Traverse Environmental

Gisborne District Council

Periphyton biomass baseline attribute state

Multiple lines of evidence approach to estimate periphyton biomass (Chlorophyll-a) state at Gisborne District Council monitoring sites

Report Information

Report Status	Final
Author	Mark Heath
Review By	Laura Keenan
Date	27/02/2024

Contents

List of Tables

1 Introduction

Gisborne District Council (GDC) are currently in the process of implementing the National Policy Statement for Freshwater Management 2020 (NPS-FM), which requires baseline attribute states (BAS) to be set for each National Objectives Framework (NOF) attribute from which prospective target attribute states (TAS) and limits can be considered. One of the NOF attributes is periphyton in rivers.

However, there is currently a paucity of periphyton monitoring data for the Tairāwhiti region from which BAS can be derived. Until this summer, periphyton sample collection for chlorophyll-*a* (i.e., periphyton biomass) analysis was conducted annually at river state of environment monitoring sites, during summertime macroinvertebrate collection, rather than monthly as required by the national objectives framework (NOF) for the periphyton biomass attribute.

The NOF periphyton attribute requires that the assessment of state is based on a monthly chlorophyll-*a* monitoring regime with a minimum record length of three years. This minimum record length is important as it accounts for some of the interannual variability in periphyton biomass/cover, which can be significant. Due to paucity of periphyton data available, BAS for the periphyton biomass attribute cannot be derived directly.

NPS-FM guidance is clear that if there is insufficient data to ascertain a NOF attribute's BAS, then it should be derived using the best information available (NPS-FM clause 1.6), which may include modelling, partial data, and local knowledge. It emphasises that local authorities must not delay making decisions solely because of uncertainty about the quality or quantity of the information available, i.e., doing nothing because of a lack of information is not an acceptable option.

Thus, the NPS-FM directs local authorities to proceed with the definition of BAS, even in the absence of sufficient and scientifically robust data.

The aim of this report is to use a multiple lines of evidence approach to estimate the periphyton biomass baseline attribute state [1] for each monitoring site in Tairāwhiti.

This report was commissioned By Gisborne District Council through the A2E funding mechanism.

[1] NB, the estimated periphyton biomass states derived by the multiple lines of evidence approach for each site is intended to serve as a proxy for BAS, which, according to NPS-FM, is technically meant to represent the state of the attribute on 7 September 2017.

2 Methods

To estimate periphyton biomass BAS state for GDC SoE monitoring sites, a multiple lines of evidence approach was employed. The lines of evidence assessed were:

- Site monitoring and meta data, including water quality, suspended sediment and substrate data;
- Annual summertime periphyton biomass data collected by GDC since 2016;
- Nutrient concentration look-up tables[2] to achieve periphyton target attribute states, developed by Snelder & Kilroy (2023);
- Nutrient concentration look-up tables for compliance with periphyton chlorophyll-*a* guidelines during summer growth period, developed by Matheson (2016); and
- Local knowledge of GDC science and monitoring officers.

Each of these lines of evidence are described in further detail below.

Site monitoring and meta data

The collated data includes information on site substate (i.e., whether a site is hard or soft bottom), river environment classification (REC), visual clarity, and nutrient concentrations, including total nitrogen (TN), total phosphorus (TP), dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP).

The primary focus of collating SoE monitoring data for each monitoring site was to allow for the assessment of annual summertime periphyton biomass data and for the input of nitrogen and phosphorus data into nutrient concentration look-up tables. SoE water quality data was also used to understand the potential susceptibility of a monitoring site to periphyton growth. For instance, a site with poor visual clarity is not expected to support the same level of periphyton growth as a site with good visual clarity, all other factors being equal. Stream habitat assessment data, including stream bed substrate was used to provide an indication of the site's susceptibility to periphyton growth.

