



THE WEST COAST REGIONAL COUNCIL

To: Resource Management Committee Meeting, 10 November 2020
From: Kawatiri Freshwater Management Unit Group
Date: 30 October 2020
Subject: Recommendations from the Kawatiri Freshwater Management Unit Group

1. Executive summary

The National Policy Statement for Freshwater Management (NPSFM), versions 2014, 2017 and 2020, require regional councils to identify freshwater management units (FMU's), establish community representative groups for each FMU, and make changes to freshwater regional plans. Under the NPSFM, current water quality and stream health must be maintained or enhanced.

The Kawatiri FMU Group consisted of eight selected community members, two Te Rūnanga o Ngāti Waewae representatives, and Regional Council support staff. This Group worked through issues associated with water quality and quantity, from August 2019 to October 2020, and produced recommendations to the Regional Council.

The Group identified a range of values associated with freshwater that were important to the Kawatiri FMU community. These values, combined with water monitoring results and policy requirements, shaped discussions and subsequent recommendations. The Group was aware that Te Mana o te Wai was a fundamental concept in the NPSFM. Rangatiratanga and the needs of Ngāti Waewae will be at the forefront of policy development, and the concept of ki uta ki tai is imperative when managing freshwater. The Group acknowledged that there are waterbodies within the Kawatiri FMU that require improvement, particularly in regard to faecal contamination and sedimentation.

There are many difficulties associated with a small population and wet climate. Resourcing much of the work required under the NPSFM will be difficult without combined assistance from volunteers, industry and central government. The small community depends heavily on primary industry for

economic survival, so balanced approaches, utilising non-regulatory methods, were deemed favourable. While scarcity of water is currently not a widespread issue in the Kawatiri FMU, changes to the allocation and consenting of water takes were recommended in order to make things fairer and future proofed for both consumptive and non-consumptive use.

2. Long term vision for freshwater

The Kawatiri Freshwater Management Unit group developed a long term vision to sum up the Kawatiri FMU's aspirations:

In the Kawatiri FMU, freshwater is valued and will be managed utilising the ki uta ki tai (mountains to the sea) philosophy. The health and mauri of water is to be sustained for our community's future wellbeing.

3. Background

The original NPSFM came into effect in 2011, with amendments in 2014 and 2017. The 2017 version is what has guided the Kawatiri FMU Group through their process. The NPSFM 2020 came into effect at the end of the process, and while it has been acknowledged, it has not been the primary guidance document. The Group obtained an analysis of their draft Recommendations Report and were satisfied that none of their recommendations have contravened the NPSFM 2020.

The NPSFM allows regional councils flexibility in how they go about identifying FMUs. The guidance suggests that the scale of the FMU needs to be appropriate for objective and limit-setting, freshwater accounting, and monitoring. An FMU should not be so large that it prevents the setting of objectives that are specific enough to be effective. Equally, an FMU should not be so small that it results in undue complexity and cost in either the planning process or in the management of the FMU. The West Coast FMU's took into account existing monitoring sites and community boundaries, combined with catchment boundaries which have an overarching influence on the partial distribution of water and people. The whole of the Kawatiri FMU is within the takiwā of Te Rūnanga o Ngāti Waewae. It is important to note that upper sections of the Buller River catchment are in the Tasman Region and beyond the jurisdiction of the WCRC (Figure 1). A range of water resource monitoring is undertaken by the Council in the Kawatiri FMU (Figure 2).

Freshwater objectives stipulated in the NPSFM seek to ensure that what is valued about each FMU will be maintained or enhanced. To understand what is valued, and therefore what needs to be achieved in each FMU, there needed to be engagement with Te Rūnanga o Ngāti Waewae, and local communities.

The FMU community groups are established for each FMU. These groups consult with the local community and work together to understand the issues in that FMU, identify values and provide a package of recommendations to Council for consideration (including recommended objectives and limits where required). Those recommendations, if agreed, will influence the Regional Land and Water Plan. The FMU group's composition is tailored to suit the circumstances in each FMU.

The NPSFM – Regional Implementation Strategy was approved by Council in May 2018. In accordance with the Strategy, public information sessions were held in June 2019 for the Kawatiri FMU community. Following this, community member applications were considered and brought to the Resource Management Committee for approval. The Kawatiri FMU Group convened in August 2019 and consisted of eight community members: Nathan Keoghan (Chair), Douglas Phillips, Caroline Jones, Di Rossiter, Colin Hope, Campbell Robertson, Michael Kingsbury, and Lisa Steenhauer. Community members came from a range of backgrounds representing a broad array of professional and personal interests (Appendix 1). The Buller District Council (BDC) was approached to provide a representative, with a BDC Councillor nominated to attend by the BDC. However, they did not attend the meetings. The Te Rūnanga o Ngāti Waewae representatives on the FMU Group were Francois Tumahai and Philippa Lynch, and the Regional Council rep was John Hill. WCRC staff supported the group. The Kawatiri FMU Group held its final formal meeting in October 2020.

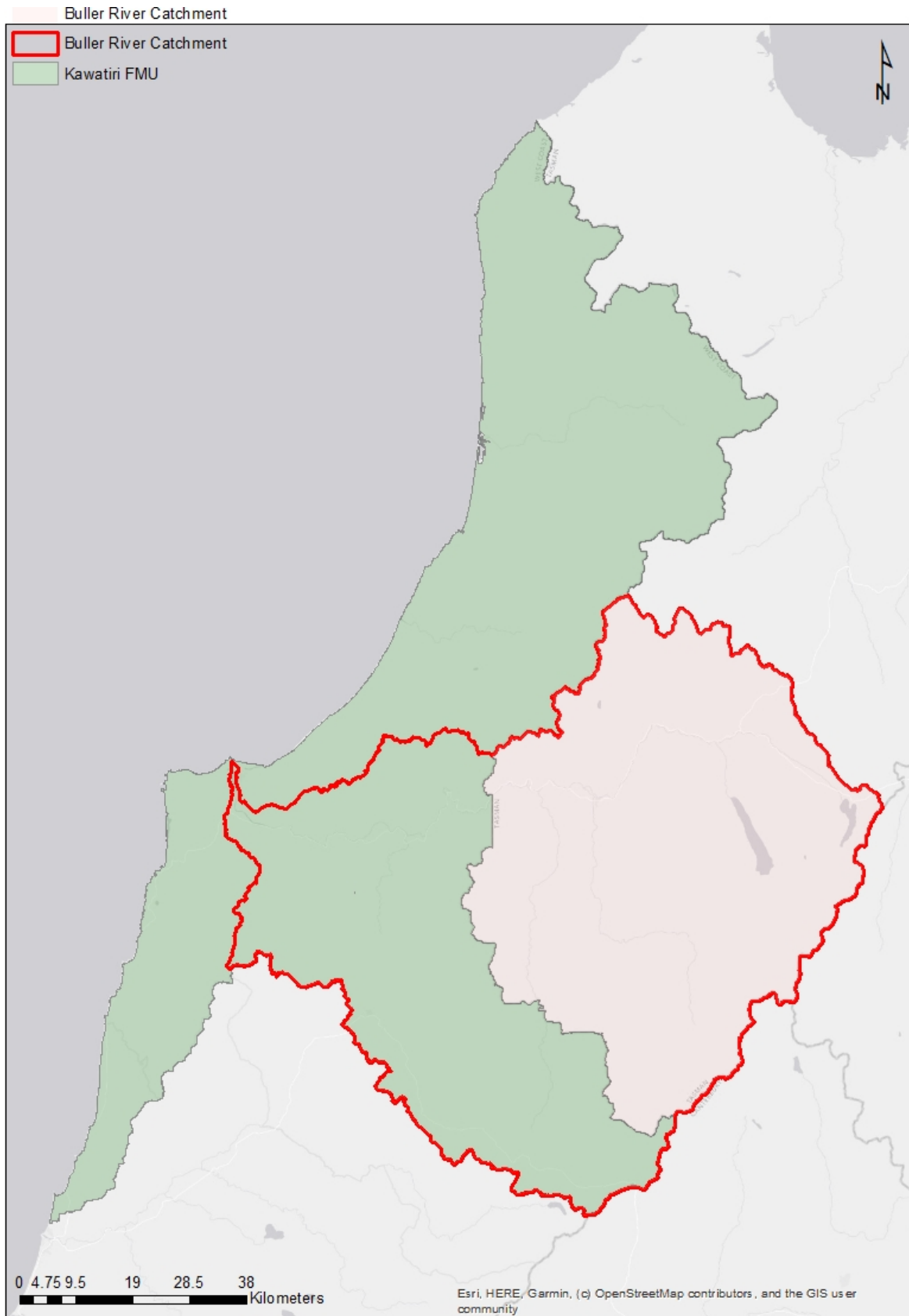


Figure 1: Location of Kawatiri FMU boundary and the entire Buller River catchment boundary

