0.3	0.42	7.5

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

Dissolved Reactive Phosphorus (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.003	0.002	0.002	0.007	0.000	1.99	0.002
Ohaaki Br	11	0.007	0.007	0.002	0.010	0.003	-0.73	0.006
Ohakuri Tailrace Br	11	0.007	0.007	0.002	0.015	0.008	0.27	0.008
Whakamaru Tailrace	11	0.011	0.011	0.002	0.019	0.004	-0.25	0.010
Waipapa Tailrace	11	0.016	0.017	0.010	0.022	0.006	0.11	0.014
Karapiro Tailrace	11	0.014	0.015	0.002	0.022	0.010	-0.70	0.013
Narrows Boat Ramp	11	0.015	0.016	0.002	0.024	0.007	-0.78	0.016
Horotiu Br	11	0.016	0.019	0.002	0.024	0.010	-0.88	0.018
Huntly-Tainui Br	11	0.017	0.020	0.006	0.024	0.010	-0.78	0.021
Rangiriri Br	11	0.017	0.021	0.006	0.026	0.011	-0.72	0.016
Mercer Br	11	0.014	0.017	0.006	0.021	0.010	-0.45	0.018
Tuakau Br	11	0.012	0.011	0.006	0.019	0.010	0.12	0.015

Total Phosphorus (g/m ³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.005	0.004	0.002	0.011	0.003	1.60	0.004
Ohaaki Br	11	0.013	0.013	0.008	0.017	0.005	-0.32	0.012
Ohakuri Tailrace Br	11	0.020	0.020	0.015	0.027	0.003	0.54	0.020
Whakamaru Tailrace	11	0.023	0.023	0.016	0.032	0.005	0.30	0.023
Waipapa Tailrace	11	0.028	0.027	0.018	0.042	0.006	0.79	0.027
Karapiro Tailrace	11	0.031	0.032	0.017	0.038	0.009	-0.98	0.028
Narrows Boat Ramp	11	0.031	0.031	0.020	0.048	0.007	0.70	0.030
Horotiu Br	11	0.034	0.035	0.014	0.051	0.009	-0.48	0.034
Huntly-Tainui Br	11	0.039	0.040	0.024	0.056	0.009	0.04	0.042
Rangiriri Br	11	0.044	0.045	0.028	0.071	0.013	1.03	0.046
Mercer Br	11	0.042	0.042	0.026	0.059	0.008	0.43	0.047
Tuakau Br	11	0.042	0.044	0.026	0.058	0.011	0.16	0.047

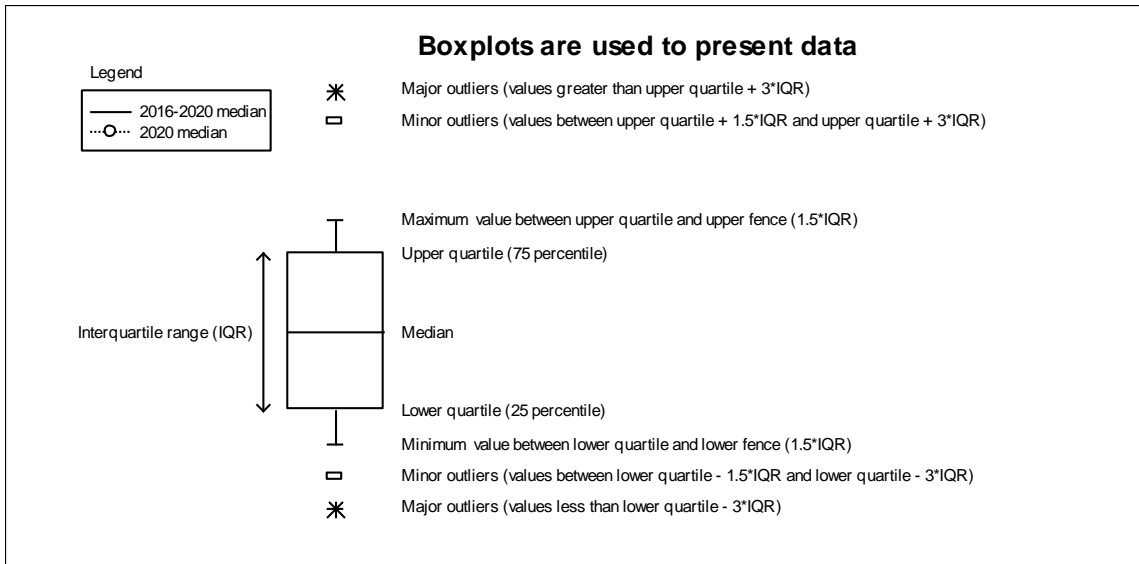
Water Temperature (°C)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	15.2	14.9	10.9	21.2	5.2	0.58	14.9
Ohaaki Br	11	16.4	15.8	11.9	22.0	4.5	0.45	15.8
Ohakuri Tailrace Br	11	16.4	15.5	11.8	23.2	6.6	0.45	15.8
Whakamaru Tailrace	11	16.5	15.3	12.2	22.6	6.6	0.48	16.7
Waipapa Tailrace	11	16.3	15.6	11.9	22.5	6.5	0.50	16.2
Karapiro Tailrace	11	16.3	15.1	12.2	22.4	6.7	0.44	16.3
Narrows Boat Ramp	11	15.9	14.1	11.3	22.1	7.4	0.39	16.0
Horotiu Br	11	16.0	14.8	11.5	22.2	7.4	0.30	16.1
Huntly-Tainui Br	11	16.3	15.5	10.9	22.8	8.7	0.28	16.4
Rangiriri Br	11	16.4	15.6	11.0	23.0	7.6	0.34	15.9
Mercer Br	11	16.7	16.7	10.9	23.0	7.6	0.19	16.8
Tuakau Br	11	17.1	16.5	11.2	23.6	7.2	0.25	16.9

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

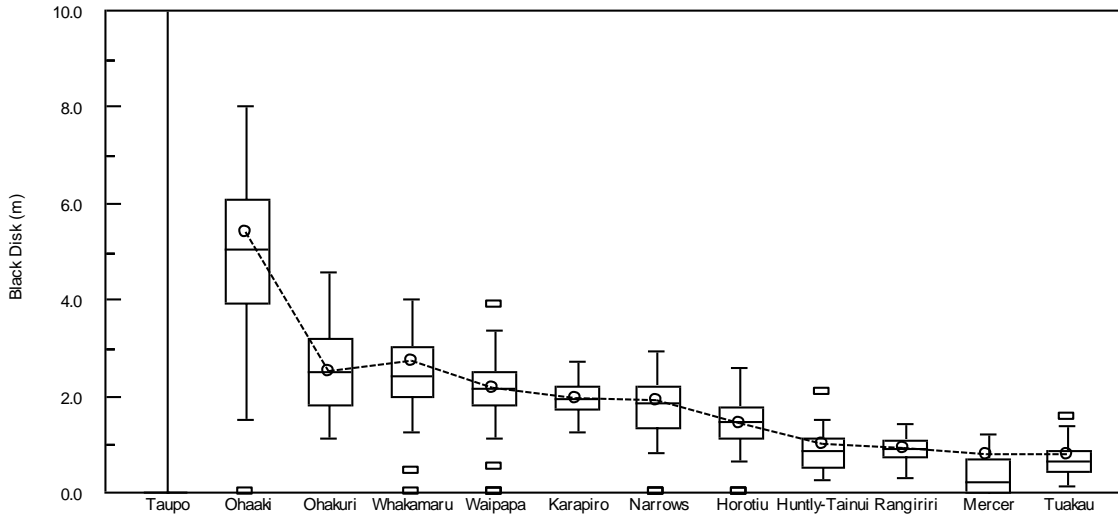
Turbidity (NTU)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 year median
Taupo Control Gates	11	0.4	0.3	0.2	0.8	0.2	1.65	0.4
Ohaaki Br	11	0.6	0.6	0.4	1.2	0.3	1.67	0.8
Ohakuri Tailrace Br	11	1.0	0.8	0.4	1.8	0.7	0.86	1.1
Whakamaru Tailrace	11	1.1	0.9	0.5	2.2	0.9	0.90	1.1
Waipapa Tailrace	11	1.1	1.1	0.6	1.8	0.4	0.63	1.2
Karapiro Tailrace	11	1.6	1.6	0.8	2.0	0.4	-1.17	1.5
Narrows Boat Ramp	11	1.9	1.7	1.0	5.2	0.8	2.69	1.9
Horotiu Br	11	2.5	2.5	1.1	5.0	1.5	1.04	2.4
Huntly-Tainui Br	11	4.6	4.2	1.7	8.8	4.2	0.54	5.3
Rangiriri Br	11	5.6	5.0	2.5	13.3	3.0	1.78	5.7
Mercer Br	11	6.7	7.3	3.4	9.9	4.0	-0.20	8.0
Tuakau Br	11	6.3	6.7	2.7	12.4	4.6	0.60	8.8

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

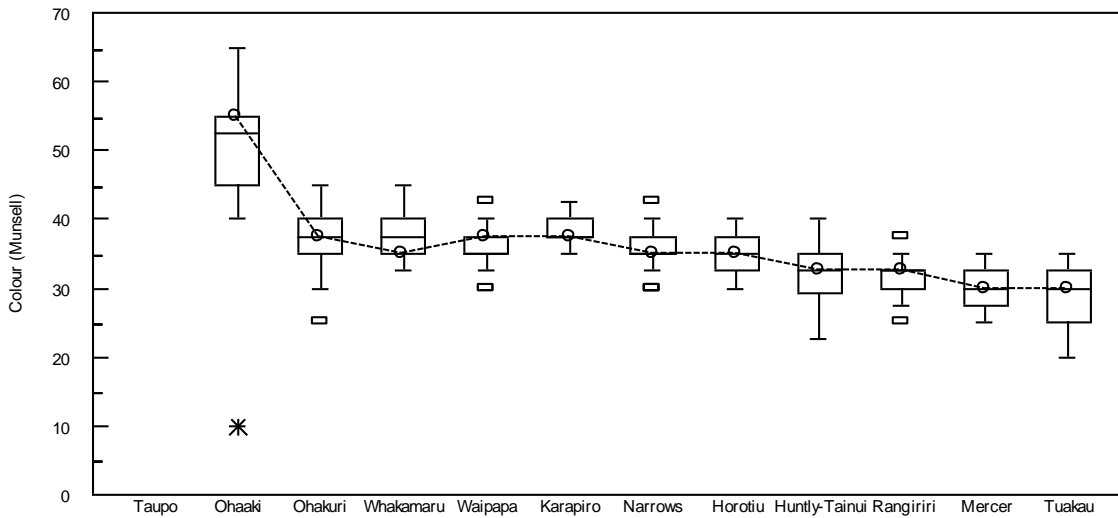
Key parameter graphs



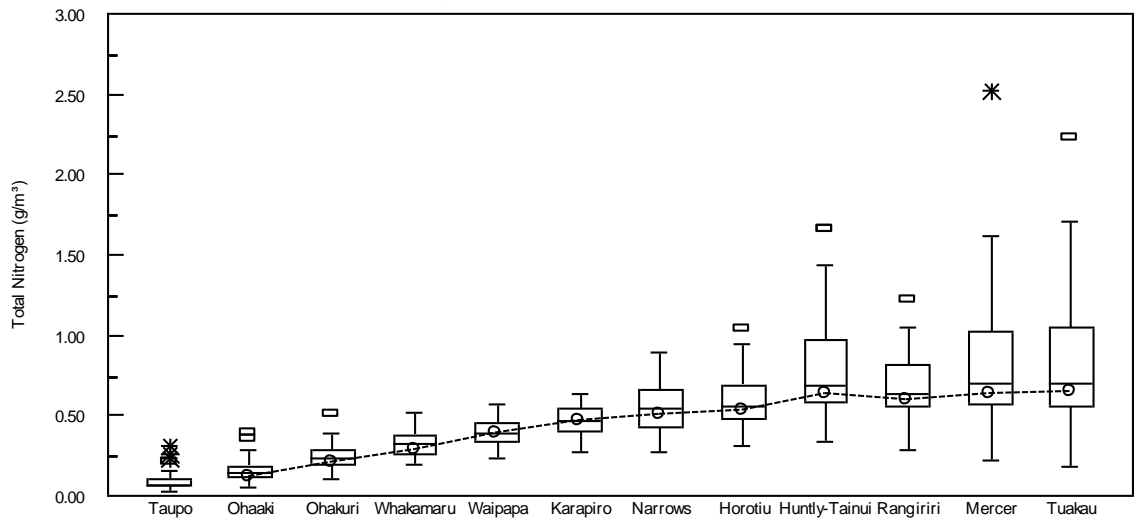
Black Disk, 2016-2020 Data. Dashed line is 2020 median.



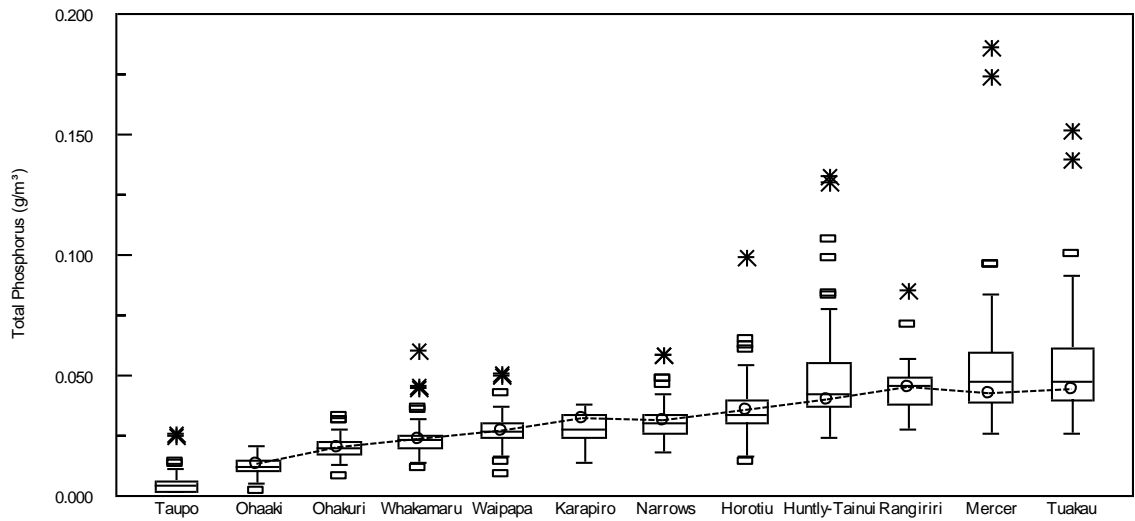
Colour (Munsell), 2016-2020 Data. Dashed line is 2020 median.



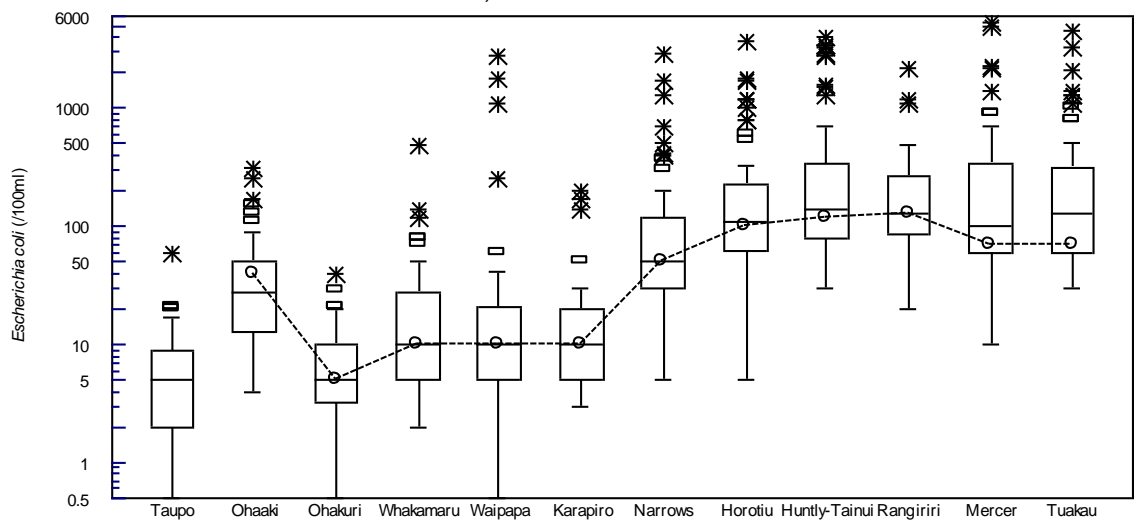
Total Nitrogen, 2016-2020 Data. Dashed line is 2020 median.