Shading is also an important factor in determining the potential susceptibility of a monitoring site to periphyton growth. However, no robust assessment has been conducted at GDC SoE monitoring sites to determine whether they should be classified as shaded or unshaded. Feedback from GDC science and monitoring staff indicated almost all monitoring sites are unshaded. Consequently, for this assessment, all sites were considered as unshaded.

Annual summertime monitoring data

In the Gisborne Region, monitoring of periphyton biomass (chlorophyll-*a*) began in 2016 and has been conducted annually in summer in conjunction with macroinvertebrate monitoring. However, each monitoring site has not been monitored every year, and the number of monitoring occasions varies between one and five. For this assessment, estimates of periphyton biomass state were made from the annual summertime monitoring results by matching median and maximum chlorophyll-*a* concentrations with the corresponding periphyton biomass attribute state band. Subsequently, an expert evaluation was conducted, taking into account the estimated median and maximum periphyton biomass attribute states, along with the number of monitoring occasions, to derive an overall estimate of annual summertime biomass state.

Nutrient criteria model & look-up tables (Snelder and Kilroy, 2023)

---

[2] Also referred to as nutrient criteria look up tables

Snelder & Kilroy (2023) developed nutrient concentration criteria look-up tables, to assess nutrient concentrations to achieve periphyton TAS in hard bottomed (i.e., cobble-gravel-bed) rivers. From Snelder & Kilroy (2023), page 10:

> *The nutrient criteria are defined so that three NOF periphyton target attribute states measured as: 50, 120, and 200 mg Chla92 m^{-2}, are not exceeded. These targets correspond to the boundaries between the A and B, B and C, and C and D bands defined by the NOF periphyton attribute… For each target, criteria apply to rivers classified into 21 Source-of-flow classes defined by the River Environment Classification (REC).*

The NOF requires that periphyton attribute state be based on three years of monthly samples (i.e., 36 samples per site). Periphyton state classification relies on the threshold reached by the top 8%[3] of sample results for each site. When 36 monthly samples are collected over a three-year period, this is equivalent to a maximum of three samples (or one sample per year) exceeding the threshold and is equivalent to comparing the 92nd percentile (Chla92).

Snelder & Kilroy (2023) derived the nutrient criteria using generalised linear models (GLM) based on data from 251 periphyton monitoring sites across New Zealand. The look-up tables contain separate nutrient concentration criteria for TN, TP, DIN and DRP. For more information about the nutrient criteria and the underlying regression modelling refer to Snelder & Kilroy (2023).

In this assessment, TN and TP concentrations[4] for all GDC state of the environment (SoE) monitoring sites were assessed against the relevant nutrient look-up tables to estimate a periphyton biomass state. For example, a site with a TN concentration of 0.34 mg/L and with REC class of WW/L is assigned to attribute band C based on the TN look-up tables with a 20% under protection risk. According to the TN look-up tables the threshold between bands D and C sits between 0.21 mg/L and 2.28 mg/L for a 20% under protection risk for the different REC classes.

'Under protection risk' (UPR) represents the proportion of locations that are expected to exceed the biomass target i.e., the probability that a location's biomass will be above the target band threshold. A 20% UPR means 20% of locations are estimated to be above the target band threshold, while 10% UPR means 10% of locations estimated to be above the target band threshold. In the case of the example site with a TN concentration of 0.34 mg/L, there is <20% probability that the actual periphyton state is above the C and D band threshold for the WW/L REC, as the TN concentration is substantially lower than the C and D band threshold for which 20% of the observations are estimated to be above.

For our assessment, median TN and TP concentrations for each GDC SoE monitoring site were assessed against the 20% UPR TN and TP concentration criteria look-up tables designated for unshaded sites to estimate periphyton biomass. The use of a 20% UPR is recommended over 5, 10 or 15% UPR due to model uncertainty Ton Snelder (pers comm). Although both unshaded and shaded TN and TP concentration criteria look-up tables were evaluated, only unshaded results are presented in this report. This decision is based on the observation by GDC science and monitoring staff that almost all monitoring sites are unshaded.