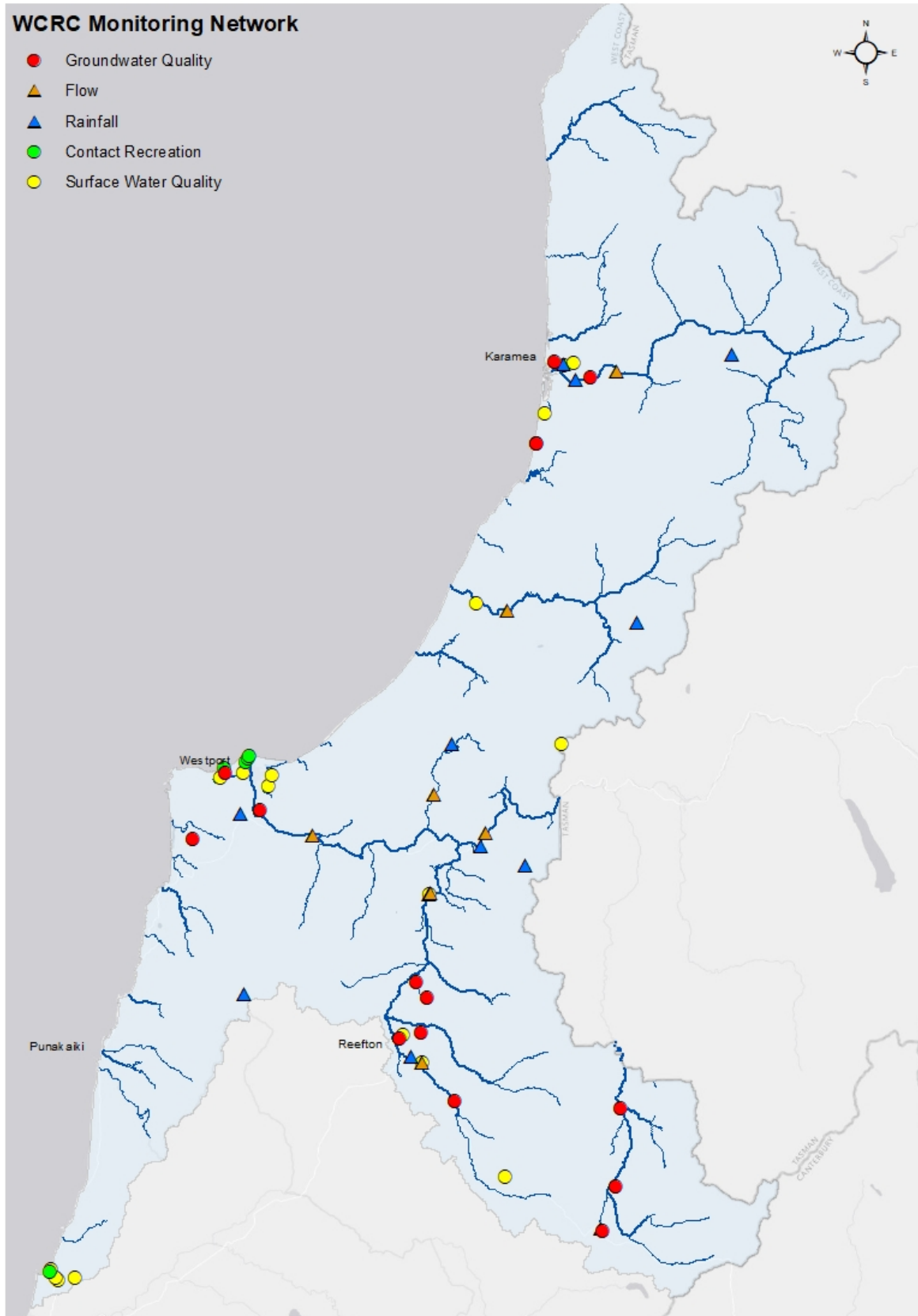


Figure 2: Location of Kawatiri FMU boundary and monitoring locations within the FMU

3.1 Kawatiri FMU meetings

During the 14 months which this Group has met on a monthly basis, they have covered a variety of topics. Through this process, and in accordance with the NPSFM, the Group has identified values that are important to the community, and which are affected by water quantity and quality. The state or condition of these values can be measured using attributes, and objectives can be set for appropriate water quality and/or quantity using limits for the attributes (Figure 3).

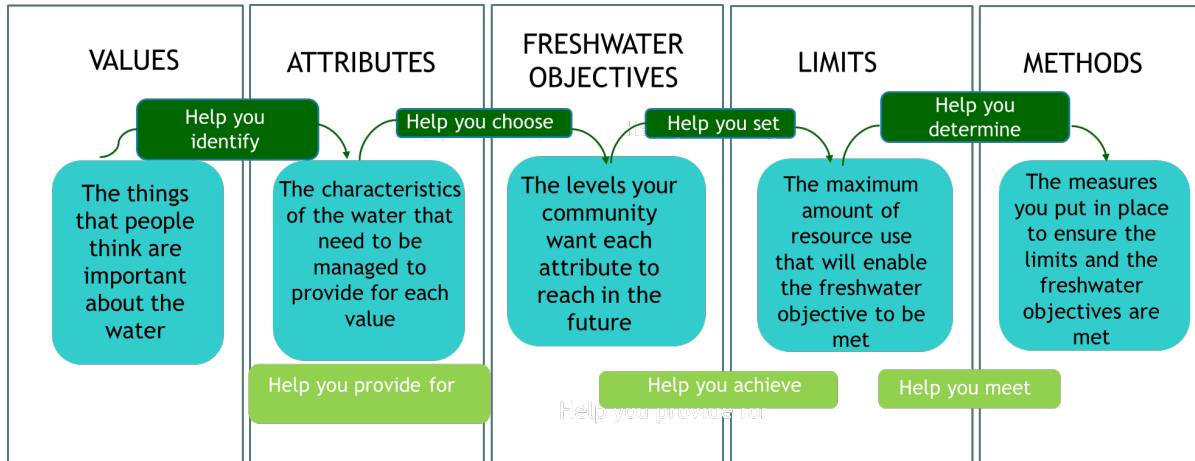


Figure 3: The process for achieving objectives for freshwater as outlined in the NPSFM 2017

Regular updates have been posted on the WCRC website and on Facebook. Updates have also been provided to the West Coast Regional Council (WCRC) Resource Management Committee. Recommendations on measures that will assist with Council’s efforts to meet the requirements of the NPSFM follow.

Note that there are mandatory actions and limits in the NPSFM 2020, which regional councils must undertake and adopt. This report recommends some measures which may already be required by the 2020 NPSFM. Other measures are recommended that are specific to the Kawatiri FMU. The 2020 NPSFM was not finalised during the Group’s main period of activity, so these recommendations have been made under the 2017 NPSFM requirements. However, a final review of these recommendations has been made in context with the NPSFM 2020 to ensure there is no conflicting information.