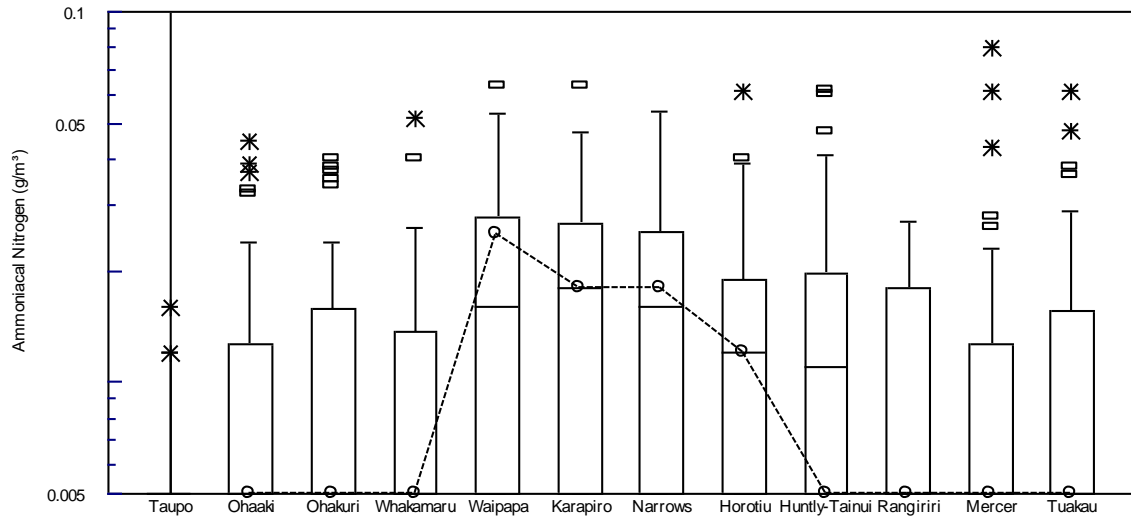
Total Phosphorus, 2016-2020 Data. Dashed line is 2020 median.



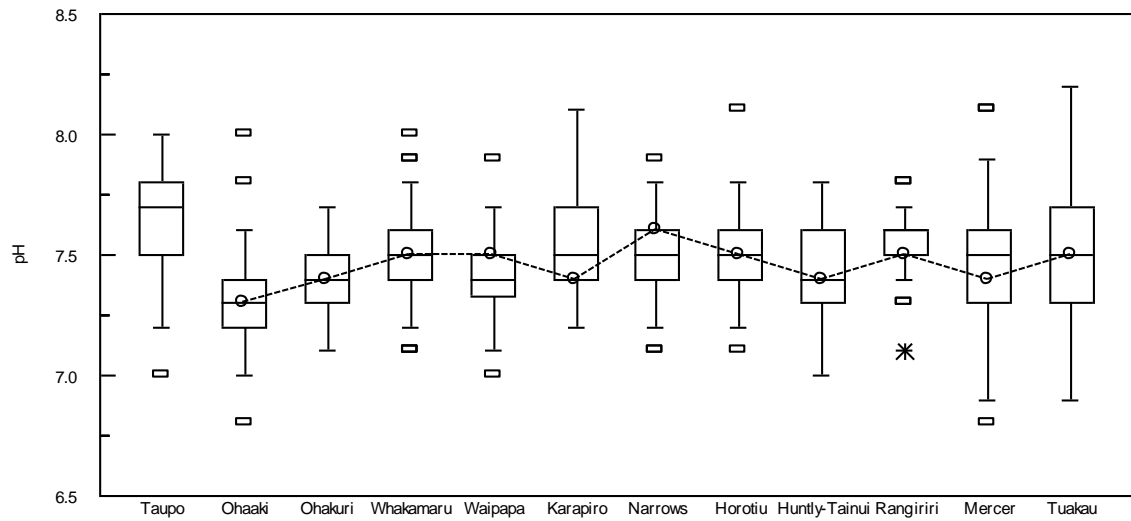
Escherichia coli, 2016-2020 Data. Dashed line is 2020 median.



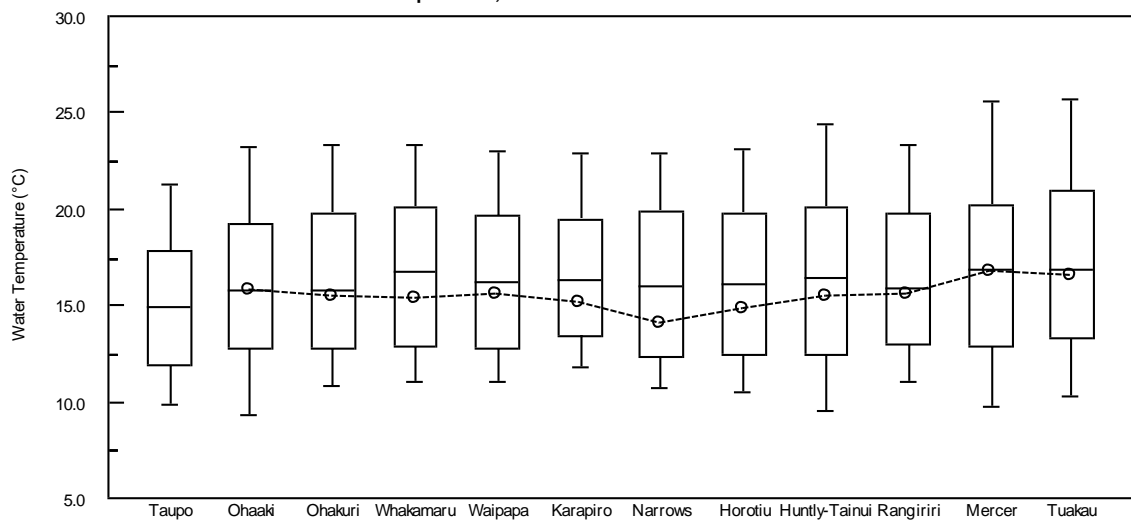
Ammoniacal Nitrogen, 2016-2020 Data. Dashed line is 2020 median.

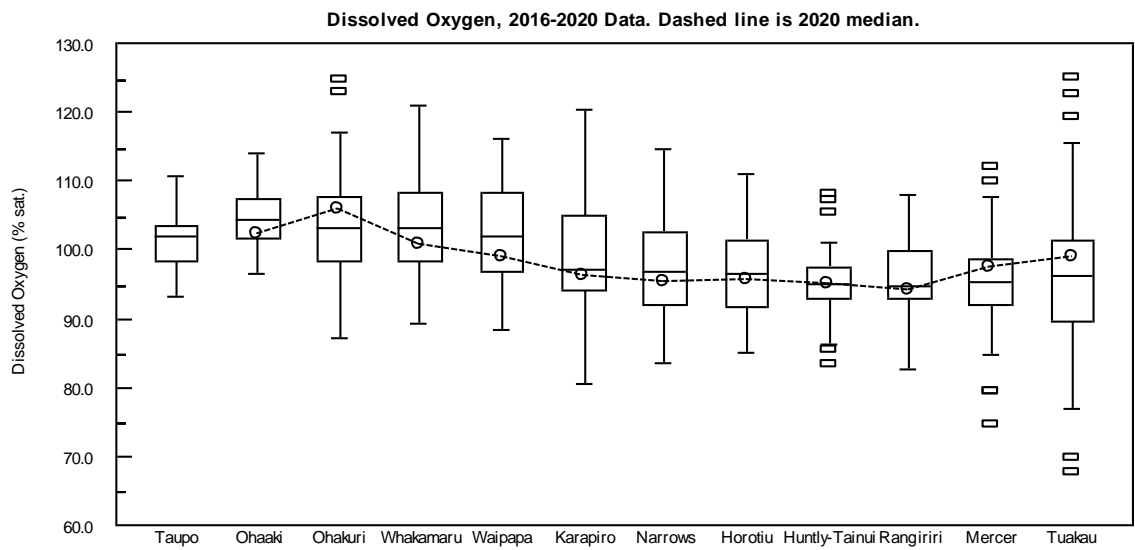
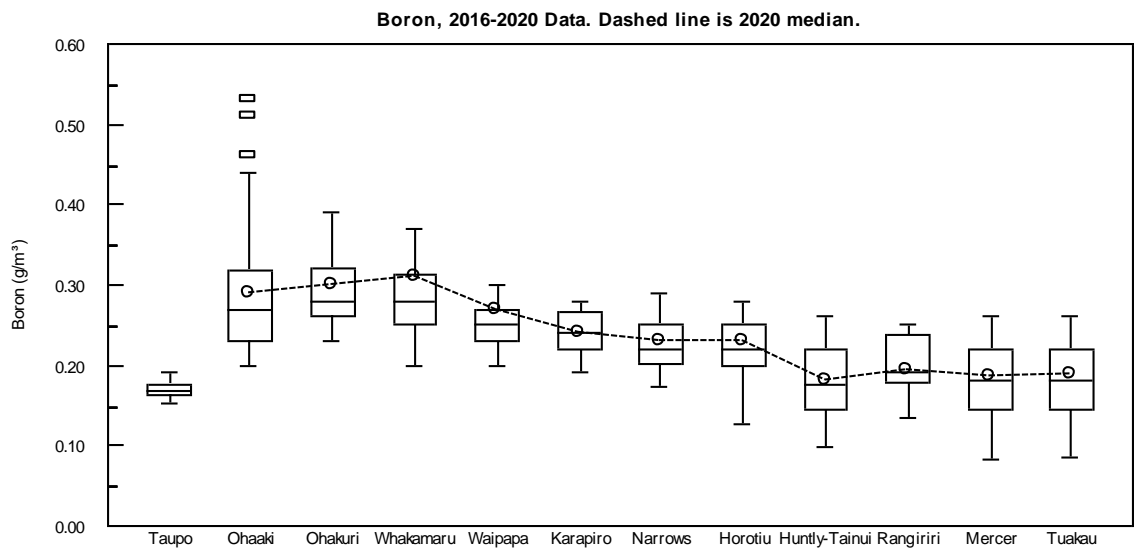
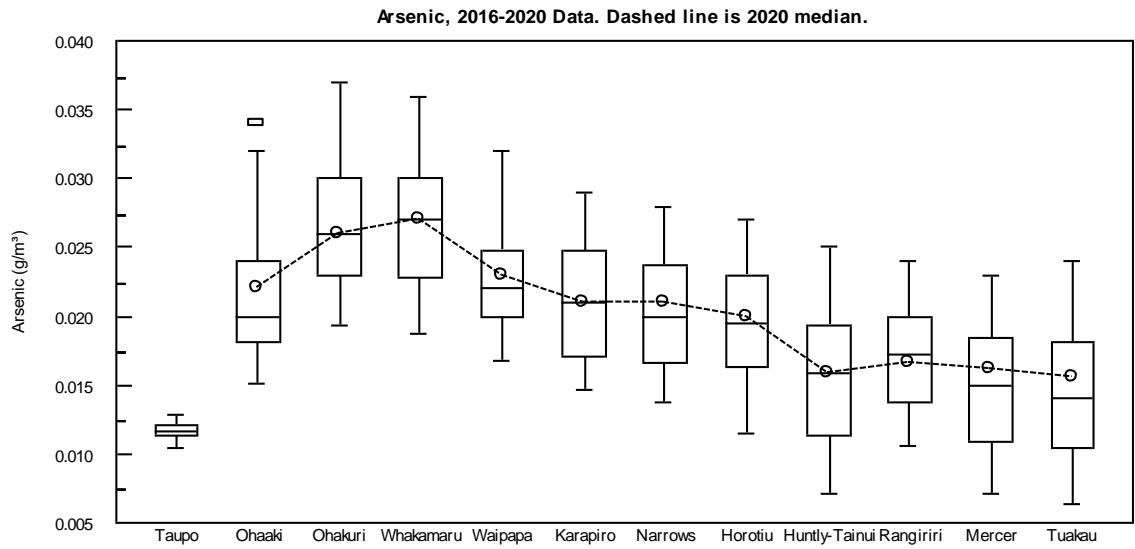


pH, 2016-2020 Data. Dashed line is 2020 median.



Water Temperature, 2016-2020 Data. Dashed line is 2020 median.





Comparison with water quality standards

Table 4: Number of monthly samples (2020) complying with the "satisfactory" water quality guidelines and standards

Location	ECOLOGICAL HEALTH							HUMAN USES					
	DO%	pH	Turb	NH ₄ N	Temp	TP	TN	Recreation			Water supply	Drinking water	
								BDisk	<i>E coli</i>	Median <i>E coli</i>	CHLa	As	B
Taupo Control Gates	11 ¹	11 ¹	11 ¹	11 ¹	7 ¹	11 ¹	11 ¹	-	11 ¹	Y	11 ¹	0 ¹	11 ¹
Ohaaki Br	11 ¹	11 ¹	11 ¹	11 ¹	5 ¹	11 ¹	11 ¹	11/11 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Ohakuri Tailrace Br	11 ¹	11 ¹	11 ¹	11 ¹	5 ¹	11 ¹	11 ¹	11/11 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Whakamaru Tailrace	11 ¹	11 ¹	11 ¹	11 ¹	3 ¹	11 ¹	9 ¹	9/10 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Waipapa Tailrace	11 ¹	11 ¹	11 ¹	11 ¹	5 ¹	10 ¹	10 ¹	10/11 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Karapiro Tailrace	11 ¹	11 ¹	11 ¹	11 ¹	4 ¹	11 ¹	6 ¹	8/10 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Narrows Boat Ramp	11 ¹	11 ¹	10 ¹	11 ¹	7 ¹	10 ¹	5 ¹	8/10 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Horotiu Br	11 ¹	11 ¹	10 ¹	11 ¹	7 ¹	8 ¹	5 ¹	5/11 ¹	10 ¹	Y	11 ¹	0 ¹	11 ¹
Huntly-Tainui Br	11 ¹	11 ¹	7 ¹	11 ¹	6 ¹	5 ¹	3 ¹	0/11 ¹	11 ¹	Y	11 ¹	0 ¹	11 ¹
Rangiriri Br	11 ¹	11 ¹	5 ¹	11 ¹	4 ¹	4 ¹	3 ¹	0/11 ¹	10 ¹	N	10 ¹	0 ¹	11 ¹
Mercer Br	11 ¹	11 ¹	4 ¹	11 ¹	4 ¹	5 ¹	3 ¹	0/11 ¹	11 ¹	Y	9 ¹	0 ¹	11 ¹
Tuakau Br	11 ¹	11 ¹	4 ¹	11 ¹	3 ¹	5 ¹	3 ¹	0/11 ¹	11 ¹	Y	9 ¹	0 ¹	11 ¹

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 (2020) complying with the "excellent" water quality guidelines and standards