In addition to using the 20% UPR TN and TP unshaded concentration criteria look-up tables to estimate periphyton state, state estimates were also derived using nutrient look-up tables with no UPR (hereafter referred to as 'mean' lookup tables). In this instance, 50% of observations are above the line of best fit and 50%

---

[3] For site classified in the default category, it is 17% for sites classified in the productive category. For further information refer to the NPS-FM 2020.

[4] Total nutrients were chosen over dissolved nutrients as they are considered better indicators of nutrient flux and availability in Tairāwhiti. The region exhibits high elevated levels of suspended sediment to which nutrients are associated. Furthermore, among the GLM models developed by Snelder and Kilroy (2023), the TN and TP models demonstrated superior performance compared to the DIN and DRP models.

of observations are below. The nutrient look-up tables for the line of best fit (i.e., mean model fit) for each REC source-of-flow class were provided by Ton Snelder (pers comm).

After obtaining periphyton biomass estimates from the 20% UPR and mean look-up tables, an evaluation was conducted to derive an overall biomass state estimate. It is crucial to note that the criteria do not consider growth limitations by TN or TP (i.e., single nutrient limitation). Therefore, the periphyton biomass state estimate was determined by the worse of the two look-up tables. For instance, if a TN look-up table estimates a B state and a corresponding TP table estimates an A state, the overall periphyton biomass state is assigned to the B state.

Nutrient look-up tables Matheson et al, (2016) model

Matheson et al. (2016) also developed nutrient concentration criteria look-up tables to assess nutrient concentrations to achieve periphyton TAS in hard bottomed (i.e., cobble-gravel-bed) rivers. They used a non-linear quantile regression analysis of combined NIWA river water quality network and regional council datasets to derive nutrient criteria look-up tables for TN, TP, DIN and DRP. Unlike Snelder & Kilroy (2023), Matheson et al. (2016) did not produce sperate nutrient criteria look-up tables for each REC class, because of several REC climate/source of flow classes were poorly represented.

The Mathson et al. (2016) nutrient criteria look-up tables are based on ≥85%[5] compliance with the periphyton chlorophyll-a during the summer (1 November to 30 April) growing season, which the authors suggest is approximately equivalent to the NOF compliance requirement of 92% for monthly observations over three years. Mean nutrient concentrations for the preceding 12 months, and not median concentrations as used for Snelder & Kilroy (2023), are to be assessed against the nutrient criteria look-up tables. For the nutrient criteria and more information about the nutrient criteria and the underlying regression modelling, refer to Matheson et al. (2016).

For this assessment, five-year median DIN and DRP concentrations for each SoE monitoring site were assessed against the DIN and DRP concentration criteria look-up tables to estimate periphyton biomass. It is important to note that the use of median concentrations instead of mean concentrations may result in the predicted periphyton biomass state being underestimated, as median nutrient concentrations are generally lower than mean concentrations. Dissolved nutrients (DIN and DRP) lookup tables were used instead of total nutrients (TN and TP) lookup tables because no TN criteria were derived by Matheson et al. due to insufficient data.

GDC assessment

Once periphyton state estimates were derived for each SoE monitoring site using annual summertime chlorophyll-*a* results and the two nutrient criteria models, they were presented to GDC science and monitoring staff for sense checking. Prior to the sense check, GDC staff underwent a periphyton biomass “calibration” exercise to ensure familiarity with the NOF attribute requirements (i.e., at least three years of monthly monitoring) and the amount of periphyton associated with each periphyton attribute band. Following the sense check and calibration exercise, GDC staff collectively estimated the periphyton biomass state for each monitoring site.

[5] The NOF periphyton attribute requires 92% compliance and for productive river classes (REC defined types: WD/SS, WD/VB, WD/VA, CD/SS, CD/VB, CD/VA) 83% compliance. NB: there are no hard bottom production river class monitoring sites in the Gisborne Region.