4. Values

An important part of the process was to identify community values pertaining to freshwater environments. The Group provided a range of values that they considered were important to the Kawatiri FMU community. These are listed in the chart below (Figure 4), using the original categories and grouping used by the Group participants.

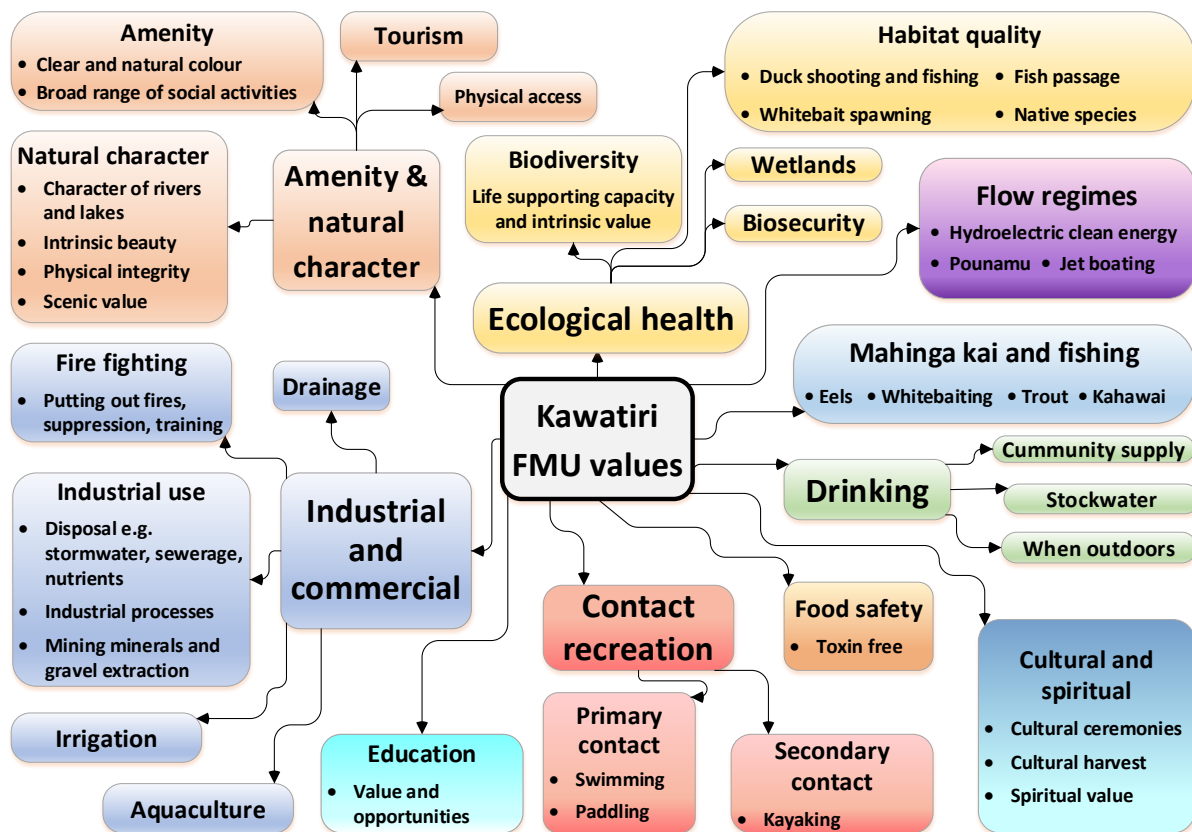


Figure 4: Value categories and grouping created collectively by the Kawatiri FMU Group. The original list of values has been categorised into primary groups, sometimes with secondary groups to accommodate a higher degree of diversity within each group.

5. Attributes and objectives

An attribute is a measurable characteristic (numeric, narrative, or both) that can be used to assess the extent to which a particular value is provided for. For example, the NPSFM has an objective around maintaining/improving swimmability. The attribute measured for this is the bacteria *Escherichia coli* (*E. coli*), and the objective sets a number of numerical limits for *E. coli* levels in certain waterways.

Attributes represent measurable characteristics relevant to an aspect of the compulsory values. Some key attributes have been set out in tables within the NPSFM with defined 'attribute states' (A–D). The attribute states are to help councils (and communities) set numeric freshwater objectives. Numeric freshwater objectives are the basis for defining limits and management actions (Figure 3). Collectively the freshwater attributes, limits and methods ensure that what is valued about a water body is maintained (or improved).

The Group became familiar with the relationship between community values (which included Ngāti Waewae values) and the attributes/objectives required to safeguard these values (Figure 5). The Group is supportive of the attributes prescribed under the current NPSFM, where they are relevant to the West Coast community and environment, as long as they do not create an impractical burden for members of the community.

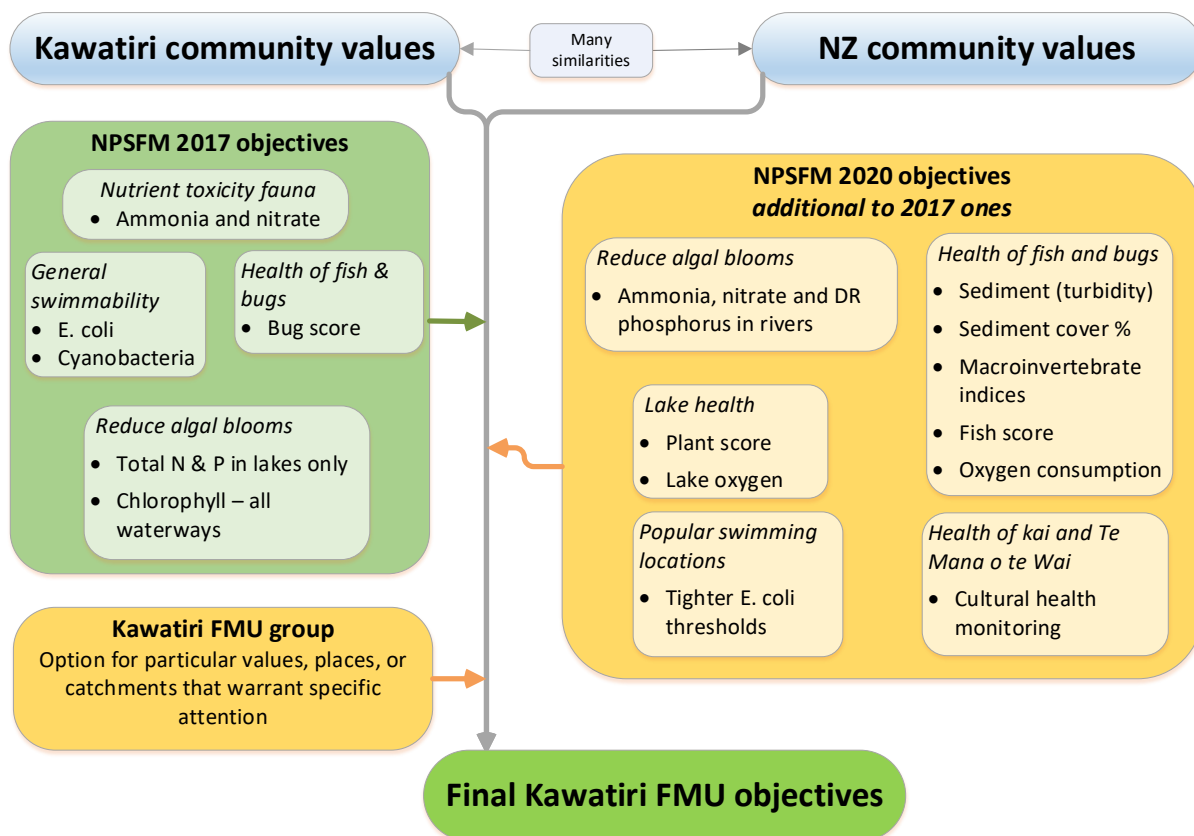


Figure 5: The chart above illustrates the links between values and currently mandatory, proposed mandatory, and community derived attributes/objectives. Compulsory attributes/objectives in the NPSFM 2020 are close to those that were proposed in the 2019 Freshwater Package, which were considered by the Group.