Location	ECOLOGICAL HEALTH							HUMAN USES					
	DO%	pH	Turb	NH ₄ N	Temp	TP	TN	Recreation			Water supply	Drinking water	
								BDisk	<i>E coli</i>	Median <i>E coli</i>	CHLa	As	B
Taupo Control Gates	11 ¹	11 ¹	11 ¹	11 ¹	3 ¹	10 ¹	10 ¹	-	11 ¹	Y	11 ¹	n/a	n/a
Ohaaki Br	11 ¹	11 ¹	11 ¹	11 ¹	1 ¹	1 ¹	4 ¹	10/11 ¹	8 ¹	N	11 ¹	n/a	n/a
Ohakuri Tailrace Br	11 ¹	11 ¹	11 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/11 ¹	11 ¹	Y	7 ¹	n/a	n/a
Whakamaru Tailrace	11 ¹	11 ¹	10 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/10 ¹	9 ¹	Y	7 ¹	n/a	n/a
Waipapa Tailrace	11 ¹	11 ¹	11 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/11 ¹	11 ¹	Y	8 ¹	n/a	n/a
Karapiro Tailrace	11 ¹	10 ¹	10 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/10 ¹	10 ¹	Y	7 ¹	n/a	n/a
Narrows Boat Ramp	9 ¹	11 ¹	8 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/10 ¹	7 ¹	N	7 ¹	n/a	n/a
Horotiu Br	9 ¹	10 ¹	4 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/11 ¹	4 ¹	N	6 ¹	n/a	n/a
Huntly-Tainui Br	11 ¹	11 ¹	1 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/11 ¹	4 ¹	N	7 ¹	n/a	n/a
Rangiriri Br	11 ¹	11 ¹	0 ¹	11 ¹	1 ¹	0 ¹	0 ¹	0/11 ¹	1 ¹	N	6 ¹	n/a	n/a
Mercer Br	11 ¹	7 ¹	0 ¹	11 ¹	0 ¹	0 ¹	0 ¹	0/11 ¹	3 ¹	N	4 ¹	n/a	n/a
Tuakau Br	11 ¹	10 ¹	0 ¹	11 ¹	0 ¹	0 ¹	0 ¹	0/11 ¹	3 ¹	N	4 ¹	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 standards in the year 2020

Date	Time	Flow	BDisk m	Colour (Munsell)	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 ₄ N g/m ³
Satisfactory Quality		Water	>1.6			6.5-9	<12May-Sep		>80		<5				<0.88
Guideline/Standard							<20Oct-Apr								

Taupo Control Gates upper decile flow = 264 m³/s, measured at Reid's farm

7/1/20	08:20	130	-	-	11.6	7.9	17.7	9.4	103.5	0.4	0.8	78	0.001	0.001	0.01
3/2/20	08:02	64	-	-	12.0	7.8	<u>21.2</u>	8.8	103.6	0.2	0.3	79	0.001	0.001	0.01
3/3/20	09:18	200	-	-	11.6	7.6	<u>20.6</u>	9.2	106.9	0.4	0.2	78	0.001	0.001	0.01
13/5/20	09:05	80	-	-	12.1	7.5	14.9	9.6	98.2	0.2	0.3	82	0.001	0.001	0.01
2/6/20	09:17	57	-	-	12.3	7.5	14.0	9.8	99.7	0.2	0.3	84	0.005	0.001	0.01
7/7/20	09:03	70	-	-	12.0	7.0	11.7	10.2	100.1	0.7	0.3	69	0.001	0.001	0.01
10/8/20	08:52	120	-	-	11.9	7.2	10.9	10.4	98.3	0.2	0.4	87	0.001	0.001	0.01
2/9/20	09:03	211	-	-	11.6	7.7	11.6	10.4	100.5	0.2	0.5	71	0.001	0.001	0.01
6/10/20	07:51	103	-	-	12.2	7.7	13.1	10.4	102.2	0.2	0.4	82	0.001	0.001	0.01
3/11/20	08:40	54	-	-	11.8	7.9	15.8	9.8	101.8	0.7	0.2	98	0.001	0.001	0.01
1/12/20	07:56	179	-	-	11.5	7.8	15.9	9.7	103.1	0.2	0.3	69	0.001	0.001	0.01

Ohaaki Br upper decile flow = 264 m³/s, measured at Reid's farm

7/1/20	09:20	127	4.4	50.0	14.2	7.4	18.7	9.1	101.7	0.4	0.7	93	0.035	0.001	0.01
3/2/20	08:55	65	5.2	55.0	14.1	7.6	<u>22.0</u>	8.5	100.2	0.2	0.6	97	0.046	0.001	0.01
3/3/20	10:10	200	6.0	45.0	12.9	7.5	<u>21.9</u>	8.7	102.3	0.4	0.5	87	0.031	0.001	0.01
13/5/20	09:55	80	6.4	57.5	13.4	7.2	15.7	10.0	102.9	0.4	0.4	80	0.060	0.001	0.02
2/6/20	10:09	57	5.5	55.0	17.5	7.3	15.8	9.3	97.7	0.2	0.8	144	0.092	0.001	0.05
7/7/20	09:51	71	6.1	57.5	18.3	7.1	13.9	9.8	99.6	0.6	0.7	112	0.077	0.001	0.04
10/8/20	09:56	124	5.1	55.0	14.5	7.0	11.9	11.1	107.3	0.2	0.7	100	0.057	0.001	0.01
2/9/20	10:09	213	3.5	55.0	13.7	8.0	12.2	11.4	110.7	0.7	1.2	92	0.033	0.001	0.01
6/10/20	08:44	100	6.3	52.5	14.9	7.0	14.0	10.6	106.1	0.2	0.5	99	0.045	0.001	0.01
3/11/20	09:43	54	5.4	62.5	17.2	7.1	17.6	9.1	97.4	0.5	0.5	106	0.087	0.001	0.01
1/12/20	09:00	186	5.4	52.5	14.2	7.3	17.0	9.6	104.5	0.2	0.5	99	0.042	0.001	0.01

Ohakuri Tailrace Br upper decile flow = 352 m³/s, measured at Ohakuri

7/1/20	10:21	205	1.9	30.0	16.2	7.5	19.9	9.3	105.8	0.7	1.2	119	0.031	0.001	0.01
3/2/20	09:41	208	2.3	32.5	15.4	7.7	<u>23.2</u>	9.0	108.2	0.7	0.7	108	0.007	0.001	0.01
3/3/20	11:04	277	3.1	35.0	15.3	7.4	<u>21.5</u>	9.2	106.9	0.8	0.4	108	0.036	0.001	0.01
13/5/20	10:56	244	2.7	37.5	17.1	7.4	15.5	9.2	93.6	0.5	0.7	115	0.164	0.001	0.02
2/6/20	10:54	159	3.8	37.5	16.4	7.4	14.3	9.7	97.7	0.2	0.8	120	0.141	0.001	0.01
7/7/20	10:42	271	3.7	42.5	15.5	7.4	12.1	10.3	100.4	0.6	0.8	111	0.147	0.002	0.02
10/8/20	10:41	191	3.2	37.5	15.3	7.2	11.8	10.9	104.0	0.2	0.8	109	0.136	0.001	0.01
2/9/20	11:01	291	1.9	40.0	15.8	7.7	12.3	11.3	109.2	0.8	1.4	126	0.105	0.002	0.01
6/10/20	09:33	253	2.5	37.5	17.5	7.0	14.6	10.2	102.8	0.6	0.7	121	0.157	0.002	0.01
3/11/20	10:45	256	2.0	32.5	18.1	7.6	17.9	10.7	114.8	1.3	1.8	144	0.056	0.003	0.01
1/12/20	09:49	278	2.2	37.5	15.7	7.5	17.6	10.1	110.3	0.9	1.6	117	0.034	0.001	0.01

Whakamaru Tailrace upper decile flow = 323 m³/s, measured at Whakamaru

7/1/20	11:24	142	<u>1.3</u>	35.0	15.3	7.6	<u>20.0</u>	9.2	103.5	0.5	1.7	114	0.112	0.001	0.03
3/2/20	10:30	222	2.7	32.5	17.6	7.9	<u>22.6</u>	9.2	109.0	0.5	0.8	117	0.054	0.001	0.02
3/3/20	11:52	255	3.1	35.0	15.0	7.6	<u>22.1</u>	8.4	98.7	0.2	0.5	117	0.088	0.001	0.01
13/5/20	11:55	239	3.9	35.0	16.9	7.5	15.3	9.2	92.7	0.5	0.7	122	0.250	0.002	0.01
2/6/20	11:35	254	3.9	42.5	16.4	7.4	14.1	10.1	100.1	0.5	0.6	142	0.199	0.001	0.01
7/7/20	11:24	224	2.9	40.0	17.3	7.3	12.4	9.8	95.6	0.7	0.8	128	0.320	0.004	0.02
10/8/20	11:23	249	3.7	37.5	15.5	7.4	12.2	10.5	100.6	0.2	1.0	115	0.210	0.002	0.01
2/9/20	11:46	251	2.1	40.0	15.4	7.8	12.6	11.1	107.7	1.0	1.9	103	0.198	0.001	0.01
6/10/20	10:32	247	2.1	35.0	16.8	7.1	14.4	10.9	108.3	1.0	0.9	119	0.200	0.002	0.01
3/11/20	12:14	165	2.0	35.0	17.1	7.7	17.4	10.8	113.8	1.4	2.2	129	0.127	0.003	0.01
1/12/20	10:27	354	(2.2)	37.5	15.7	7.3	18.3	9.0	98.5	0.7	1.3	125	0.176	0.002	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 standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed 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. /100ml	F coli /100ml	E coli /100ml	CHL _a g/m ³	DOC g/m ³	TOC g/m ³
	<0.5		<0.04		<0.01	<1.4				<77		<550	<0.02		

Taupo Control Gates

0.08	0.08	0.002	0.005	8.1	<u>0.012</u>	0.18	0.042	0.003	0.001	5	20	20	0.002	0.9	1.3
0.06	0.06	0.002	0.002	8.2	<u>0.012</u>	0.19	0.045	0.001	0.001	10	5	5	0.002	1.0	0.8
0.03	0.03	0.007	0.005	8.4	<u>0.012</u>	0.17	0.041	0.001	0.001	10	5	5	0.002	0.7	1.1
0.06	0.06	0.006	0.004	7.3	<u>0.013</u>	0.18	0.042	0.001	0.001	5	5	5	0.002	0.6	0.8
0.10	0.11	0.002	0.002	8.1	<u>0.012</u>	0.18	0.043	0.001	0.001	10	5	5	0.002	0.6	0.6
0.07	0.07	0.002	0.004	8.2	<u>0.012</u>	0.17	0.039	0.001	0.001	5	5	5	0.002	0.6	0.9
0.03	0.03	0.002	0.002	8.2	<u>0.013</u>	0.17	0.041	0.001	0.001	5	5	5	0.002	0.8	0.9
0.06	0.06	0.002	0.011	8.0	<u>0.013</u>	0.17	0.039	0.001	0.001	1	5	4	0.002	0.6	1.1
0.03	0.03	0.002	0.005	8.1	<u>0.012</u>	0.18	0.043	0.001	0.001	5	5	5	0.002	0.8	0.9
0.06	0.06	0.002	0.006	8.2	<u>0.012</u>	0.17	0.042	0.001	0.001	1	6	6	0.002	1.0	0.9
0.03	0.03	0.002	0.004	8.0	<u>0.012</u>	0.19	0.043	0.001	0.001	10	23	16	0.002	1.3	1.2

Ohaaki Br

0.08	0.12	0.002	0.011	13.4	<u>0.022</u>	0.27	0.071	0.004	0.001	5	30	30	0.002	0.9	1.1
0.06	0.11	0.008	0.013	12.0	<u>0.019</u>	0.24	0.067	0.004	0.001	<u>150</u>	250	250	0.002	0.7	0.9
0.03	0.06	0.006	0.008	11.0	<u>0.016</u>	0.21	0.055	0.004	0.001	<u>110</u>	140	110	0.002	0.6	1.1
0.09	0.15	0.010	0.010	10.3	<u>0.020</u>	0.24	0.061	0.003	0.001	20	50	40	0.002	0.7	0.8
0.15	0.24	0.010	0.016	18.3	<u>0.026</u>	0.44	0.103	0.005	0.001	10	50	40	0.002	0.6	0.8
0.12	0.20	0.006	0.016	23.0	<u>0.031</u>	0.53	0.117	0.007	0.001	5	40	40	0.002	0.7	1.1
0.03	0.08	0.007	0.016	13.2	<u>0.018</u>	0.31	0.071	0.003	0.001	10	10	10	0.002	0.7	0.8
0.06	0.09	0.002	0.013	11.4	<u>0.019</u>	0.22	0.060	0.002	0.001	9	29	20	0.002	0.6	1.0
0.03	0.07	0.006	0.012	14.9	<u>0.029</u>	0.29	0.086	0.003	0.001	10	90	70	0.002	0.6	1.1
0.11	0.20	0.009	0.017	19.8	<u>0.034</u>	0.38	0.119	0.004	0.001	12	17	16	0.002	0.7	1.0
0.08	0.12	0.008	0.013	14.2	<u>0.024</u>	0.29	0.080	0.004	0.001	50	42	41	0.002	1.0	1.2

Ohakuri Tailrace Br

0.15	0.18	0.004	0.021	16.3	<u>0.029</u>	0.32	0.102	0.010	0.002	5	5	5	0.002	0.9	1.4
0.12	0.13	0.008	0.015	13.9	<u>0.025</u>	0.27	0.087	0.005	0.001	5	20	20	0.007	0.9	1.0
0.07	0.11	0.007	0.019	15.0	<u>0.024</u>	0.27	0.084	0.005	0.001	5	5	5	0.004	0.7	1.2
0.09	0.25	0.015	0.027	18.4	<u>0.029</u>	0.33	0.109	0.006	0.001	5	5	5	0.002	0.8	1.0
0.12	0.26	0.010	0.018	15.9	<u>0.026</u>	0.31	0.097	0.004	0.001	5	5	5	0.002	0.6	1.0
0.11	0.26	0.012	0.020	15.2	<u>0.025</u>	0.28	0.087	0.005	0.001	5	10	10	0.002	1.0	1.8
0.07	0.21	0.010	0.018	14.8	<u>0.024</u>	0.28	0.088	0.004	0.001	5	5	5	0.002	0.7	1.0
0.09	0.20	0.002	0.021	15.2	<u>0.025</u>	0.28	0.090	0.004	0.001	1	5	5	0.014	0.9	1.5
0.07	0.23	0.007	0.023	17.4	<u>0.031</u>	0.36	0.117	0.006	0.001	5	10	10	0.003	0.7	1.3
0.16	0.22	0.002	0.020	21.0	<u>0.035</u>	0.39	0.131	0.006	0.001	3	2	2	0.010	0.9	1.4
0.13	0.16	0.002	0.022	16.0	<u>0.029</u>	0.30	0.101	0.007	0.001	7	19	18	0.006	1.1	1.6

Whakamaru Tailrace

0.16	0.27	0.012	0.028	15.9	<u>0.027</u>	0.31	0.100	0.011	0.002	20	80	80	0.002	1.1	1.6
0.14	0.19	0.012	0.016	15.2	<u>0.027</u>	0.28	0.098	0.006	0.001	5	5	5	0.007	1.0	1.0
0.12	0.21	0.009	0.020	15.0	<u>0.028</u>	0.26	0.086	0.005	0.001	20	500	490	0.003	0.8	1.3
0.09	0.34	0.015	0.025	17.0	<u>0.027</u>	0.31	0.115	0.008	0.002	10	10	10	0.002	0.8	1.1
0.09	0.29	0.011	0.022	16.0	<u>0.024</u>	0.31	0.101	0.005	0.001	10	20	20	0.002	0.6	1.0
0.20	<u>0.52</u>	0.019	0.032	19.1	<u>0.027</u>	0.33	0.116	0.011	0.002	10	5	5	0.002	0.9	1.4
0.07	0.28	0.011	0.018	14.7	<u>0.022</u>	0.27	0.094	0.005	0.001	5	10	10	0.002	0.8	1.2
0.31	<u>0.51</u>	0.009	0.023	15.6	<u>0.023</u>	0.27	0.092	0.006	0.001	1	7	6	0.017	0.8	1.3
0.12	0.32	0.007	0.022	18.2	<u>0.027</u>	0.31	0.111	0.007	0.001	5	10	10	0.006	0.8	1.5
0.21	0.34	0.002	0.024	21.0	<u>0.028</u>	0.36	0.128	0.007	0.002	10	5	5	0.011	0.9	1.2
0.10	0.28	0.013	0.026	16.4	<u>0.028</u>	0.29	0.104	0.009	0.001	4	27	22	0.002	1.1	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 standards.