2.1 Final periphyton biomass state estimates

After the preparation of the multiple lines of evidence, an assessment was conducted to estimate the final periphyton biomass attribute state for each site. This assessment prioritised the actual monitoring data (i.e., the annual summertime chlorophyll-a biomass results). Additionally, substantial weight was placed on the nutrient concentration criteria look-up tables of Snelder and Kilroy (2023), which, unlike Matheson (2016), account for REC class variations and incorporate more recent data.

3 Results

The results of the each line of evidence are presented in Table 1,Table 2,Table 3Table 4 below.

Table 1: Tairāwhiti monitoring sites River Environment Classification (REC) climate/source of flow class and substrate type. Median dissolved inorganic nitrogen (DIN), dissolved reactive phosphorus (DRP), total nitrogen (TN) and total phosphorus (TP) concentrations as well as median visual clarity are also shown for the period 2018-2023. OB = observed.

Planning area	Sample site	REC	Substrate type	Visual clarity (m)	Median DIN (mg/L)	Median DRP (mg/L)	Median TN (mg/L)	Median TP (mg/L)
Wharekahika-Waikura	Awatere River at SH35 Bridge	WX/L	HB	1.24	0.06	0.009	0.11	0.015
Ūawa	Hikuwai River at Willowflat	WW/L	HB	1.17	0.03	0.006	0.19	0.019
Waiapu	Ihungia River at Ihungia Rd Br	WW/L	HB	0.40	0.03	0.007	0.19	0.024
Wharekahika-Waikura	Karakatuwhero River at SH35 Br	WX/H	HB	>2	0.04	0.011	0.1	0.016
Ūawa	Mangaheia River at Paroa Road Bridge	WW/L	SB-OB	1.13	0.02	0.008	0.23	0.022
Waiapu	Mangaoporo River at Tutumatai Bridge	WX/H	HB	0.42	0.08	0.012	0.11	0.025
Waipaoa	Mangatu River at Omapere Station	CW/H	HB	0.08	0.12	0.005	0.24	0.047
Wharekahika-Waikura	Mangatutu Str at Sh35-Waipahuru	WX/H	HB	>2	0.02	0.013	0.06	0.017
Waiapu	Mata River at Aorangi (Makarika Road)	WW/L	SB-REC	0.19	0.07	0.009	0.12	0.041
Waiapu	Mata River at Pouturu Br	CW/H	HB	0.14	0.05	0.005	0.23	0.035
Mōtū	Matawai Stream at Tawai	CW/H	HB	1.03	0.44	0.013	0.72	0.041
Mōtū	Mōtū River above Falls	CW/H	HB	1.07	0.28	0.016	0.44	0.041
Mōtū	Mōtū River at Kotare Station Bridge	CW/H	HB	1.18	0.27	0.02	0.4	0.04
Mōtū	Mōtū River at Matawai Conservation	CW/H	HB	1.61	0.02	0.013	0.1	0.018
Wharekahika-Waikura	Oweka River at SH35 Bridge	WX/L	HB	>2	0.04	0.011	0.09	0.016
Waimatā	Pakarae River at Pakarae Station Bridge	WW/L	HB	0.89	0.03	0.011	0.32	0.031
Waiapu	Poroporo River at Rangitukia Rd Bridge	WX/L	HB	0.70	0.06	0.009	0.16	0.021
Waiapu	Tapuaeroa River at Tapuaeroa Rd	WX/L	HB	0.45	0.09	0.015	0.12	0.027
Waipaoa	Taruheru River at Tuckers Rd Bridge	WD/L	SB-REC+OB	0.46	1.45	0.106	2.1	0.2
Waipaoa	Te Arai River at Pykes Weir	WW/L	HB	1.11	0.02	0.006	0.28	0.014
Waiapu	Waiapu River at Rotokautuku Br (SH35)	CX/H	HB	0.19	0.06	0.01	0.14	0.043
Waipaoa	Waihirere Str at Domain	WW/L	HB	1.49	0.13	0.037	0.34	0.054
Waipaoa	Waikohu River at Mahaki Station	CW/H	HB	1.24	0.10	0.008	0.34	0.023
Waimatā	Waimatā River at Goodwins Rd Bridge	WW/L	HB	0.62	0.03	0.014	0.38	0.036
Waimatā	Waimatā River at Monowai Bridge	WW/L	HB	0.77	0.04	0.014	0.32	0.031
Waipaoa	Waingaromia River at Terrace Station	WW/L	HB	0.32	0.08	0.006	0.22	0.035
Waipaoa	Waipaoa River at Kanakanaia	WW/L	SB-REC	0.11	0.14	0.012	0.36	0.082
Waipaoa	Waipaoa River at Matawhero Bridge	WW/L	SB-OB	0.12	0.16	0.013	0.34	0.05
Waipaoa	Whakaahu Str at Brunton Rd	WD/L	SB-REC+OB	0.66	0.04	0.019	0.5	0.055
Wharekahika-Waikura	Wharekahika River U/S of Wharf Bridge	WW/L	HB	>2	0.06	0.015	0.13	0.023
Waipaoa	Wharekopae River at Rangimoe	CW/H	HB	0.76	0.12	0.019	0.5	0.046