6. Recommendations framework

The recommendations are listed throughout the remainder of this report as it goes through the various topics covered by the Group. All recommendations are numbered from one onwards.

The Group was aware of the Council’s limited ability to resource measuring, and modelling complicated environmental processes, given our small rating population. This work is needed to create and maintain the tools required to underpin sophisticated regulatory measures and monitoring programmes. Large investment in science is required to robustly estimate what impact land management changes can have on water quality. If this is unaffordable for the small West Coast community then it will be hard to develop robust, defensible objectives, methods and limits. We need to be realistic about what we can achieve.

Current water quality related objectives and policies in Council plans apply over the entire region, except for the Lake Brunner catchment (in the Grey FMU) where there have been concerns over aspects of lake health. There was discussion over setting unique objectives and methods for a specific area within the Kawatiri FMU but it was determined that this was not warranted.

While the focus in the Kawatiri FMU discussions has been on improving a number of key attributes (*E. coli* and sediment), NPSFM national bottom line numerical objectives need to be observed for all attributes consistent with the NPSFM concept of “maintain or improve”.

Recommendation

1. **The Group recommends targeted regulation for specific areas in the future where required, providing there is thorough consultation with local iwi and stakeholders prior to development of policy.**
2. **NPSFM national bottom line numerical objectives should be observed for all attributes consistent with the NPSFM concept of “maintain or improve”.**

7. Cultural considerations

The NPSFM recognises that tangata whenua are to be actively involved in freshwater management (including decision making processes), and that cultural values are identified and provided for.

To Ngāti Waewae, water is a treasure (taonga) and having the ability to exercise rangatiratanga over water within their takiwā is of upmost importance to them. The representatives of Te Rūnanga o Ngāti Waewae on the FMU Group explained that ki uta ki tai (from the mountains to the sea) is the concept used by Ngāti Waewae to describe their overall approach to water management. Ngāti Waewae consider that water and land are interconnected and so need to be managed using a holistic approach. Land and water are interconnected and are not separate entities, because what happens on the land affects water. The representatives highlighted that all water is important and valued by Ngāti Waewae whether it is groundwater, coastal water or water flowing in rivers or ‘drains’.

The representatives of Ngāti Waewae explained the importance of maintaining the mauri - the life-giving essence – of water. If water is degraded it impacts mana as it reduces the ability for Ngāti Waewae to collect mahinga kai and manaaki their visitors. The representatives explained that mana whenua as kaitiaki, have an inherited responsibility to pass healthy water onto future generations.

Ngāti Waewae consider that cultural and public health uses of water and the ecological values of water need to be recognised and provided for before consumptive uses of water are provided for.

Ngāti Waewae values and uses of water include:

- Role in creation stories
- Role in identity
- Connections through historical accounts
- Navigational routes – traditional travel routes
- Water is a taonga
- Wāhi tapu – scared places, sites and areas
- Cultural purposes e.g. ceremonies
- Mahinga kai
- Cultural materials e.g. weaving and medicines
- Gathering of pounamu - it is not taken from areas with poor water quality.

Mahinga kai is not just the gathering of food. It includes a range of natural materials along with the places that they are gathered from, and the practices used for collection. Sometimes water quality issues have reduced mahinga kai abundance which has meant that harvests are not possible and intergenerational traditional knowledge can consequently be lost.

Western science uses particular measures to determine water quality. These can be useful for informing the cultural health of a waterway but they don't fully determine the cultural health of a waterway for Ngāti Waewae. The Ngāti Waewae representatives explained the Cultural Health Index (CHI) which is a cultural method for determining the health of a waterway. Traditional knowledge is required to utilise this method, so only Ngāti Waewae are able to undertake cultural health monitoring in the Kawatiri FMU.

The FMU Group have provided recommendations to ensure the interests, rights and responsibilities of Ngāti Waewae are provided for.

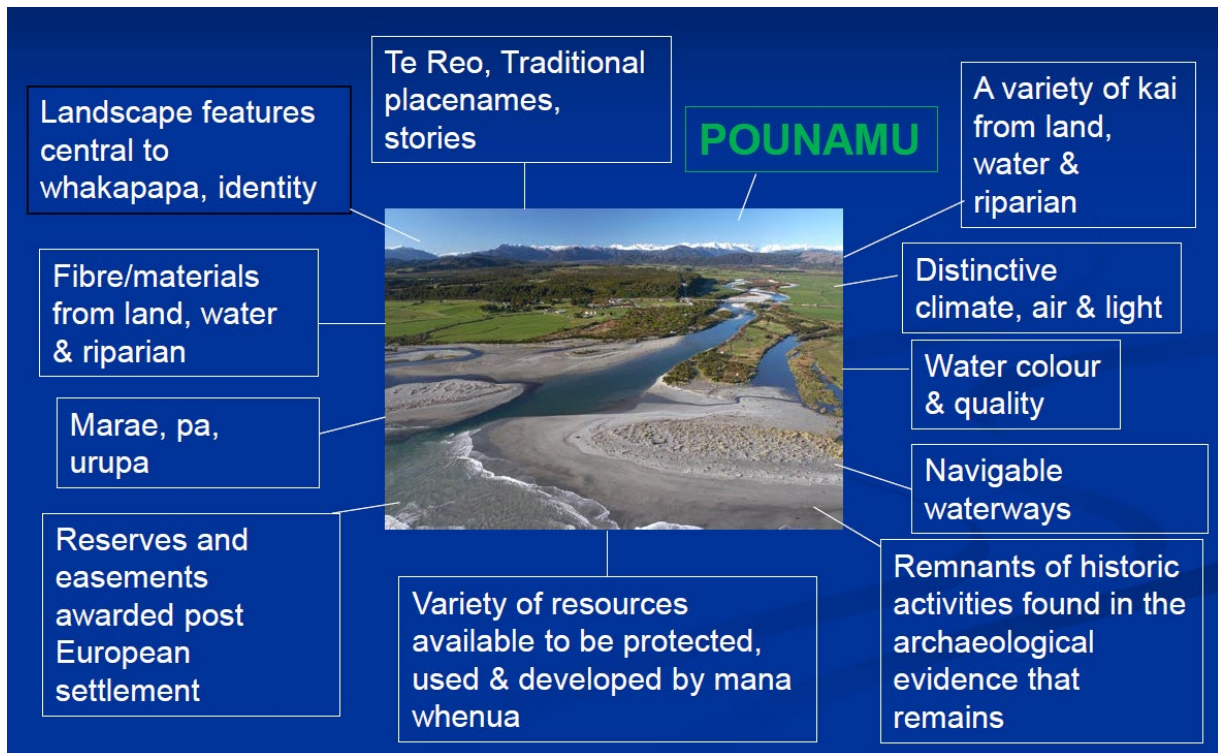


Figure 6: An overview of some of the eco-cultural attributes of a catchment

Recommendations

3. Include provisions in the Regional Land and Water Plan to ensure freshwater is managed so that:
 - a) Mahinga kai is safe to harvest and eat;
 - b) Species are plentiful enough for long term harvest; and
 - c) The range of species is present across all life stages.
- 3A. Include provisions in the Regional Land and Water Plan to protect the mauri of freshwater, and ensure that fresh waterbodies are available and able to be used for customary use.
4. Include provisions in the Regional Land and Water Plan that ensure a cultural allocation for the values of Te Rūnanga o Ngāti Waewae is provided for in the allocation of water.