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

Date	Time	Flow	BDisk m	Colour (Munsell)	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 ₄ N g/m ³
Satisfactory Quality		Water	>1.6			6.5-9	<12May-Sep		>80		<5				<0.88
Guideline/Standard							<20Oct-Apr								

Waipapa Tailrace upper decile flow = 378 m³/s, measured at Waipapa

7/1/20	12:25	184	2.2	40.0	14.7	7.4	19.7	8.7	95.9	0.4	1.1	99	0.240	0.005	0.05
3/2/20	11:06	288	2.7	40.0	15.8	7.5	<u>22.5</u>	8.9	104.5	0.2	0.7	114	0.142	0.003	0.03
3/3/20	12:33	336	2.5	35.0	15.7	7.7	<u>22.2</u>	8.5	98.8	0.2	0.6	123	0.150	0.003	0.03
13/5/20	12:48	144	-	35.0	16.8	7.4	15.6	9.1	91.6	0.2	0.8	128	0.300	0.003	0.03
2/6/20	12:18	80	3.9	40.0	16.3	7.5	14.0	9.8	96.4	0.4	0.8	145	0.300	0.001	0.01
7/7/20	11:57	266	2.2	37.5	16.6	7.5	12.1	9.8	94.0	0.8	1.2	128	0.410	0.005	0.03
10/8/20	11:56	198	3.4	37.5	14.9	7.5	11.9	10.9	102.9	0.2	0.8	114	0.280	0.001	0.01
2/9/20	12:33	290	1.9	37.5	14.5	7.7	12.4	11.0	105.1	0.7	1.6	106	0.250	0.002	0.01
6/10/20	11:12	168	1.8	35.0	14.6	7.1	14.9	10.8	107.1	2.1	1.1	100	0.290	0.004	0.01
3/11/20	13:14	161	1.7	35.0	15.9	7.5	16.6	10.2	104.3	1.0	1.8	125	0.240	0.005	0.02
1/12/20	11:12	259	1.9	32.5	15.2	7.4	17.9	9.1	98.7	0.5	1.2	124	0.240	0.004	0.04

Karapiro Tailrace upper decile flow = 370 m³/s, measured at Karapiro

8/1/20	07:47	219	<u>1.5</u>	40.0	14.4	7.4	19.8	8.2	90.3	0.7	1.8	105	0.210	0.007	0.06
5/2/20	07:07	177	2.2	37.5	16.8	7.5	<u>21.2</u>	8.8	99.7	0.8	0.8	119	0.152	0.008	0.01
4/3/20	06:53	234	<u>1.5</u>	35.0	15.4	7.2	<u>22.4</u>	8.3	96.2	0.8	2.0	116	0.121	0.011	0.02
19/5/20	08:42	344	2.0	37.5	15.8	7.4	14.5	9.4	91.1	0.7	1.6	130	0.380	0.004	0.03
3/6/20	07:34	155	2.0	40.0	17.0	7.4	13.4	9.8	93.7	0.4	1.5	134	0.380	0.003	0.03
8/7/20	07:41	216	1.9	40.0	15.2	7.7	12.3	10.1	96.6	0.2	1.5	65	0.410	0.002	0.01
3/8/20	08:39	386	(2.2)	42.5	15.1	7.4	12.2	10.3	95.8	1.6	1.2	104	0.460	0.004	0.01
3/9/20	08:03	321	1.7	37.5	14.5	7.3	12.4	11.3	105.9	1.2	2.0	113	0.330	0.003	0.01
7/10/20	06:40	164	1.8	37.5	14.3	8.1	15.1	11.0	109.5	0.9	1.6	104	0.240	0.003	0.02
4/11/20	07:30	219	2.5	35.0	15.1	7.5	17.7	10.0	104.1	1.0	1.9	110	0.280	0.004	0.02
2/12/20	06:25	253	1.7	37.5	15.5	7.4	17.9	9.1	96.0	0.8	1.8	126	0.290	0.005	0.04

Narrows Boat Ramp upper decile flow = 370 m³/s, measured at Karapiro

8/1/20	08:21	241	2.1	35.0	14.9	7.4	19.9	7.8	85.7	0.6	1.7	120	0.250	0.008	0.05
5/2/20	07:32	178	2.9	37.5	16.4	7.5	<u>21.7</u>	8.0	91.6	0.5	1.0	122	0.189	0.007	0.02
4/3/20	07:23	204	1.7	35.0	15.6	7.6	<u>22.1</u>	7.8	89.9	0.6	1.4	107	0.148	0.013	0.03
19/5/20	09:14	346	2.2	35.0	16.0	7.6	14.1	9.4	90.8	0.5	1.7	118	0.420	0.005	0.02
3/6/20	08:01	171	2.1	40.0	17.2	7.6	12.7	10.0	94.3	0.2	1.7	130	0.410	0.003	0.02
8/7/20	08:11	279	<u>1.0</u>	35.0	15.4	7.9	11.5	10.2	95.6	0.2	<u>5.2</u>	96	0.500	0.003	0.01
3/8/20	09:09	392	(2.6)	42.5	15.8	7.8	11.3	10.4	95.3	0.5	1.3	115	0.490	0.003	0.01
3/9/20	08:29	319	1.7	35.0	14.6	7.4	11.8	11.2	103.8	0.9	1.0	105	0.360	0.002	0.01
7/10/20	07:17	163	1.9	35.0	14.2	7.7	13.9	10.8	104.3	0.8	1.2	100	0.260	0.003	0.01
4/11/20	07:56	219	1.8	32.5	15.3	7.7	17.8	9.9	103.0	1.1	2.1	120	0.280	0.004	0.01
2/12/20	06:52	253	<u>1.6</u>	35.0	16.0	7.3	17.9	9.3	97.8	0.7	2.1	125	0.310	0.005	0.02

Horotiu Br upper decile flow = 365 m³/s, measured at Hamilton Traffic

8/1/20	09:06	172	1.7	35.0	14.8	7.5	19.9	8.1	89.0	0.7	1.8	100	0.290	0.008	0.04
5/2/20	08:31	173	2.2	37.5	22.9	7.6	<u>21.3</u>	8.6	96.8	0.6	1.5	129	0.173	0.004	0.01
4/3/20	08:32	209	<u>1.3</u>	32.5	15.4	7.5	<u>22.2</u>	7.7	88.8	0.8	3.5	113	0.178	0.012	0.02
19/5/20	10:05	176	<u>1.4</u>	35.0	16.3	7.5	14.4	9.4	90.9	0.7	2.8	137	0.420	0.004	0.02
3/6/20	08:48	154	1.9	37.5	17.3	7.4	12.8	9.9	93.5	0.5	2.5	140	0.430	0.004	0.01
8/7/20	09:02	234	<u>1.0</u>	35.0	15.0	7.1	11.5	10.1	95.1	0.5	<u>5.0</u>	101	0.490	0.003	0.01
3/8/20	09:49	215	2.3	37.5	15.3	7.6	11.6	10.4	95.5	0.5	1.8	131	0.500	0.003	0.01
3/9/20	09:25	254	<u>1.3</u>	32.5	14.9	7.6	11.9	11.2	103.2	0.9	1.1	110	0.360	0.003	0.01
7/10/20	08:21	178	1.6	37.5	14.8	8.1	14.8	10.5	103.6	0.8	2.0	105	0.260	0.004	0.01
4/11/20	08:44	161	<u>1.1</u>	32.5	15.6	7.8	18.4	9.6	100.9	1.1	3.4	123	0.300	0.004	0.01
2/12/20	07:48	297	<u>1.4</u>	32.5	15.5	7.5	17.7	9.5	98.9	0.7	2.5	124	0.330	0.005	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 standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed 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. /100ml	F coli /100ml	E coli /100ml	CHL _a g/m ³	DOC g/m ³	TOC g/m ³
	<0.5		<0.04		<0.01	<1.4				<77		<550	<0.02		

Waipapa Tailrace

0.15	0.39	0.019	0.033	15.1	<u>0.023</u>	0.26	0.087	0.012	0.003	30	40	10	0.002	1.2	1.5
0.13	0.27	0.017	0.023	15.2	<u>0.026</u>	0.28	0.089	0.007	0.001	5	10	10	0.002	0.9	1.0
0.14	0.29	0.014	0.027	15.1	<u>0.023</u>	0.25	0.083	0.008	0.001	5	20	10	0.002	1.4	1.4
0.15	0.45	0.022	0.030	17.0	<u>0.023</u>	0.29	0.100	0.010	0.002	5	10	10	0.002	1.0	1.2
0.14	0.44	0.017	0.029	16.5	<u>0.021</u>	0.30	0.101	0.006	0.001	5	5	5	0.002	0.7	0.8
0.13	<u>0.54</u>	0.021	<u>0.042</u>	17.6	<u>0.021</u>	0.27	0.091	0.017	0.004	30	30	30	0.002	1.6	2.0
0.06	0.34	0.014	0.018	14.6	<u>0.020</u>	0.25	0.086	0.005	0.001	5	5	5	0.002	1.0	1.1
0.09	0.34	0.012	0.025	14.2	<u>0.020</u>	0.22	0.075	0.007	0.001	5	10	5	0.011	1.1	1.6
0.15	0.44	0.012	0.025	14.5	<u>0.019</u>	0.23	0.079	0.011	0.002	5	5	5	0.007	1.1	1.7
0.17	0.41	0.010	0.027	17.9	<u>0.023</u>	0.28	0.095	0.009	0.001	5	30	30	0.011	1.0	1.5
0.13	0.37	0.017	0.031	16.1	<u>0.025</u>	0.27	0.095	0.013	0.002	9	42	42	0.002	1.5	1.6

Karapiro Tailrace

0.18	0.39	0.014	0.032	13.7	<u>0.022</u>	0.21	0.071	0.012	0.003	5	5	5	0.002	1.3	2.0
0.15	0.30	0.012	0.026	16.4	<u>0.025</u>	0.27	0.091	0.009	0.001	10	5	5	0.004	1.1	1.6
0.15	0.27	0.010	0.034	14.8	<u>0.028</u>	0.22	0.072	0.009	0.001	40	220	200	0.018	1.1	1.3
0.18	<u>0.56</u>	0.020	0.036	17.0	<u>0.021</u>	0.26	0.089	0.009	0.002	20	5	5	0.002	1.3	1.7
0.22	<u>0.60</u>	0.022	0.038	17.6	<u>0.021</u>	0.28	0.100	0.006	0.001	5	10	10	0.002	1.1	1.6
0.10	<u>0.51</u>	0.021	0.038	15.3	<u>0.018</u>	0.24	0.083	0.010	0.002	10	50	50	0.002	0.8	1.5
0.14	<u>0.60</u>	0.020	0.033	15.0	<u>0.016</u>	0.24	0.077	0.011	0.002	5	10	10	0.002	1.7	1.6
0.17	<u>0.50</u>	0.015	0.028	14.3	<u>0.017</u>	0.21	0.071	0.010	0.002	5	10	6	0.009	1.6	1.6
0.16	0.40	0.002	0.017	13.5	<u>0.017</u>	0.19	0.063	0.009	0.001	5	10	10	0.008	1.2	1.8
0.19	0.47	0.006	0.026	16.2	<u>0.019</u>	0.25	0.083	0.010	0.001	20	30	20	0.015	1.2	1.8
0.18	0.47	0.017	0.031	17.0	<u>0.025</u>	0.27	0.092	0.012	0.002	13	19	18	0.002	1.5	1.8

Narrows Boat Ramp

0.16	0.41	0.017	0.032	13.9	<u>0.022</u>	0.21	0.070	0.012	0.003	20	40	40	0.002	1.4	1.5
0.16	0.35	0.014	0.022	16.6	<u>0.024</u>	0.28	0.092	0.010	0.001	<u>90</u>	130	30	0.002	1.1	1.5
0.16	0.31	0.014	0.027	14.9	<u>0.028</u>	0.22	0.073	0.009	0.002	50	450	370	0.008	1.1	1.7
0.13	<u>0.55</u>	0.022	0.036	17.0	<u>0.021</u>	0.26	0.089	0.009	0.002	5	70	50	0.002	1.0	1.4
0.23	<u>0.64</u>	0.024	0.036	17.8	<u>0.021</u>	0.29	0.099	0.006	0.001	60	50	50	0.002	1.1	1.5
0.13	<u>0.63</u>	0.023	<u>0.048</u>	15.6	<u>0.017</u>	0.23	0.078	0.014	0.003	<u>170</u>	570	420	0.002	1.3	2.1
0.17	<u>0.66</u>	0.018	0.030	14.7	<u>0.017</u>	0.23	0.075	0.012	0.002	20	100	40	0.002	1.7	1.6
0.15	<u>0.51</u>	0.014	0.030	14.4	<u>0.017</u>	0.21	0.069	0.012	0.002	23	33	21	0.011	1.5	1.8
0.16	0.42	0.002	0.020	13.7	<u>0.017</u>	0.20	0.066	0.010	0.003	10	20	20	0.010	1.2	1.8
0.20	0.48	0.005	0.031	16.0	<u>0.020</u>	0.25	0.085	0.010	0.001	<u>130</u>	110	80	0.019	1.3	2.0
0.19	<u>0.50</u>	0.016	0.033	16.5	<u>0.025</u>	0.25	0.089	0.014	0.003	<u>90</u>	70	70	0.004	2.0	1.9

Horotiu Br

0.20	0.49	0.019	0.038	14.2	<u>0.021</u>	0.20	0.071	0.012	0.003	20	50	40	0.002	1.3	1.7
0.17	0.34	0.011	0.023	16.8	<u>0.024</u>	0.27	0.094	0.010	0.001	<u>100</u>	150	110	0.002	1.1	1.8
0.13	0.31	0.014	0.036	15.1	<u>0.026</u>	0.23	0.070	0.011	0.002	<u>440</u>	900	<u>800</u>	0.010	1.0	1.6
0.14	<u>0.56</u>	0.020	<u>0.040</u>	17.3	<u>0.021</u>	0.26	0.088	0.009	0.001	<u>80</u>	150	100	0.004	1.4	2.1
0.11	<u>0.54</u>	0.023	<u>0.045</u>	17.8	<u>0.020</u>	0.28	0.095	0.007	0.001	<u>110</u>	110	100	0.002	1.2	1.8
0.14	<u>0.63</u>	0.024	<u>0.051</u>	15.8	<u>0.016</u>	0.23	0.078	0.014	0.003	<u>150</u>	310	250	0.002	1.7	2.3
0.11	<u>0.61</u>	0.022	0.033	14.9	<u>0.016</u>	0.23	0.075	0.012	0.003	20	100	40	0.002	1.9	1.6
0.13	0.49	0.015	0.030	14.5	<u>0.017</u>	0.22	0.068	0.013	0.003	28	30	30	0.012	1.9	2.1
0.17	0.43	0.002	0.014	14.1	<u>0.016</u>	0.21	0.067	0.011	0.002	60	100	90	0.009	1.2	1.8
0.24	<u>0.54</u>	0.006	0.033	15.8	<u>0.020</u>	0.26	0.085	0.012	0.002	40	50	50	0.019	1.2	1.9
0.20	<u>0.53</u>	0.021	0.035	17.2	<u>0.024</u>	0.26	0.089	0.016	0.004	<u>150</u>	260	210	0.005	1.8	1.9