Table 2: Median and maximum annual summertime periphyton chlorophyll-a (Chl-a) concentrations as well as number of monitoring occasions for the period 2017 – 2023. Estimated NPS-FM periphyton biomass attribute states based on median and maximum annual summertime periphyton chlorophyll-a results as well as an overall state periphyton biomass state estimate. * highly uncertain.# Soft bottom

Planning area	Sample site	Number of monitoring occasions	Median summertime Chl-a (mg/m^2)	Max summertime Chl-a (mg/m^2)	Estimate NPS-FM Median Chl-a state	Max Chl-a state	Estimate NPS periphyton state based on summertime biomass data
Wharekahika-Waikura	Awatere River at SH35 Bridge	3	2	11	A	A	A
Ūawa	Hikuwai River at Willowflat	3	16	19	A	A	A
Waiapu	Ihungia River at Ihungia Rd Br	4	25	55	A	B	A/B
Wharekahika-Waikura	Karakatuwhero River at SH35 Br	3	30	38	A	A	A
Ūawa	Mangaheia River at Paroa Road Bridge	1	6	6	A	A	A
Waiapu	Mangaoporo River at Tutumatai Bridge	5	10	31	A	A	A
Waipaoa	Mangatu River at Omapere Station	3	3	6	A	A	A
Wharekahika-Waikura	Mangatutu Str at Sh35-Waipahuru Bridge	3	53	107	B	B	B
Waiapu	Mata River at Aorangi (Makarika Road)	4	30	55	A	B	A/B
Waiapu	Mata River at Pouturu Br	4	33	191	A	C	C/A
Mōtū	Matawai Stream at Tawai	5	61	184	B	C	C/B
Mōtū	Mōtū River above Falls	3	52	89	B	B	B
Mōtū	Mōtū River at Kotare Station Bridge	5	8	9	A	A	A
Mōtū	Mōtū River at Matawai Conservation Area	4	25	65	A	B	B/A
Wharekahika-Waikura	Oweka River at SH35 Bridge	3	12	36	A	A	A
Waimatā	Pakarae River at Pakarae Station Bridge	2	117	201	B	D	C/D*
Waiapu	Poroporo River at Rangitukia Rd Bridge	3	6	13	A	A	A
Waiapu	Tapuaeroa River at Tapuaeroa Rd	1	4	4	A	A	A
Waipaoa	Taruheru River at Tuckers Rd Bridge#						NA
Waipaoa	Te Arai River at Pykes Weir	4	45	80	A	B	B
Waiapu	Waiapu River at Rotokautuku Br (SH35)	4	3	15	A	A	A
Waipaoa	Waihirere Str at Domain	4	37	39	A	A	A
Waipaoa	Waikohu River at Mahaki Station	4	45	286	A	D	A - D*
Waimatā	Waimatā River at Goodwins Rd Bridge	4	115	175	B	C	C
Waimatā	Waimatā River at Monowai Bridge	3	127	150	C	C	C
Waipaoa	Waingaromia River at Terrace Station	4	93	271	B	D	C/D
Waipaoa	Waipaoa River at Kanakanaia	3	5	7	A	A	A
Waipaoa	Waipaoa River at Matawhero Bridge	3	10	54	A	B	A/B
Waipaoa	Whakaahu Str at Brunton Rd#	2	186	355	C	D	D
Wharekahika-Waikura	Wharekahika River U/S of Wharf Bridge	3	21	95	A	B	A/B
Waipaoa	Wharekopae River at Rangimoe	4	8	42	A	A	A