8. Water quantity

Community values are underpinned by a range of attributes as diverse as the selection of values themselves. The Group considered water quantity as fundamental, interacting with other attributes and underpinning all values.

While the West Coast has a reputation for abundant water, low flows and droughts can come about relatively quickly in the region. Agricultural issues associated with climate in the Kawatiri FMU are unique. Droughts come on quickly and are short-lived, relative to Canterbury. Given a higher frequency and quantity of rain, the depth and energy stored within grass roots are less than grass in other drier areas of the country. Therefore, West Coast grass can be more susceptible to dry periods. Grass, and subsequently stock productivity, can be retarded for the remaining growing season once interrupted by a drought. Therefore, solutions such as irrigation can be required for relatively short, dry periods in order to ensure continuity of production. Existing land use practices may need alteration to future proof them in the face of climate change.

The Group discussed potential allocation issues in the Kawatiri FMU and acknowledged that there are not significant issues in this area. Future changes in climate, land use practices, and commercial activity may lead to an increase in demand for water. While there may only be 'hotspots' where allocation becomes an issue, it is important to get the allocation framework right so that pressures, current and future, can be managed fairly.

Some key points about water use in the Kawatiri FMU are:

- There are some significant water takes in the Kawatiri FMU (Figure 7).
- There are 'hotspots' in certain areas, notably a cluster of takes in the Inangahua River Valley.
- The Kawatiri FMU climate/land use combination are unique to this area of the country.
- Climate and land use are predicted to change in response to global warming, new technology, and commodity trends.

There is potential pressure on water resource availability in the upper Grey catchment. Hot, dry summer conditions, with low river levels, can combine with a need for pasture irrigation. Irrigation is the main consumptive use of water in the Grey FMU (Figure x). There are potential problems for water allocation under the current planning framework. This was one of the key issues within this FMU that needed to be addressed.

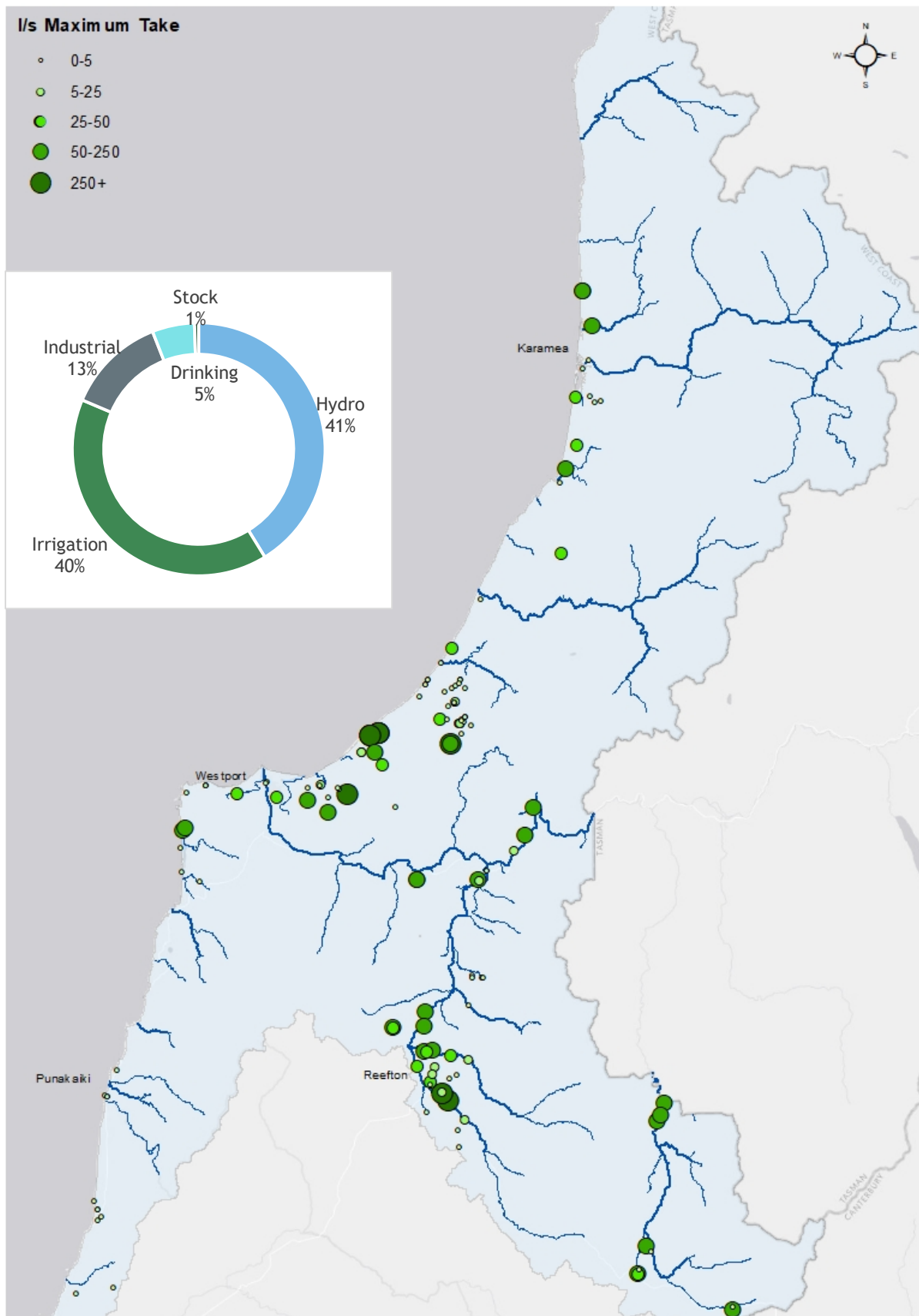


Figure 7: Current allocation framework within the Kawatiri FMU, based on consented water takes as of 2019 (excluding hydroelectric takes).

8.1 Consumptive and non-consumptive takes

Water takes fall into two categories: consumptive and non-consumptive. A consumptive water take occurs when the water is consumed, or it is removed from the immediate catchment without being returned. Examples of this would be irrigation where water is lost to the atmosphere via evapotranspiration, or a water bottling plant. Non-consumptive takes are those where all, or almost all, of the water is kept within the immediate system. An example of this would be a 'run of the river' hydro scheme, where water might be diverted over a short distance before re-entering the natural channel. For example, in Reefton, water gets diverted from the Inangahua River for power generation but gets diverted back into its natural catchment.

8.2 Rules and allocation pressure

8.2.1. Consents and permitted activity rules

Most consumptive water take permits currently issued by the WCRC are granted for 35 years. The Group considered a national review of timeframes allocated to water take consents. Reducing the timeframes as much as some other regions may not be necessary in certain areas due to the consistent rainfall received, and investment that hinges on water permit continuity. However, the Group concluded from the review that, in some catchments, the current lifespan of permits on the West Coast could be too great to respond to changes in resource use and climate variability.

It is often claimed that longer durations are not prohibitive because consents can be reviewed on the anniversary of their approval. However this is difficult and rarely done so it should not be considered a viable option. Shorter consent tenures make it easier and fairer to manage the resource for others not yet part of any allocation structure.

The Group suggested that the Council considers using an adaptive approach for reducing consent timeframes for water takes. Although the details of how this would work are unclear, consideration should be given to resource availability and how adaptive the resource is.

Recommendations

5. **Amend timeframes of water permits for consumptive water takes to 10 years from 35 years. Amend consent status to controlled for renewal of water take permits for the first and second renewals of 10 year water permits."**
6. **Permitted takes need to be recorded in a schedule which ensures their continuity is periodically confirmed to Council so Council are aware how much is being taken, and where these takes occur.**

Community drinking water supply permit durations are not recommended to be reduced as they are a critical public service.