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

Date	Time	Flow	BDisk m	Colour (Munsell)	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 ₄ N g/m ³
Satisfactory Quality		Water	>1.6			6.5-9	<12May-Sep		>80		<5				<0.88
Guideline/Standard							<20Oct-Apr								

Huntly-Tainui Br upper decile flow = 546 m³/s, measured at Huntly power station

8/1/20	09:48	186	<u>1.2</u>	32.5	14.4	7.5	<u>21.2</u>	8.3	93.3	0.6	2.3	98	0.330	0.005	0.01
5/2/20	09:02	184	<u>1.5</u>	37.5	16.7	7.7	<u>22.0</u>	8.8	100.9	0.6	1.7	126	0.200	0.005	0.01
4/3/20	09:54	207	<u>1.2</u>	32.5	15.6	7.5	<u>22.8</u>	8.5	99.1	0.6	2.3	122	0.179	0.005	0.01
19/5/20	10:40	191	<u>1.3</u>	40.0	16.4	7.3	14.4	9.7	94.0	0.5	3.4	121	0.460	0.006	0.02
3/6/20	09:42	187	<u>1.4</u>	37.5	16.8	7.3	12.4	10.1	94.3	0.5	3.6	128	0.470	0.005	0.02
8/7/20	09:39	415	<u>0.7</u>	32.5	14.4	7.3	10.9	10.2	94.4	0.6	<u>8.8</u>	59	0.600	0.003	0.01
3/8/20	10:23	311	<u>1.0</u>	37.5	14.8	7.2	11.8	10.2	94.6	0.9	4.2	120	0.600	0.003	0.01
3/9/20	10:02	418	<u>0.8</u>	30.0	13.9	7.4	11.8	10.8	99.7	0.9	4.3	108	0.590	0.003	0.01
7/10/20	09:07	298	<u>0.7</u>	35.0	13.2	7.5	15.5	10.0	100.5	2.1	<u>6.0</u>	107	0.440	0.003	0.01
4/11/20	09:26	207	<u>0.9</u>	30.0	14.5	7.6	19.0	9.3	99.9	0.9	<u>7.0</u>	115	0.400	0.003	0.01
2/12/20	09:09	396	<u>0.9</u>	32.5	14.3	7.4	17.3	9.1	94.9	0.8	<u>7.1</u>	113	0.430	0.005	0.01

Rangiriri Br upper decile flow = 547 m³/s, measured at Rangiriri

8/1/20	10:23	186	<u>1.1</u>	32.5	14.6	7.5	<u>20.3</u>	8.5	94.2	0.6	3.2	110	0.330	0.004	0.01
5/2/20	09:38	179	<u>1.4</u>	32.5	17.0	7.6	<u>22.4</u>	8.5	97.3	0.6	2.5	130	0.190	0.003	0.01
4/3/20	10:27	204	<u>0.9</u>	32.5	15.6	7.7	<u>23.0</u>	8.6	101.0	0.9	2.9	115	0.127	0.003	0.01
19/5/20	11:18	189	<u>1.4</u>	32.5	16.5	7.6	14.1	9.7	92.7	0.6	3.9	128	0.480	0.005	0.01
3/6/20	09:57	192	<u>0.9</u>	32.5	17.1	7.3	12.8	9.7	92.0	0.7	<u>7.6</u>	137	0.540	0.004	0.03
8/7/20	10:07	424	<u>0.5</u>	27.5	16.2	7.5	11.0	10.0	93.0	0.5	<u>13.3</u>	117	0.650	0.004	0.02
3/8/20	11:02	313	<u>1.0</u>	32.5	15.3	7.4	12.0	10.0	92.9	0.6	4.6	133	0.650	0.004	0.02
3/9/20	10:36	436	<u>0.9</u>	27.5	14.6	7.4	12.2	10.9	101.5	1.0	<u>5.0</u>	103	0.470	0.002	0.01
7/10/20	09:45	322	<u>0.7</u>	35.0	14.0	7.6	15.6	10.1	101.5	0.9	<u>6.1</u>	107	0.360	0.003	0.01
4/11/20	09:57	221	<u>0.8</u>	30.0	15.1	7.6	18.9	9.4	100.6	1.0	<u>6.5</u>	116	0.350	0.003	0.01
2/12/20	09:43	396	<u>1.1</u>	30.0	14.8	7.5	17.7	9.0	94.2	0.6	<u>5.8</u>	121	0.420	0.004	0.01

Mercer Br upper decile flow = 629 m³/s, measured at Mercer

8/1/20	11:07	227	<u>1.1</u>	32.5	14.6	7.7	<u>20.2</u>	8.8	97.5	0.8	4.3	111	0.300	0.003	0.01
5/2/20	10:02	214	<u>1.1</u>	30.0	17.2	8.1	<u>22.7</u>	9.1	105.4	1.0	3.7	124	0.107	0.003	0.01
4/3/20	10:55	223	<u>0.9</u>	32.5	15.5	8.1	<u>23.0</u>	9.4	109.9	1.1	3.4	116	0.034	0.003	0.01
19/5/20	11:44	210	<u>1.0</u>	40.0	16.1	7.4	14.6	9.8	95.2	0.6	4.9	135	0.470	0.003	0.01
3/6/20	10:22	262	<u>0.9</u>	30.0	17.0	7.4	13.0	9.9	94.5	0.6	<u>7.3</u>	132	0.510	0.004	0.01
8/7/20	10:31	398	<u>0.5</u>	27.5	15.8	7.4	10.9	10.2	94.0	0.4	<u>9.3</u>	114	0.650	0.004	0.01
3/8/20	11:26	301	<u>0.6</u>	30.0	16.6	6.9	12.1	10.0	93.0	0.6	<u>6.8</u>	123	0.700	0.003	0.01
3/9/20	11:00	422	<u>0.8</u>	25.0	14.7	7.6	12.3	10.7	100.1	0.9	<u>7.3</u>	116	0.540	0.002	0.01
7/10/20	10:18	311	<u>0.5</u>	32.5	14.4	6.9	16.7	9.9	101.8	0.7	<u>8.6</u>	103	0.380	0.002	0.01
4/11/20	10:23	217	<u>0.7</u>	27.5	15.0	7.8	19.7	9.5	103.5	1.4	<u>9.9</u>	116	0.320	0.001	0.01
2/12/20	10:06	356	<u>0.6</u>	30.0	14.5	7.4	18.0	9.1	96.1	0.8	<u>7.9</u>	134	0.410	0.002	0.01

Tuakau Br upper decile flow = 629 m³/s, measured at Mercer

8/1/20	11:32	227	<u>0.9</u>	35.0	16.6	7.6	<u>20.4</u>	9.7	106.9	0.9	3.3	122	0.290	0.003	0.01
5/2/20	10:39	210	<u>1.0</u>	32.5	18.4	7.7	<u>23.5</u>	9.4	110.6	1.0	2.7	115	0.114	0.003	0.01
4/3/20	11:29	220	<u>0.9</u>	32.5	15.8	8.2	<u>23.6</u>	9.8	115.4	1.1	3.1	119	0.012	0.003	0.01
19/5/20	12:23	206	<u>1.2</u>	30.0	16.2	7.5	15.0	10.1	98.9	0.6	3.8	143	0.480	0.003	0.01
3/6/20	10:56	261	<u>1.0</u>	30.0	17.2	7.4	13.6	9.7	93.0	0.7	<u>6.7</u>	125	0.540	0.006	0.01
8/7/20	11:00	399	<u>0.6</u>	27.5	17.2	7.6	11.2	9.9	91.3	0.8	<u>12.4</u>	88	0.720	0.005	0.03
3/8/20	11:55	309	<u>0.8</u>	30.0	16.3	7.0	12.3	9.8	91.7	0.7	<u>5.8</u>	105	0.640	0.004	0.01
3/9/20	11:35	425	<u>0.7</u>	25.0	15.2	7.4	13.1	10.3	97.8	1.0	<u>8.2</u>	115	0.530	0.002	0.01
7/10/20	11:05	310	<u>0.5</u>	30.0	14.2	7.1	16.5	9.9	100.9	0.8	<u>8.5</u>	103	0.370	0.002	0.01
4/11/20	10:58	217	<u>0.7</u>	27.5	15.2	7.9	<u>20.3</u>	9.7	106.3	1.2	<u>7.3</u>	100	0.340	0.001	0.01
2/12/20	10:31	356	<u>0.7</u>	27.5	14.6	7.4	18.6	9.0	95.6	0.8	<u>7.5</u>	121	0.400	0.003	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 standards.

Bracketed black disk measurements were carried out at flows above the upper decile and were not assessed 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. /100ml	F coli /100ml	E coli /100ml	CHL _a g/m ³	DOC g/m ³	TOC g/m ³
	<0.5		<0.04		<0.01	<1.4				<77		<550	<0.02		

Huntly-Tainui Br

0.13	0.46	0.024	<u>0.042</u>	14.6	<u>0.018</u>	0.18	0.060	0.017	0.004	5	40	40	0.002	1.5	1.9
0.17	0.37	0.016	0.029	17.0	<u>0.022</u>	0.25	0.086	0.012	0.001	30	170	130	0.002	1.3	1.6
0.16	0.34	0.008	0.039	15.0	<u>0.023</u>	0.23	0.071	0.011	0.002	40	130	120	0.017	1.1	2.0
0.15	<u>0.61</u>	0.023	<u>0.042</u>	17.0	<u>0.019</u>	0.24	0.084	0.010	0.001	<u>80</u>	230	170	0.002	1.2	1.4
0.21	<u>0.68</u>	0.024	<u>0.043</u>	17.1	<u>0.016</u>	0.23	0.078	0.010	0.001	<u>100</u>	70	50	0.002	1.2	1.8
0.24	<u>0.84</u>	0.017	<u>0.056</u>	14.5	<u>0.011</u>	0.16	0.051	0.018	0.004	<u>130</u>	580	370	0.002	1.7	3.0
0.14	<u>0.74</u>	0.021	0.038	14.4	<u>0.013</u>	0.19	0.061	0.015	0.003	20	50	50	0.002	1.9	1.9
0.15	<u>0.74</u>	0.020	0.032	13.6	<u>0.011</u>	0.15	0.048	0.019	0.004	27	90	80	0.009	2.0	2.8
0.17	<u>0.61</u>	0.006	0.024	12.8	<u>0.011</u>	0.14	0.043	0.016	0.003	60	60	50	0.008	1.4	2.2
0.23	<u>0.63</u>	0.011	<u>0.040</u>	14.8	<u>0.013</u>	0.18	0.059	0.021	0.004	30	360	300	0.014	1.6	2.3
0.21	<u>0.64</u>	0.022	<u>0.049</u>	15.3	<u>0.016</u>	0.18	0.059	0.028	0.006	<u>100</u>	570	340	0.002	2.0	3.2

Rangiriri Br

0.14	0.47	0.021	<u>0.040</u>	14.6	<u>0.018</u>	0.19	0.062	0.018	0.005	10	70	60	0.002	1.4	1.9
0.18	0.37	0.015	0.034	17.2	<u>0.021</u>	0.25	0.086	0.012	0.001	20	60	60	0.005	1.2	1.6
0.16	0.29	0.010	0.037	15.5	<u>0.021</u>	0.21	0.067	0.013	0.003	<u>140</u>	230	190	<u>0.026</u>	1.2	1.9
0.15	<u>0.63</u>	0.023	<u>0.046</u>	17.0	<u>0.020</u>	0.24	0.078	0.011	0.001	40	240	110	0.004	1.1	1.4
0.28	<u>0.82</u>	0.026	<u>0.057</u>	17.9	<u>0.017</u>	0.24	0.081	0.015	0.003	<u>1500</u>	610	450	0.002	1.7	2.2
0.29	<u>0.94</u>	0.023	<u>0.071</u>	16.1	<u>0.015</u>	0.19	0.063	0.022	0.004	<u>370</u>	1200	<u>1200</u>	0.002	2.6	4.1
0.22	<u>0.87</u>	0.021	<u>0.046</u>	15.0	<u>0.012</u>	0.19	0.061	0.018	0.003	5	100	80	0.002	1.9	1.8
0.14	<u>0.61</u>	0.018	0.034	13.6	<u>0.014</u>	0.18	0.059	0.017	0.003	53	50	50	0.006	2.0	2.3
0.21	<u>0.57</u>	0.006	0.028	13.6	<u>0.014</u>	0.17	0.055	0.014	0.003	20	160	130	0.012	1.3	2.7
0.24	<u>0.59</u>	0.006	<u>0.048</u>	14.2	<u>0.015</u>	0.21	0.067	0.020	0.004	40	250	200	0.018	1.5	2.6
0.16	<u>0.58</u>	0.021	<u>0.045</u>	15.1	<u>0.017</u>	0.19	0.066	0.024	0.004	50	260	220	0.002	2.0	2.9

Mercer Br

0.15	0.45	0.017	<u>0.042</u>	14.9	<u>0.017</u>	0.18	0.061	0.016	0.004	10	10	10	0.002	1.3	1.9
0.25	0.36	0.010	0.037	17.0	<u>0.021</u>	0.26	0.085	0.012	0.001	5	70	70	0.008	1.1	2.0
0.19	0.22	0.007	0.038	15.0	<u>0.023</u>	0.23	0.073	0.010	0.002	<u>90</u>	130	120	<u>0.043</u>	1.2	1.5
0.14	<u>0.61</u>	0.021	<u>0.044</u>	17.1	<u>0.019</u>	0.26	0.084	0.011	0.002	5	50	30	0.004	1.4	1.4
0.20	<u>0.71</u>	0.020	<u>0.057</u>	17.7	<u>0.016</u>	0.24	0.078	0.012	0.001	<u>170</u>	320	250	0.005	1.8	2.3
0.26	<u>0.91</u>	0.019	<u>0.059</u>	16.1	<u>0.013</u>	0.19	0.059	0.021	0.004	<u>170</u>	430	350	0.002	1.9	3.4
0.21	<u>0.91</u>	0.017	0.039	15.2	<u>0.011</u>	0.18	0.057	0.020	0.004	20	90	70	0.002	2.4	2.6
0.16	<u>0.70</u>	0.015	0.034	14.3	<u>0.013</u>	0.16	0.050	0.020	0.004	12	40	30	0.008	2.0	2.9
0.29	<u>0.67</u>	0.006	0.026	13.4	<u>0.012</u>	0.16	0.049	0.016	0.003	10	140	70	0.008	1.5	2.8
0.25	<u>0.57</u>	0.008	<u>0.043</u>	15.4	<u>0.014</u>	0.20	0.062	0.020	0.004	5	100	100	<u>0.023</u>	1.6	4.4
0.22	<u>0.63</u>	0.017	<u>0.045</u>	14.9	<u>0.016</u>	0.18	0.060	0.025	0.005	41	210	190	0.006	2.0	2.7

Tuakau Br

0.20	0.49	0.013	0.036	15.0	<u>0.017</u>	0.18	0.059	0.017	0.004	30	30	30	0.002	1.3	2.0
0.23	0.34	0.006	0.031	17.2	<u>0.021</u>	0.26	0.084	0.015	0.001	20	80	70	0.010	1.1	2.0
0.17	0.18	0.006	0.035	15.3	<u>0.024</u>	0.24	0.074	0.010	0.002	50	300	200	<u>0.028</u>	1.1	1.6
0.13	<u>0.61</u>	0.019	<u>0.044</u>	17.4	<u>0.018</u>	0.24	0.079	0.011	0.003	40	70	50	0.005	1.2	1.3
0.23	<u>0.77</u>	0.017	<u>0.055</u>	17.8	<u>0.016</u>	0.24	0.075	0.011	0.001	<u>180</u>	430	310	0.006	1.6	2.1
0.33	<u>1.05</u>	0.011	<u>0.058</u>	17.1	<u>0.012</u>	0.18	0.056	0.029	0.005	<u>190</u>	390	320	0.004	2.9	4.5
0.28	<u>0.92</u>	0.014	0.039	15.5	<u>0.012</u>	0.19	0.057	0.029	0.005	50	70	70	0.002	2.2	2.8
0.26	<u>0.79</u>	0.011	<u>0.044</u>	15.0	<u>0.012</u>	0.17	0.050	0.032	0.006	13	80	54	0.010	3.0	4.1
0.28	<u>0.65</u>	0.006	0.026	15.5	<u>0.013</u>	0.16	0.046	0.019	0.003	20	80	70	0.012	1.6	2.9
0.21	<u>0.55</u>	0.009	<u>0.044</u>	15.6	<u>0.013</u>	0.20	0.059	0.023	0.004	5	70	60	<u>0.022</u>	1.9	2.9
0.27	<u>0.67</u>	0.017	<u>0.047</u>	15.1	<u>0.016</u>	0.19	0.059	0.030	0.005	46	160	150	0.004	2.3	3.2

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

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

References

- Bates N, Tulagi A 2021. Waikato River water quality monitoring programme: data report 2019. Waikato Regional Council Technical Report 2020/19. Hamilton, Waikato Regional Council.
- Ministry of Health 2018. Drinking water standards. Rev. ed. Wellington, Ministry of Health. [Drinking-water Standards for New Zealand 2005 \(Revised 2018\) | Ministry of Health NZ](#) [Accessed 01 September 2021].
- 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 2018. Trends in River Water Quality in the Waikato Region, 1993–2017. Waikato Regional Council Technical Report 2018/30, Hamilton, Waikato Regional Council.