Table 3: NPS-FM periphyton biomass attribute state estimates for each Tairāwhiti monitoring site based on Snelder & Kilroy (2023) and Matheson et al, (2016) nutrient criteria look-up tables. TN = total nitrogen, TP = total phosphorus, DIN = dissolved inorganic nitrogen and DRP = dissolved reactive phosphorus, UPS = under protection risk.

Planning area	Sample site	Snelder & Kilroy 2023						Matheson 2016		
		NPS periphyton state estimate (TN with 20% UPR)	NPS periphyton state estimate (TN mean)	NPS periphyton state estimate (TP with 20% UPR)	NPS periphyton state estimate (TP mean)	NPS state estimate (TN and TP20% UPR)	NPS state estimate (TN and TP with 50% UPR)	NPS periphyton state estimate base on DIN	NPS periphyton state estimate based on DIN	NPS periphyton state estimate based on DIN and DRP
Wharekahika-Waikura	Awatere River at SH35 Bridge	B	B	B	B	B	B	A	≤B	≤B
Ūawa	Hikuwai River at Willowflat	B	B	C	B	C	B	A	≤B	≤B
Waiapu	Ihungia River at Ihungia Rd Br	B	B	C	B	C	B	A	≤B	≤B
Wharekahika-Waikura	Karakatuwhero River at SH35 Br	B	B	B	B	B	B	A	≤B	≤B
Ūawa	Mangaheia River at Paroa Road Bridge	C	B	C	B	C	B	A	≤B	≤B
Waiapu	Mangaoporo River at Tutumatai Bridge	B	B	B	B	B	B	A	≤B	≤B
Waipaoa	Mangatu River at Omapere Station	B	B	C	B	C	B	A	≤B	≤B
Wharekahika-Waikura	Mangatutu Str at Sh35-Waipahuru Bridge	B	B	B	B	B	B	A	≤B	≤B
Waiapu	Mata River at Aorangi (Makarika Road)	B	B	C	B	C	B	A	≤B	≤B
Waiapu	Mata River at Pouturu Br	B	B	C	B	C	B	A	≤B	≤B
Mōtū	Matawai Stream at Tawai	C	B	C	B	C	B	A	≤B	≤B
Mōtū	Mōtū River above Falls	C	B	C	B	C	B	A	≤B	≤B
Mōtū	Mōtū River at Kotare Station Bridge	C	B	C	B	C	B	A	≤B	≤B
Mōtū	Mōtū River at Matawai Conservation Area	B	B	B	B	B	B	A	≤B	≤B
Wharekahika-Waikura	Oweka River at SH35 Bridge	B	B	B	B	B	B	A	≤B	≤B
Waimatā	Pakarae River at Pakarae Station Bridge	C	B	C	B	C	B	A	≤B	≤B
Waiapu	Poroporo River at Rangitukia Rd Bridge	B	B	B	B	B	B	A	≤B	≤B
Waiapu	Tapuaeroa River at Tapuaeroa Rd	B	B	B	B	B	B	A	≤B	≤B
Waipaoa	Taruheru River at Tuckers Rd Bridge#	C	D	D	D	D	D	B	≤B	B
Waipaoa	Te Arai River at Pykes Weir	C	B	B	B	B	B	A	≤B	≤B
Waiapu	Waiapu River at Rotokautuku Br (SH35)	B	A	B	B	B	B	A	≤B	≤B
Waipaoa	Waihirere Str at Domain	C	B	C	B	C	B	A	≤B	≤B
Waipaoa	Waikohu River at Mahaki Station	B	B	B	B	B	B	A	≤B	≤B
Waimatā	Waimatā River at Goodwins Rd Bridge	C	B	C	B	C	B	A	≤B	≤B
Waimatā	Waimatā River at Monowai Bridge	C	B	C	B	C	B	A	≤B	≤B
Waipaoa	Waingaromia River at Terrace Station	C	B	C	B	C	B	A	≤B	≤B
Waipaoa	Waipaoa River at Kanakanaia	C	B	C	C	C	C	A	≤B	≤B
Waipaoa	Waipaoa River at Matawhero Bridge	C	B	C	B	C	B	A	≤B	≤B
Waipaoa	Whakaahu Str at Brunton Rd#	C	C	D	C	D	C	A	≤B	≤B
Wharekahika-Waikura	Wharekahika River U/S of Wharf Bridge	B	B	C	B	C	B	A	≤B	≤B
Waipaoa	Wharekopae River at Rangimoe	C	B	B	B	B	B	A	≤B	≤B