8.2.2. Allocation

The Buller River is the main catchment within the Kawatiri FMU. Because it is a large system it is difficult to determine suitable allocations for small tributaries that will provide adequate flows in larger downstream sections, so a sensible allocation framework is required.

The Group considered a formal requirement to assemble 'catchment groups' where there is resource pressure, for example, where more than 20% of the Mean Annual Low Flow (MALF) is allocated and taken (ie. reducing MALF below 80%). These groups, consisting of a representative spectrum of the local community, would work through the issues, and could be given authority to make decisions. This may or may not be part of a different framework to the consenting process.

Recommendations

7. **The review of water take consents and the allocation management structure, within a catchment, are triggered once flow goes below 80% of MALF. If this does not occur via a trigger, then a review of the consent or the allocation management structure will be undertaken every 10 years.**
8. **If a waterway goes below 80% of MALF as a result of water takes this would trigger an ecological assessment undertaken by the Council with costs recovered from water users. The results from the ecological assessment should be used to guide further management actions.**

The Group considered that the storage of water, taken during periods of adequate supply, has potential to support consumptive takes, such as irrigation, when water resources are under pressure from dry conditions.

8.2.3. Rule 55 within the existing Regional Land and Water Plan

Rule 55 within the existing Regional Land and Water Plan contains an error. The conjunction between (i) and (ii) should be "and", not "or". The Group proposes that Rule 55 should read as follows:

18.3.3 Restricted Discretionary Takes, Uses, and Diversions of Water

Rule 55. Take and use of surface water

Unless permitted by Rules 39, 40, or 42, or controlled by Rules 52 or 53, the taking and use of surface water where:

- (i) The total volume of water allocated from the river is less than 20% of the mean annual low flow (MALF) of the river; ~~or~~ and*
- ((ii) The applicant accepts a minimum flow based on 75% of the mean annual low flow (MALF) of the river; is a **restricted discretionary** activity.*

In considering any resource consent under this rule the council will restrict the exercise of its discretion to the following:

- (a) The amount of water to be taken;*
- (b) The flow available in the source water body;*
- (c) The current allocation from the source water body;*
- (d) The minimum flow to be applied to the take, if required;*

- (e) Any adverse effect on any existing lawful take of water, if consent is granted;*
- (f) The instream values supported by the source water body and related waterbodies, and any potential adverse effect of the taking on those values, if consent is granted;*
- (g) Any need to prevent fish and eel entering the intake;*
- (h) The means and timing of the take, and the rate of take;*
- (i) The quantity of water required for the intended use;*
- (j) The duration of the resource consent;*
- (k) The information and monitoring requirements; and*
- (l) The review of conditions of the resource consent.*

An application for resource consent under this Rule does not need to be notified.

For smaller streams with high instream values the location and rate of take and the seasonal timing of the take can be controlled by conditions on the consent as set out in the explanation to Policy 7.3.1.

Part (ii) of Rule 55 does not state that takes will be stopped at < 75% MALF, rather, that the Council has discretion. The Group mooted that takes should cease at < 75% MALF, so they may be looking for more definitive rules on this.

8.3 Ground water and surface takes

Ground water and surface water are linked but often treated separately from a regulatory perspective. They should be treated as coming from the same allocation if a catchment is under quantity pressure from consumptive takes. Most regions bundle surface and ground water takes together in terms of allocation. If there are more permissive rules for ground water, then as surface water allocation runs low, ground water resources become more popular. The demand for water has increased significantly over time with 13 times more consented takes in the region since 1997. Industry and irrigation are currently the largest users in the Kawatiri FMU.

8.4 Water metering

Resource Management (Measurement and Reporting of Water Takes) Regulations 2020 require that water takes of 5 litres/sec or more need to be measured and reported. The link below is to the Regulations:

<http://www.legislation.govt.nz/regulation/public/2020/0176/latest/LMS351161.html>

Council and community are still yet to accomplish this.

Having this information is an important part of understanding and managing water resources. Metering is required under this compulsory legislation, but Council receives inconsistent data formats which makes collation difficult. There is a need for those submitting data to do so via a consistent format. Water metering is a challenge and a cost, but it is required under law, and feeds into better commercial practice. Costs associated with managing the data needs to be borne by resource users and not the general rate payer. Council has computer systems and expertise to store and analyse this data, but chasing up data and compiling it is time consuming and will require resourcing beyond what is currently available.

Recommendations

9. **All owners of takes that require metering under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2020 submit their results according to the requirements of these regulations. The format the data is supplied in should be consistent with that stipulated by these regulations or a format specified by the Council that allows the Council to efficiently compile this data.**
10. **Telemetry is utilised for takes, as specified under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2020 so Council can ensure that data collection is occurring, takes are compliant, and there is real time knowledge of resource use.**
11. **Water take consents are to stipulate that suitable data needs to be supplied to Council, as per regulation requirements, in order for the consent to remain valid.**

9. Water quality

WCRC stream monitoring data was used as a baseline to investigate state and trends for water quality within the Kawatiri FMU (Figure 8 and Figure 9). These results, in conjunction with the communities' priorities and NPSFM objectives, were instrumental in determining which objective/attribute combinations were the highest priority to address in the Kawatiri FMU (Figure 10).

Site	Nutrient toxicity		Algal blooms		Faecal contamination	Fauna health	Sediment	
	Nitrate toxicity	Ammonia toxicity	Dissolved reactive phosphorus	Chlorophyll	<i>E. coli</i>	SQMCI	Clarity	Turbidity
Baker Ck @ Baker Ck Rd	A	A	A	B	B	B	C	C
Baker Ck @ Oparara Rd	A	B	A	B	E	B	C	C
Blackwater Ck @ Farm 846	A	B	A		E		D	D
Bradshaws Ck @ Bradshaw Rd	A	A	A	B	E	D	C	A
Bradshaws Ck @ Martins Rd	A	A	A		E		B	C
Buller Rv @ Longford	A	A	A		A	B	A	B
Buller Rv @ Te Kuha	A	A	A		B	B	C	C
Burkes Ck @ SH69	A	A	A	B	E	B	C	D
Orowaiti Rv @ Excelsior Rd	A	A	A	B	E	B	B	C
Orowaiti Rv @ Keoghans Rd	A	A	A	B	A	A	A	A
Page Stm @ Chasm Ck Walkway	A	A	A	B	A	A	C	C
Seven Mile Ck @ 300m d/s Raleigh Ck	A	A	A	B	B	B	B	C
Seven Mile Ck @ Dunollie 400m u/s Ox Pd	A	B	A	A	A	B	B	C
Seven Mile Ck @ SH6 Rapahoe	A	A	B		E		C	C
Seven Mile Ck @ u/s Tillers Mine Ck	A	B	B	A	A	B	B	C

Figure 8: Attribute states for monitored streams in the Kawatiri FMU. Any site/attribute combinations that are an 'E' are below the bottom line and require intervention under the NPSFM. Blanks exist where there is no data for that site.