Appendix I

Flow information

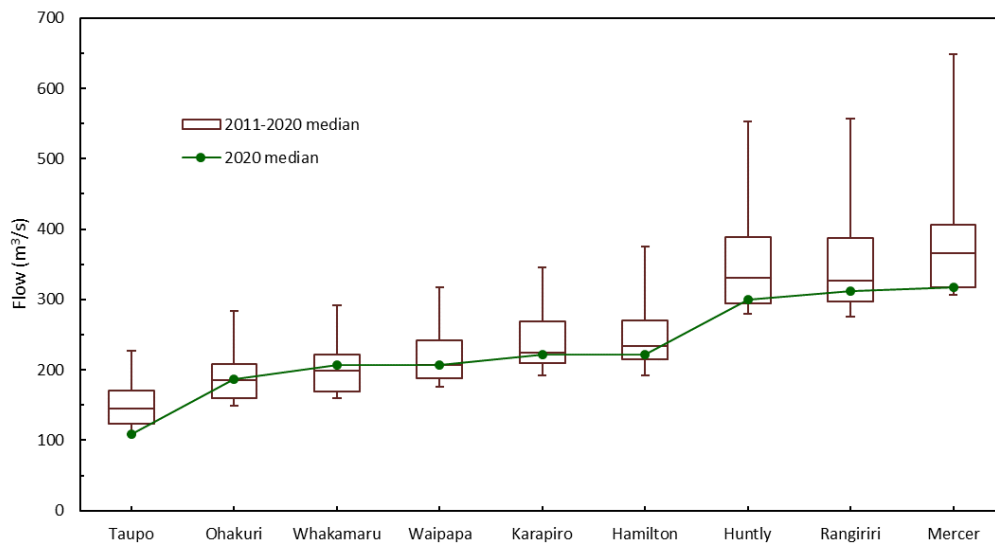
Median Flows of the Waikato River and Main Tributaries

Location	DISTANCE km	FLOW RATE* (m ³ /s)										10 YEAR MEDIAN
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Taupo	4.2	173	171	119	123	142	149	199	169	125	108	146
Ohakuri	75.8	209	205	149	152	172	183	246	214	155	187	185
Whakamaru	105.0	231	222	160	160	180	192	257	222	165	207	199
Waipapa	126.1	246	242	177	176	194	206	280	242	186	207	206
Karapiro	166.7								266	209	221	221
Hamilton	211.5	264	272	191	206	220	245	323	284	214	222	234
Huntly	246.5	394	391	292	284	317	345	470	381	280	300	331
Rangiriri	262.3								396	292	312	312
Mercer	286.3	404	407	317	317	341	389	527	420	307	317	365
Waioatapu Strm	46.6	4.5	3.8	2.8	2.6	2.8	3.3	5.2	4.4	3.0	3.1	3.2
Waipa River	232.7	92	95	69	69	75	86	113	84	57	55	79

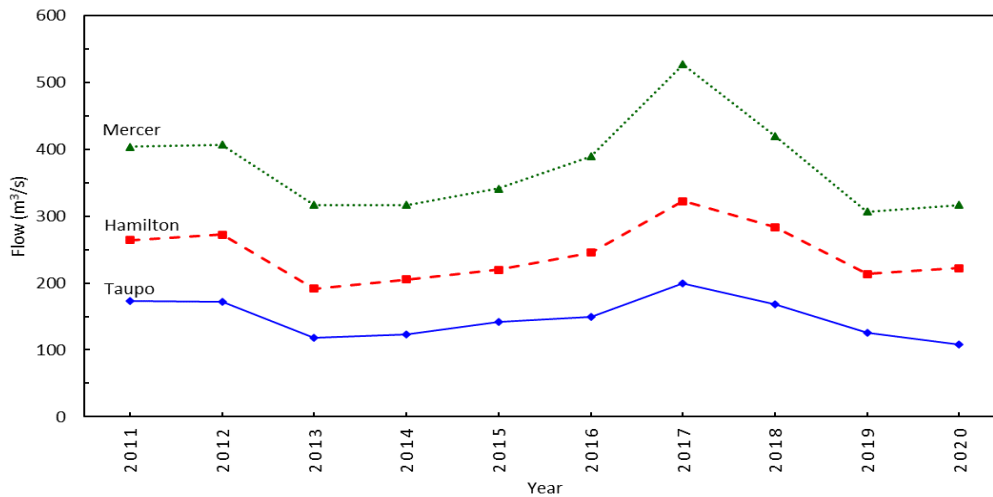
+Rating curve errors mean estimates of flow are ± 8%

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

Flow



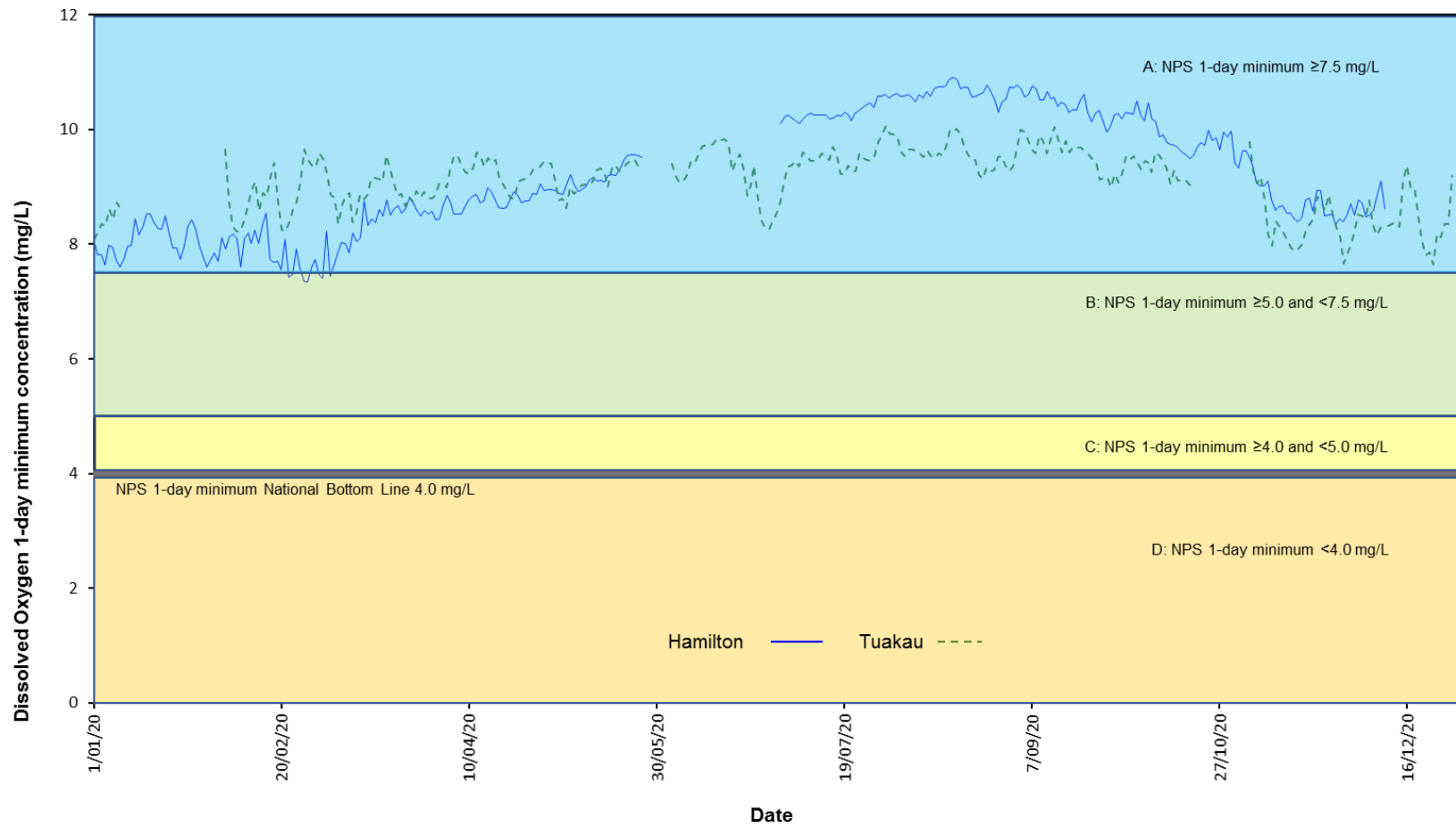
Yearly Flow Record (Median) at Taupo, Hamilton, and Mercer



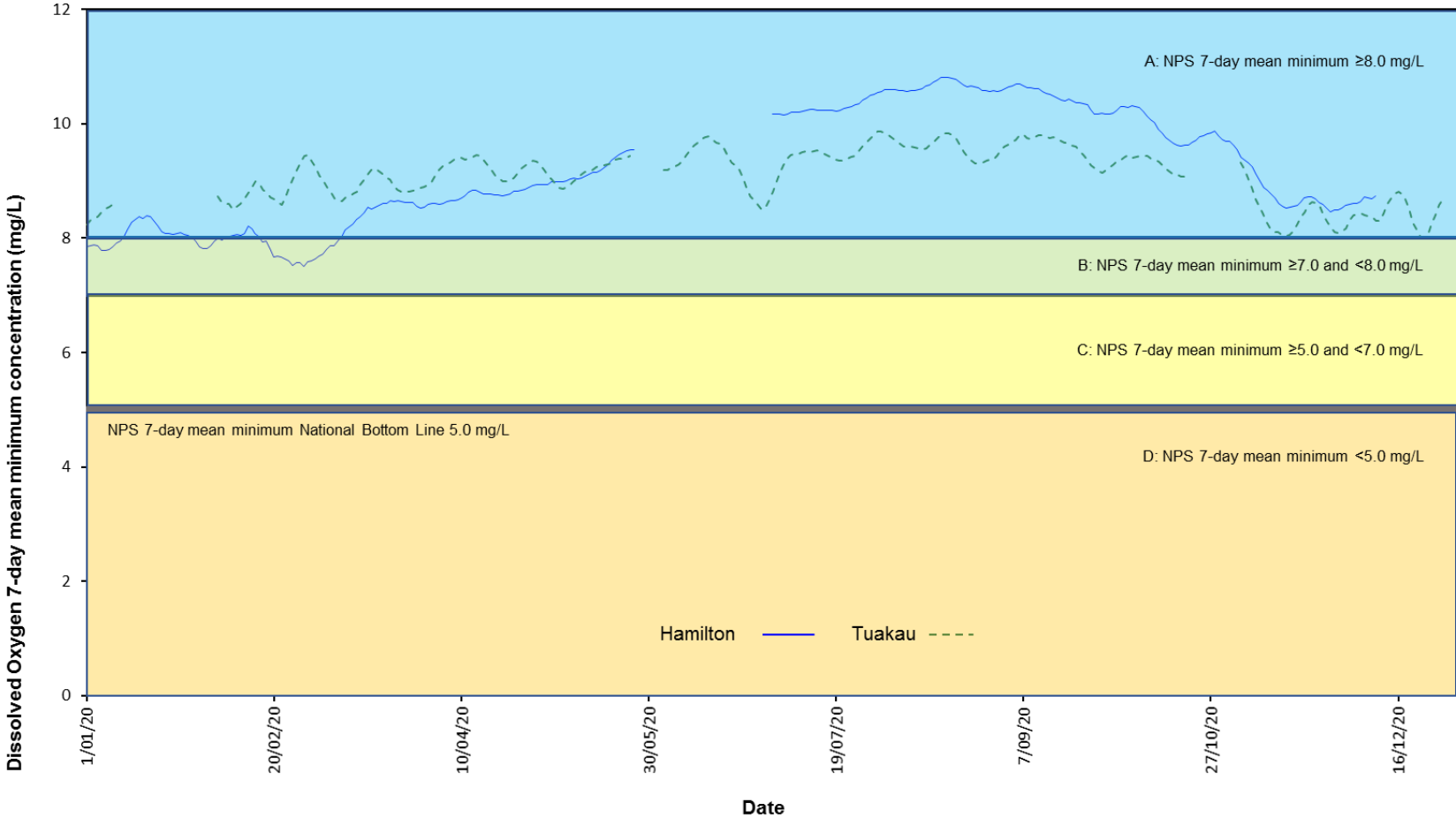
Appendix II

Datasonde deployments: selected water quality parameters

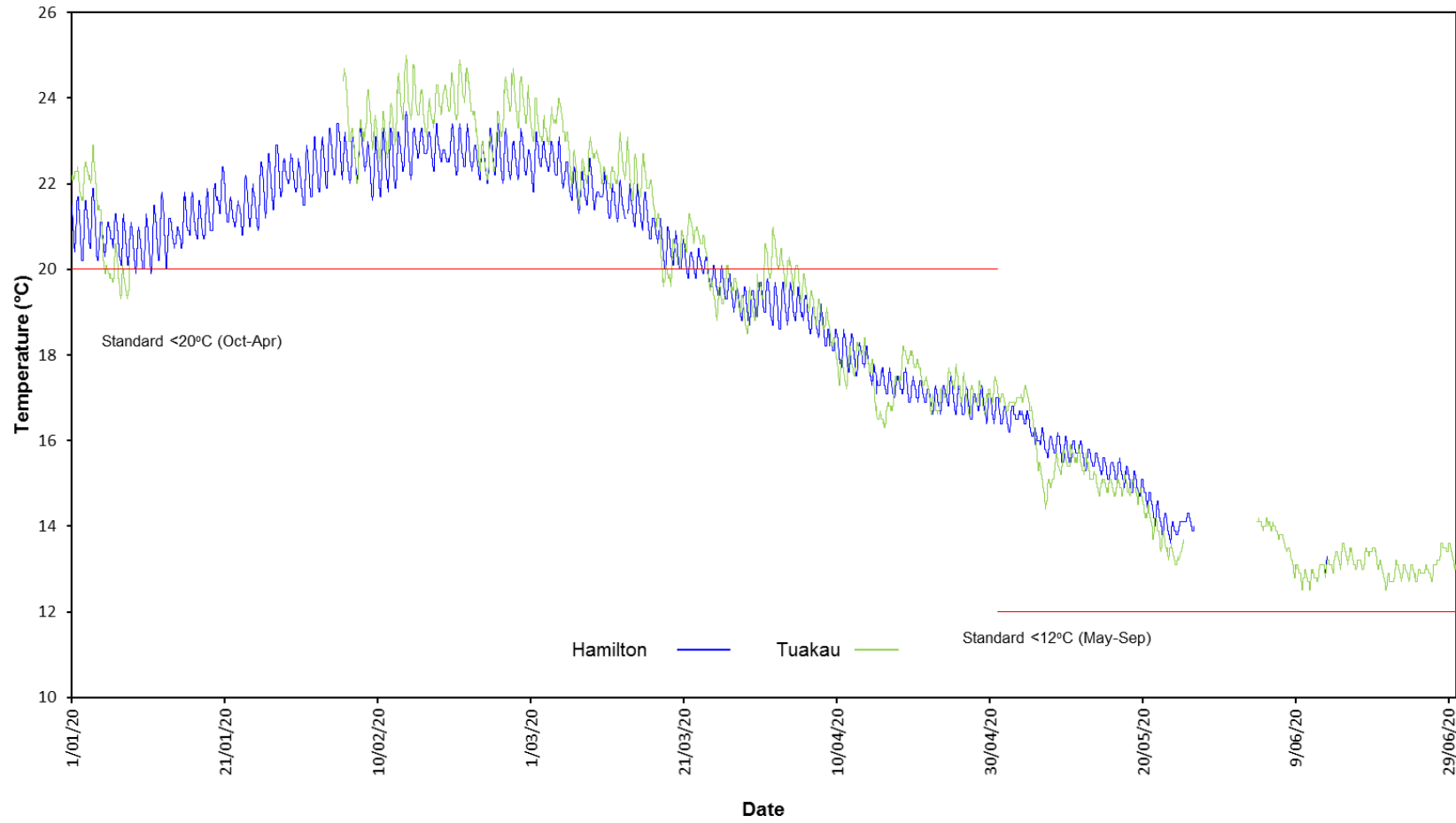
Dissolved Oxygen 1-day minimum concentration (mg/L): Lower Waikato 2020