Table 4: Final NPS-FM periphyton biomass attribute state estimates for each hard bottom Tairāwhiti monitoring site based on multiple lines of evidence approach. An uncertainty of estimate score is also provided (1 = some confidence to 3 = highly uncertain). S.K. 2023 = Snelder & Kilroy (2023), M. 2016 = Matheson et al, (2016). TN = total nitrogen, TP = total phosphorus, DIN = dissolved inorganic nitrogen and DRP = dissolved reactive phosphorus, UPS = under protection risk.

Planning area	Sample site	Estimate NPS periphyton state based on summertime	NPS state estimate (TN and TP20% UPR) S.K. 2023	NPS state estimate (TN and TP based on mean response) S.K. 2023	NPS periphyton state estimate based on DIN and DRP (M. 2016)	GDC science team estimates	Final state estimate	Uncertainty
Wharekahika-Waikura	Awatere River at SH35 Bridge	A	B	B	≤B	A	A	1
Ūawa	Hikuwai River at Willowflat	A	C	B	≤B	A	A	1
Waiapu	Ihungia River at Ihungia Rd Br	B	C	B	≤B	A	B	2
Wharekahika-Waikura	Karakatuwhero River at SH35 Br	A	B	B	≤B	A	A	2
Ūawa	Mangaheia River at Paroa Road Bridge	A	C	B	≤B	B	B	1
Waiapu	Mangaoporo River at Tutumatai Bridge	A	B	B	≤B	A	A	2
Waipaoa	Mangatu River at Omapere Station	A	C	B	≤B	A	A	2
Wharekahika-Waikura	Mangatutu Str at Sh35-Waipahuru Bridge	B	B	B	≤B	B	B	1
Waiapu	Mata River at Aorangi (Makarika Road)	B	C	B	≤B	B	B	2
Waiapu	Mata River at Pouturu Br	C	C	B	≤B	B	B	2
Mōtū	Matawai Stream at Tawai	C	C	B	≤B	B/C	C	1
Mōtū	Mōtū River above Falls	B	C	B	≤B	B	B	1
Mōtū	Mōtū River at Kotare Station Bridge	A	C	B	≤B	A	A	2
Mōtū	Mōtū River at Matawai Conservation Area	B/A	B	B	≤B	A	B	2
Wharekahika-Waikura	Oweka River at SH35 Bridge	A	B	B	≤B	A	A	1
Waimatā	Pakarae River at Pakarae Station Bridge	C/D	C	B	≤B	B/C/D?	C	3
Waiapu	Poroporo River at Rangitukia Rd Bridge	A	B	B	≤B	A	A	2
Waiapu	Tapuaeroa River at Tapuaeroa Rd	A	B	B	≤B	A	A	2
Waipaoa	Te Arai River at Pykes Weir	B	B	B	≤B	B	B	2
Waiapu	Waiapu River at Rotokautuku Br (SH35)	A	B	B	≤B	A	A	2
Waipaoa	Waihirere Str at Domain	A	C	B	≤B	A	A	2
Waipaoa	Waikohu River at Mahaki Station	A/D?	B	B	≤B	C/B	C	3
Waimatā	Waimatā River at Goodwins Rd Bridge	C	C	B	≤B	C	C	2
Waimatā	Waimatā River at Monowai Bridge	C	C	B	≤B	C	C	2
Waipaoa	Waingaromia River at Terrace Station	C/D	C	B	≤B	C	C	3
Waipaoa	Waipaoa River at Kanakanaia	A	C	C	≤B	A	A	2
Waipaoa	Waipaoa River at Matawhero Bridge	A/B	C	B	≤B	A/B	A	2
Wharekahika-Waikura	Wharekahika River U/S of Wharf Bridge	A/B	C	B	≤B	B	B	2
Waipaoa	Wharekopae River at Rangimoe	A	B	B	≤B	B	A	2