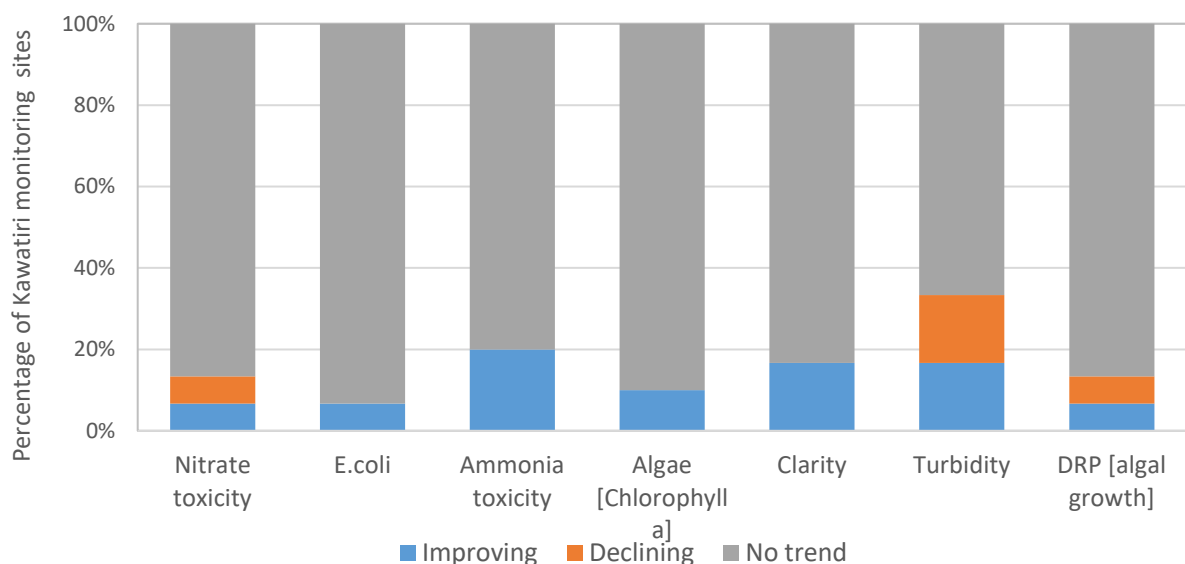


Figure 9: Attribute trends for monitored streams in the Kawatiri FMU. Any site/attribute combinations that are declining require intervention under the NPSFM.

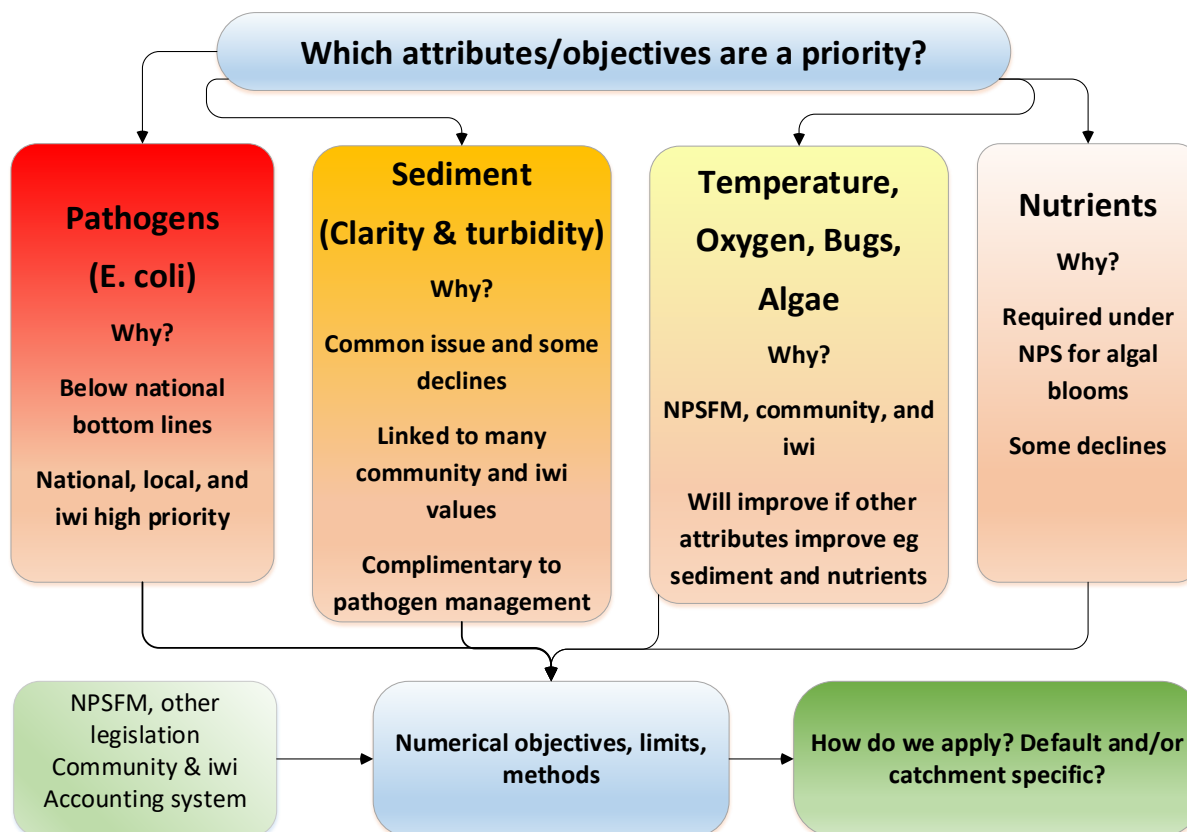


Figure 10: Attributes have been broadly prioritised based on community values, prevalence of issues, and national policy requirements. Priority increases towards the right-hand side.

9.1 Faecal contamination and *E. coli*

The Group discussed at length whether they were happy with the NPSFM 2020 *E. coli* thresholds, were there any additional locations within the FMU that require special consideration, and were there any values that require special consideration. Recent analysis indicated no declining trend for *E. coli* at Kawatiri sites but several were below the national bottom line. For example, some sites within the FMU have “E” ratings, which under the NPSFM requires intervention. The Group endorses the implementation of the proposed NPSFM 2020 national objectives for *E. coli*.

9.1.1. Mitigating on-farm sources of faecal contamination to waterways

There are many sources of faecal contamination on a farm that can enter waterways. Some are of a point source nature, for example, farm dairy shed effluent (FDE). Others can comprise of many smaller sources that add up to what can be referred to as ‘diffuse sources’, all of which accumulate. Many of these can be tackled by drainage management strategies. The Group participated in a field trip looking at the Bradshaws Creek catchment, and discussed the issues leading to faecal contamination in this catchment (Figure 11). AgResearch has suggested a range of mitigation options to reduce *E. coli* in Bradshaws Creek and we compared these to rules in the Land and Water Plan. Currently, only the Lake Brunner catchment has specific mitigation regulations that go beyond those which are standard in the rest of the region, none of which include strategies outlined by AgResearch for Bradshaws Creek.



Figure 11: Kawatiri FMU group members investigating macroinvertebrate fauna, measuring water clarity with a black disk, and assessing stream habitat (from left to right).

Treating effluent contaminated water involves retention or slowing down the flow in order to encourage settling, filtration through vegetation, or soil (vertical percolation). Large sources of effluent, for example, dairy shed effluent, require significant strategies and infrastructure to manage. An example of this is low rate application of FDE to land, as required in the Lake Brunner catchment, which is effective for FDE disposal and improving grass growth. However, the combination of many smaller sources can accumulate to form a significant contribution. It is important to tackle these sources locally where they arise. There is a wealth of guidance on how to achieve this provided by the likes of Dairy NZ, AgResearch, and many regional councils.

Group members outlined the issue of high rainfall on the West Coast causing problems on farms, for example, in Karamea where there are many drains installed to divert water, reduce flooding and reduce soil saturation. This illustrates conflicting needs – rapid drainage for flood mitigation and drier pasture (reduced pugging, higher growth) versus reducing drainage to improve contaminant assimilation.

Recommendations

12. Council initiates catchment groups to address significant water quality issues within affected areas.
13. The Group supports the Council amending regional rules to make discharging faecal contaminants directly to water more restrictive than discharging to land. They also support the use of treatment systems such as constructed wetlands, providing they are effective.

9.1.2. Farm plans/environmental plans

The Group considered it important to identify sources and problem areas across a farm, which can be referred to on a map, indicating what should be done and where. This approach is used in Britain and in New Zealand. The Group support the concept of Farm Plans as per the NES for Freshwater 2020, and strongly supported the Council organising financial and practical support for creating and implementing Farm Plans on the West Coast. The concept of catchment groups was put forward as a means to support the farm planning process and make it more integrated within the catchment.