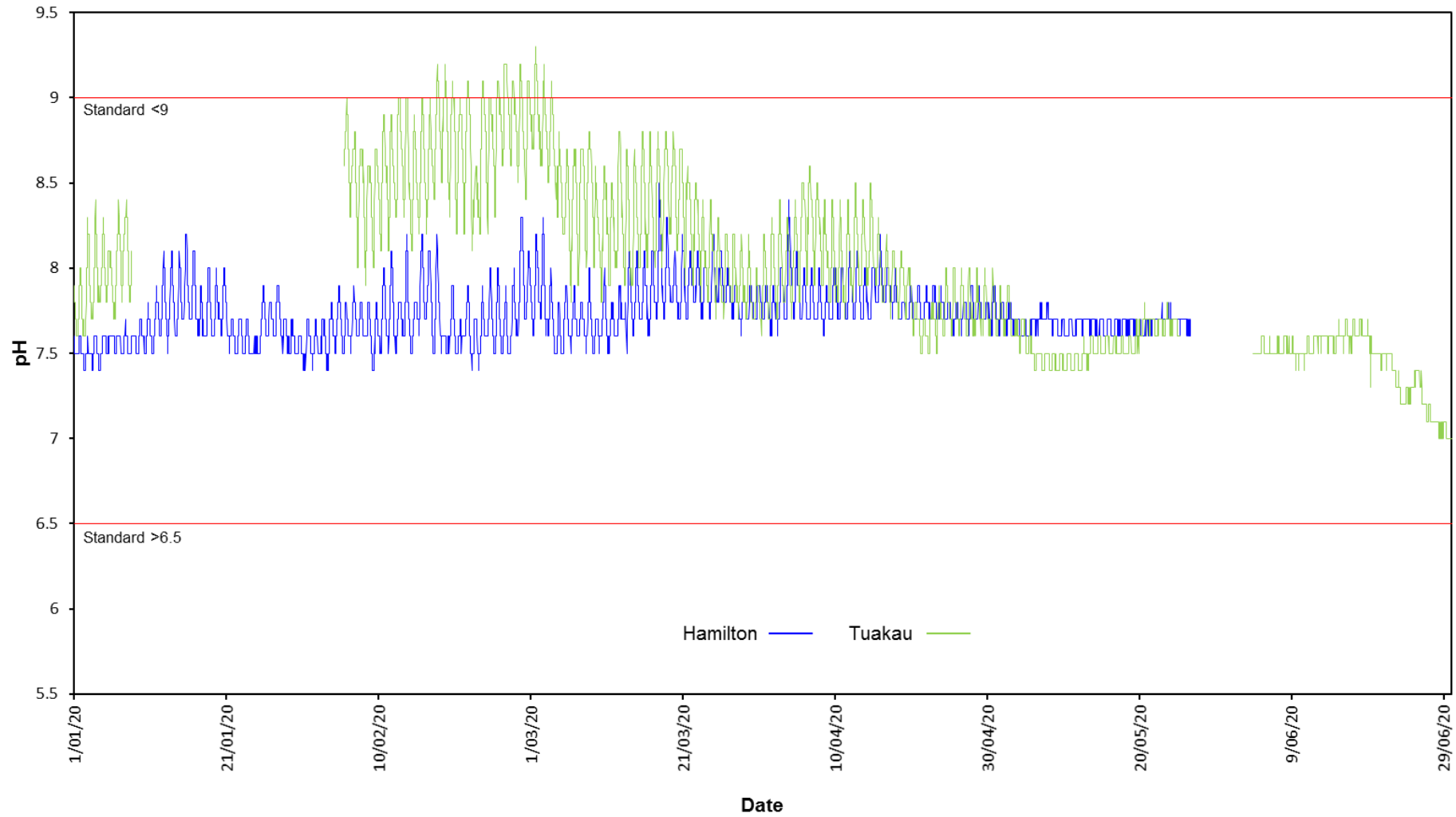
Dissolved Oxygen 7-day mean minimum concentration (mg/L): Lower Waikato 2020



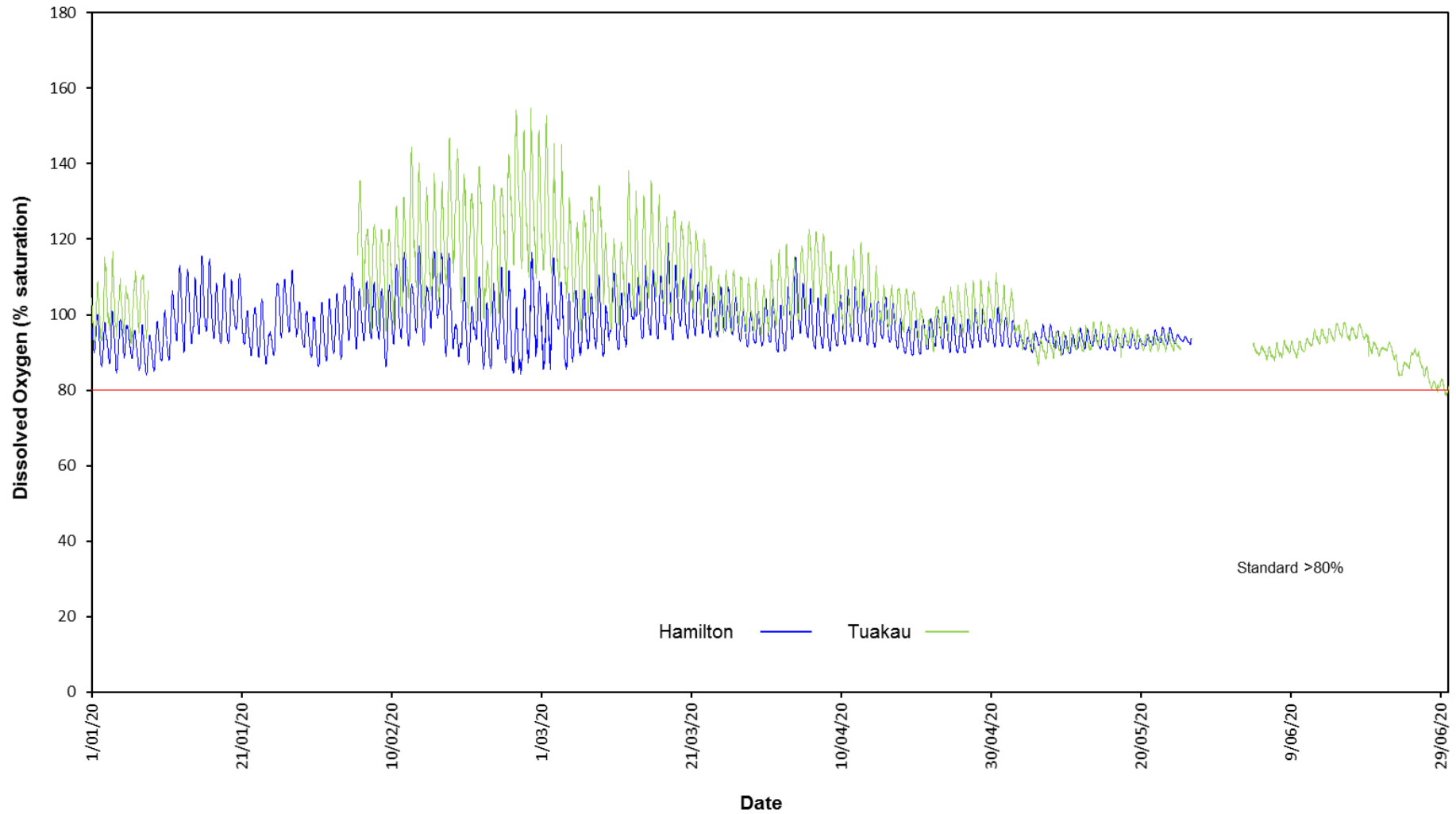
Temperature: Lower Waikato (January - June)



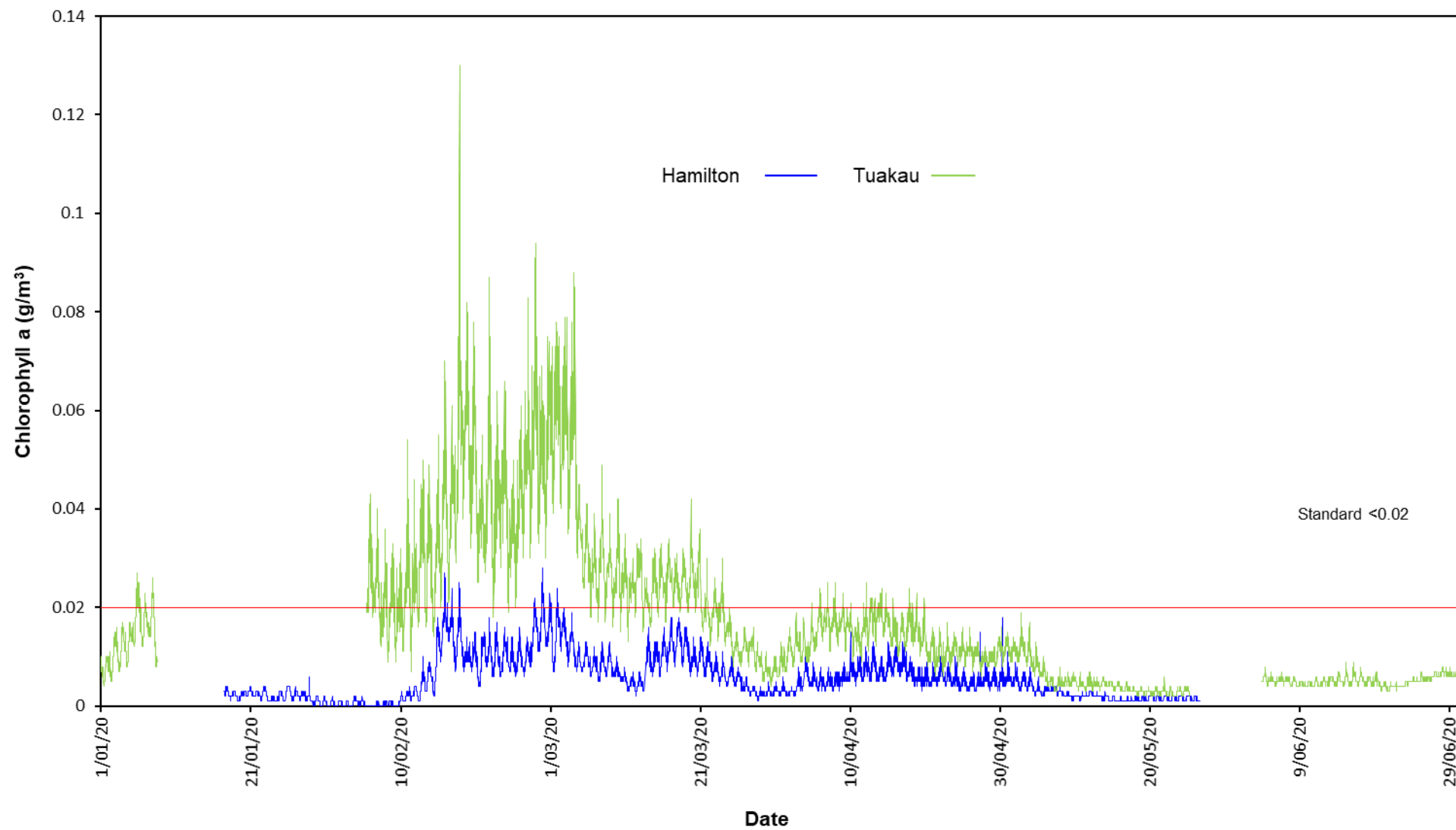
pH: Lower Waikato (January - June)



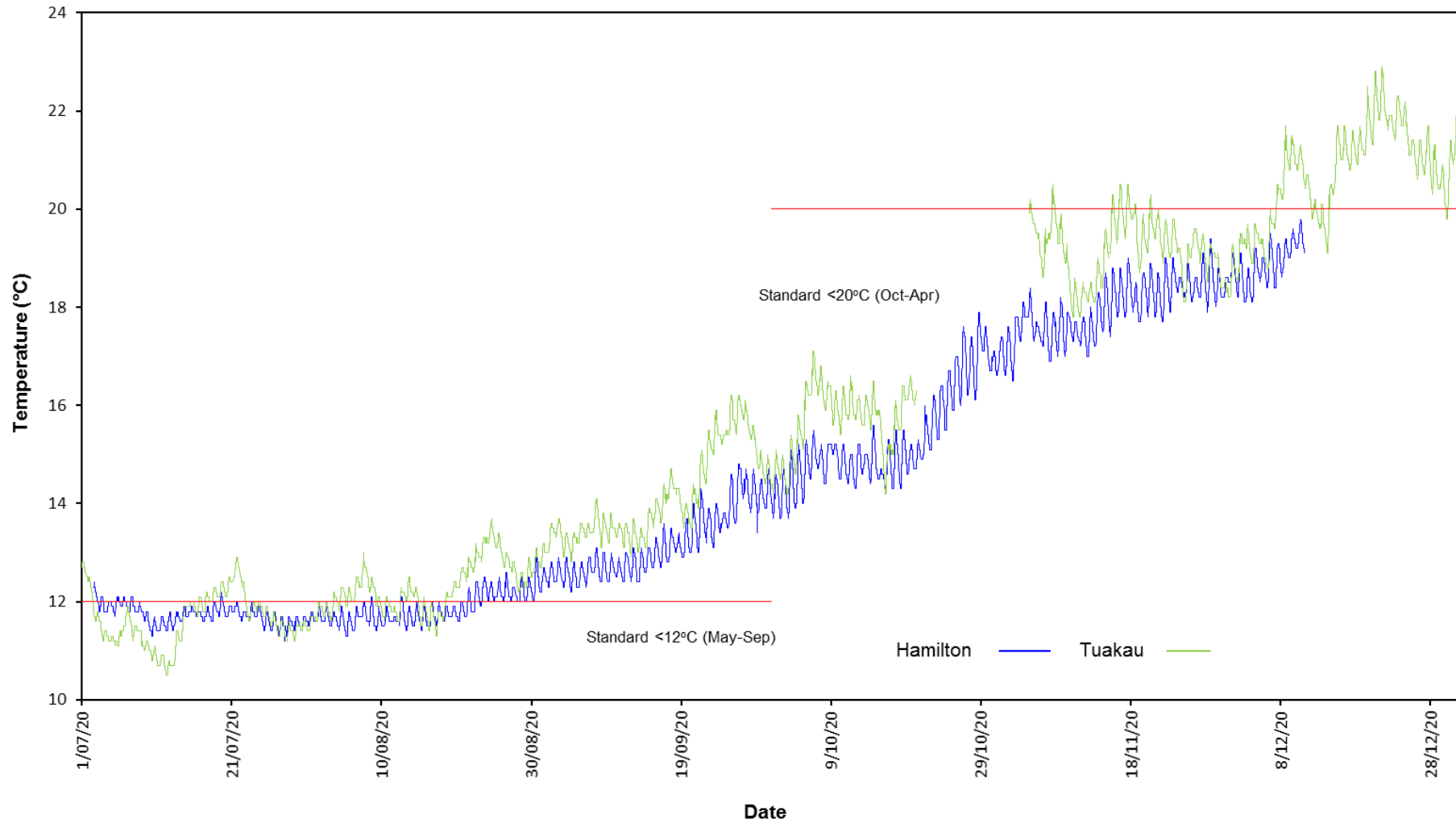
Dissolved Oxygen (% saturation): Lower Waikato (January - June)