4 Discussion

This assessment, based on multiple lines of evidence, has categorised 14 sites in band A, 9 sites in band B and 6 sites in band C. The assessment included four sites that were identified as soft bottom by either observation or REC classification, but not both. These sites were included due to their annual periphyton chlorophyll-a records, ranging from one (Mangaheia River at Paroa Road Bridge) to four (Mata River at Aorangi (Makarika Road). Two sites (Taruheru River at Tuckers Rd Bridge and Whakaahu Str at Brunton Rd) were excluded as they were identified as soft bottom by both observation and REC classification.

It is noteworthy that none of the SoE sites were estimated below the national bottom line (i.e., band D) for the NOF periphyton attribute.

The Whakaahu Stream at Brunton Rd, classified as having a soft bottom, had 2 recorded chlorophyll-*a* measurements with a maximum concentration of 355 mg/m^2, significantly exceeding the 200 mg/m^2 band D boundary. It is my understanding that this site has large standing crops macrophytes, which can have large epiphytic algae/periphyton growth. The methodology employed to sample the periphyton is unclear.

While the predicted periphyton biomass attribute states are based on multiple lines of evidence and the best available information, they are somewhat to very uncertain and should be regarded as preliminary best estimates until three years of monthly data is collected, per the periphyton attribute requirements. Considering that monthly periphyton biomass sampling began at each SoE monitoring site in July 2023, it is unlikely that three years of monitoring data will be available by the time GDC notifies the Tairāwhiti Resource Management Plan. Therefore, it is recommended that baseline attribute state estimates are reviewed and finalised once 12 months of monthly periphyton monitoring data is collected from each SoE monitoring site[6].

Gisborne District Council have divided the region into seven catchments, which are currently at different stages of implementing the NPS-FM. Periphyton BAS estimates provided by this assessment enable GDC to engage with communities in each respective catchment, facilitating discussions about prospective TAS, nutrient criteria and limits.

[6] Monthly periphyton biomass sampling began at each SoE monitoring site in July 2023.

References

Aquanet Consulting Ltd, 2023. State and trends of river water quality in Tairāwhiti – Regional reference report. Report prepared for Gisborne District Council, April 2023.

Matheson F, Quinn J and Unwin M. 2016. Review of the New Zealand instream plant and nutrient guidelines and development of an extended decision making framework: Phase 3. NIWA report prepared for Ministry of Business, Innovation and Employment Envirolink Fund: 117.

Ministry for the Environment. 2020. National Policy Statement for Freshwater Management 2020. Ministry for the Environment publication, February 2023.

Snelder T and Kilroy C. 2023. Revised nutrient criteria for periphyton biomass objectives: updating criteria referred to in Ministry for Environment 2022 guidance. Land Water People project: 2023-08, November 2023.