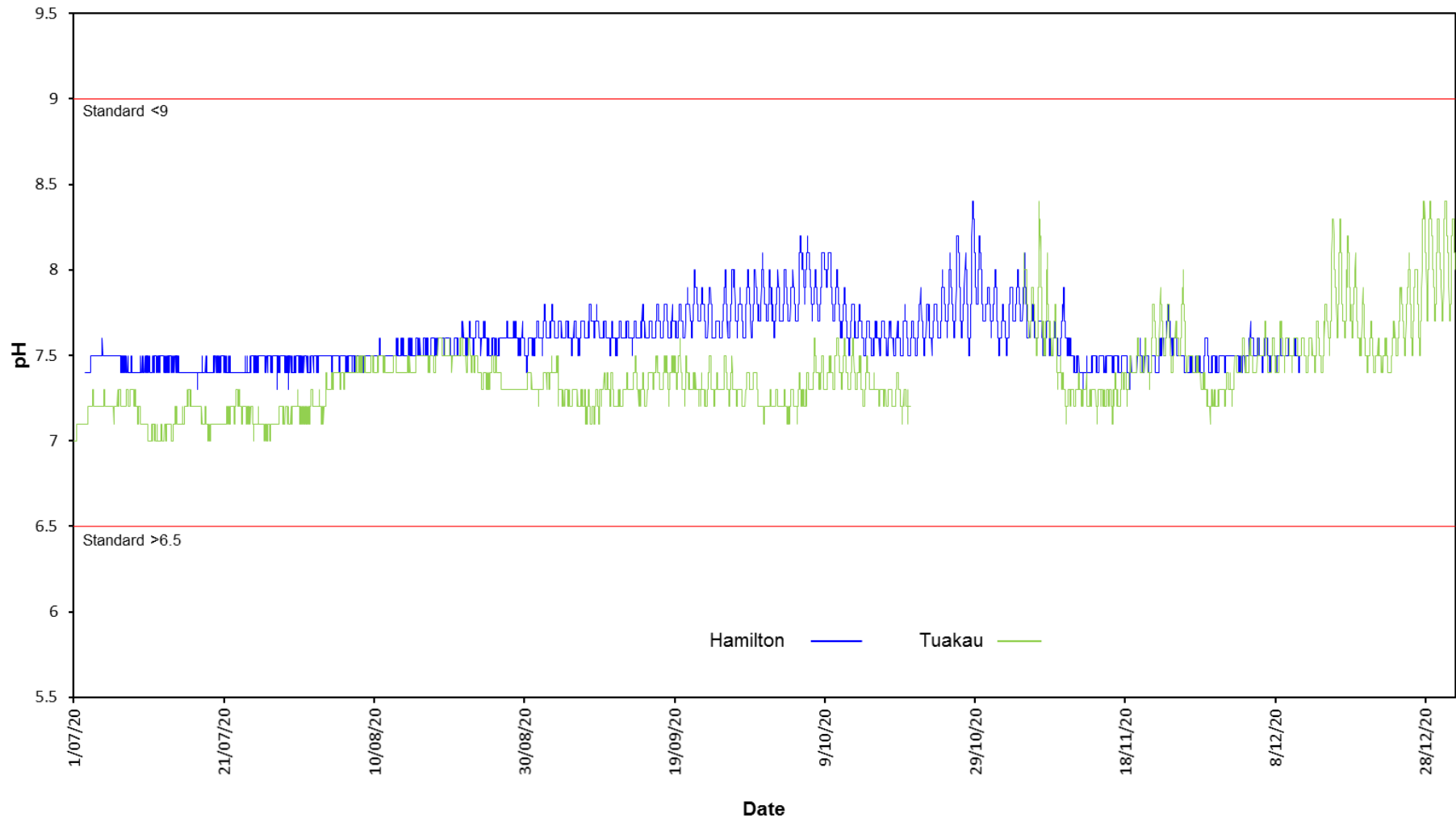
Chlorophyll a: Lower Waikato (January - June)



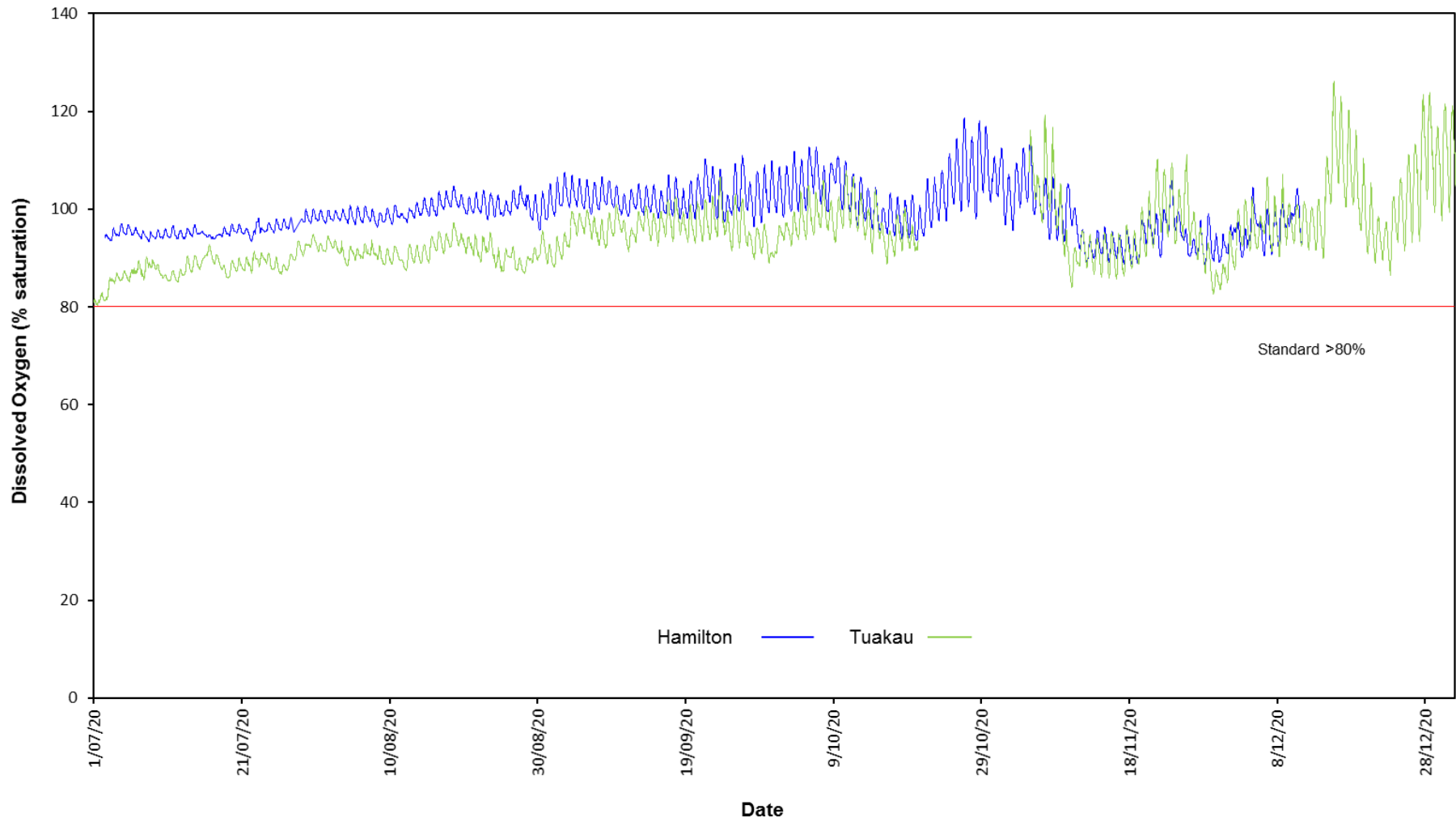
Temperature: Lower Waikato (July - December)



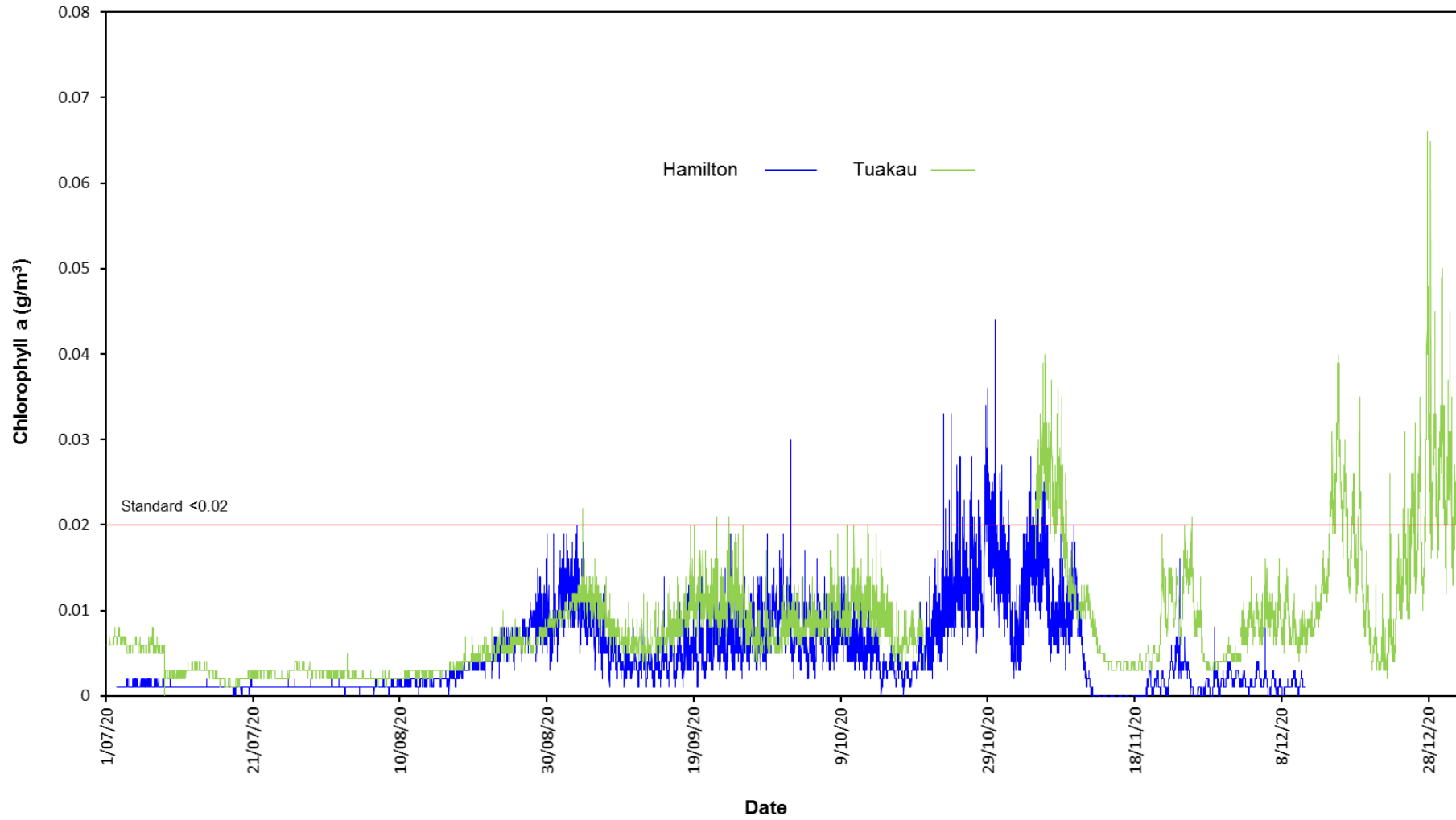
pH: Lower Waikato (July - December)



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



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 - turbidity - black disk (visual clarity)	- aesthetic appearance	Turbidity	routine
	- light availability for excessive plant growth	Black disk	routine (field)
	- aquatic life protection		
	- indicator of catchment condition, land use		
Colour - light absorption	- aesthetic appearance	Munsell colour	routine (field)
	- light availability for excessive plant growth	Absorbance at:	routine
	- indicator of presence of organic matter	340,440,780nm	
Nutrients (N and P) chlorophyll <i>a</i>	- enrichment, excessive plant growth	NO ₃ -N+NO ₂ -N	routine
	- nutrient limitation for plant/algal growth	NH ₄ -N,TKN	
		DRP, TP, Chl <i>a</i>	
Geothermal contaminants	- indicators of geothermal inflows	Cl, Li, B, As	routine
	- aquatic life protection (ecotoxicity)		
	- drinking water (human health aspects)		
Organic carbon	- indicator of organic pollution	BOD ₅	routine
	- catchment characteristics	TOC/DOC	routine
Faecal bacteria - E. coli - enterococci - faecal coliforms	- indicator of pollution with faecal matter	E. Coli	routine
	- disease risk for swimming etc.	ENT	routine
		FC	routine

¹ see 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.
Dissolved oxygen	>4.0 mg/L 1-day minimum	National Policy Statement for Freshwater Management 2020, Appendix 2B, Table 17.
Dissolved oxygen	>5.0 mg/L 7-day mean minimum	National Policy Statement for Freshwater Management 2020, Appendix 2B, Table 17.
pH	6.5–9	ANZECC. (2000). Australia and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council. Agriculture and Resource Management Council of Australia and New Zealand. ISBN 09578245 0 5.
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).
<i>Escherichia coli</i>	<550/100 mL	Ministry for the Environment (2003) guidelines for the management of recreational and marine shellfish-gathering waters.
Median <i>Escherichia coli</i>	<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 <i>a</i>	<0.02 g/m ³	Ministry for the Environment (1992).
Arsenic	<0.01 g/m ³	Ministry of Health (2018).
Boron	<1.4 g/m ³	Ministry of Health (2018).

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
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 <i>a</i>	CHLa	Acetone extraction. Spectroscopy. APHA method 10200 H (modified)
Cl Diss	Chloride Dissolved	CL	Filtered sample. Ferric thiocyanate colorimetry, Discrete analyser. APHA method 4500 Cl ⁻ E (modified)
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	<i>Escherichia coli</i>	<i>E coli</i>	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
Li	Lithium	Li	ICP-MS, method APHA 3125 B
NH4	Ammoniacal Nitrogen	NH ₄ N	Filtration, Phenol/Hypochlorite Colorimetry. Discrete analyser. APHA method 4500-NH ₃ 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 - NO ₃ -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)

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

²Water 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