Farm plans need to be practical, and farmers may require assistance with developing them (technical expertise). A regionally specific template, for example, one that includes humped and hollowed land, and accommodates regional characteristics such as Ngāti Waewae values and mahinga kai enhancement, would be better than a more generic template that fits local conditions poorly. The Group acknowledge the value of farm planning as a concept, and the cost to farms and communities.

Farm plans as a concept, renamed as Environmental Plans, could be expanded to encompass additional activities and industries that affect water quality. This would further benefit water quality and spread responsibility across a wider range of stakeholders responsible for direct and indirect discharges to water.

Recommendations

- 14. The Council assists with financial and practical support for implementing Farm Plans on the West Coast.**
- 15. The Group would like Central Government to support the development of farm plan templates that can be adjusted to the West Coast context e.g. climate and geology.**
- 16. The Council works with Poutini Ngāi Tahu and organisations such as Westland Milk Products to help create farm plans.**
- 17. The Council promotes the use of Environmental Plans for industries other than commercial farming e.g. lifestyle blocks, water bottling plants, gold and coal mines, forestry.**

9.1.3. Septic tanks and combined reticulated systems

Septic tanks can discharge faecal contamination to water bodies if they are incorrectly installed, inadequately maintained, and situated in locations where drainage is poor. Another anthropogenic problem occurs where urban dwellings are connected to historic municipal systems that combine sewerage and stormwater. The Group strongly supports facilitation of connections from mixed sewerage and stormwater to separated services when upgraded facilities are available. They also support further efforts that ensure septic tanks are legal, and that they meet the criteria under the Regional Land and Water Plan and the RMA.

Recommendations

- 18. The Council ensures septic tank effluent discharges are compliant with regional rules and the RMA and do not cause pathogen contamination of waterways.**
- 19. The Council works collaboratively with District Council's for the maintenance, upgrading, and connection of properties to separate reticulated sewage and stormwater systems.**

9.1.4. Cultural considerations around faecal contamination of freshwater

Faecal matter entering waterways from livestock, while less offensive than human sources, is still culturally unacceptable to Poutini Ngāi Tahu if it is not adequately treated on land first. Many wetland systems are used to polish treated effluent discharges prior to entering a waterway, but these need to be effective at reducing contaminants that affect both human health and ecology. 'Token' wetland treatment is not adequate for cultural purposes. We should be working towards no direct discharges to water from effluent – human or animal, because it is culturally unacceptable.

There is significant cultural emphasis on Mahinga kai when it comes to faecal contamination, and concerns were raised by the Group regarding shellfish edibility. Commonly consumed shellfish live in

coastal environments that are periodically or entirely saline. The NPSFM does not specify monitoring or attributes for saline or coastal environments, or typical shellfish waters, but the NPSFM requires that activities which affect freshwater must have no downstream adverse effects on the coastal environment. This philosophy is in line with ki uta ki tai.

The WCRC does not have relevant data to assess stream bacterial monitoring results against shellfish quality assurance guidelines, but attempts were made to roughly assess this using proxy attributes and locations. Some conclusions included the following:

- Open coastal marine environments have lower pathogen indicator bacteria compared to rivers and estuarine environments. On reaching the ocean there is additional dilution and increased pathogen mortality. Lakes and lake outlets usually have low levels of indicator bacteria.
- It seems likely that most coastal areas meet the median shellfish guidelines, but often exceed the top 10% guideline threshold. What this means is that most of the time bacteria levels are satisfactory, but the magnitude of occasional spikes are larger than what is allowed under the guidelines.
- Few estuarine environments on the West Coast met the guidelines. Like marine environments, more estuarine environments met the median opposed to the top 10% criteria.
- Applying shellfish quality assurance guidelines to freshwater environments may not be appropriate. Many freshwater sites did not comply with shellfish quality assurance guidelines. This indicates the significant role of the region's heavy and frequent rainfall, which generates run-off from surrounding land. Undisturbed catchments still have sources of E. coli from the likes of wild animals, but these levels are nearly always a lot lower than levels observed in catchments with urban or agricultural land use.
- The guidelines apply to shellfish, not to other edible freshwater or marine species like fish. And the vast majority of areas covered by the NPSFM don't have shellfish.
- Adding faecal coliform testing to some sites where shellfish are present or nearby would help us assess against the shellfish guidelines.

9.2 Sediment

The Group discussed how sources of sediment can originate from both natural events like slips, and anthropogenic activities like earthworks. If streams have high sediment loads, then it will be important to differentiate between sources. The NPSFM 2020 has compulsory numerical objectives for clarity (a proxy for suspended sediment), and deposited sediment. The numerical objectives are broken down into groups based on geology types, so that intrinsic characteristics are in part considered when these sediment objectives are applied to specific water ways. This means that less stringent clarity standards will be applied in catchments with erodible geologies.

The National Environmental Standard for Plantation Forestry (NESPF) has web tools that allow people to calculate erosion risk and potential impacts on fish, based on geology and slope. These tools and approaches could have direct relevance to managing sediment loss and meeting the requirements of the NPSFM.

The Group supported the use of farm plans to manage activities that lead to problematic additions of sediment to waterways. The Group does not, as a majority, support prescriptive measures to achieve these goals.

As has been discussed previously, the Group suggested that there are incentives to assist with the implementation of mitigation measures used to reduce the impact from sediment on freshwater values in the Kawatiri FMU.

Possible support that was suggested by the Group included:

- Education/farm extension officers
- More relevant information for stakeholders on how they can mitigate impacts in order to improve water quality.

Catchment care groups have the potential to disseminate and share information. The scope of topics and support they provide is potentially very broad and could cover whatever the participants require. They could tie in with farm planning or could be independent of this if desired.

Recommendations

- 20. When managing sediment effects on freshwater, there needs to be efforts made to differentiate between what is erosion exacerbated by human activity, and what is natural.**
- 21. Council should promote best practice for managing sediment. Part of this should include web-based links to a range of information that covers the good practice measures required to meet the NPSFM.**
- 22. Council approaches central government for assistance to meet the NPSFM.**
- 23. Council should help facilitate applications made by parties that seek support for implementing NPSFM requirements.**

9.3 Nutrient and macroinvertebrate attributes

NIWA have provided a report to Council on how Council should further evaluate the relationship between nutrients and periphyton growth in a West Coast context. Council monitoring to date has indicated that nuisance periphyton growth is neither frequent nor widespread. This stands to reason considering the predominantly cool, wet climate we have. Therefore, nutrient enrichment is of lower priority than issues such as faecal contamination and sediment/habitat degradation.

Macroinvertebrates are good bioindicators. The NPSFM 2020 provides a bottom line for macroinvertebrates, setting a minimum MCI and QMCI score of 90 and 4.5, respectively. There is also a 'Macroinvertebrate Average Score Per Metric' (ASPM, which is calculated from a group of several metrics), with a bottom line of 0.3. Like other attributes, the NPSFM 2020 stipulates that these macroinvertebrate attributes shall not deteriorate beyond their current state. The Group considers that the constituents of the NPSFM 2020, other government policy and rules, and recommendations made by the Group will provide good protection for ecological values.

9.4 Pest plants and pest fish

Undesirable pest plants and animals pose a significant risk to aquatic biodiversity and amenity values. Examples of this include the incursion of the weed *Myriophyllum aquaticum* (Parrots Feather), which is present at several locations within the Kawatiri FMU. The vigorous growth of this weed will choke waterbodies making it difficult to swim, fish, and use boats. Many native species will be permanently

displaced by its presence, and chemical processes within the waterbodies altered. It is imperative that pest plants such as these are not allowed to spread or establish further. The regional council and DOC both have initiatives underway to monitor and manage the spread of freshwater aquatic pest organisms.

Recommendation

24. Council facilitates an audit of aquatic biosecurity/pests, and Council considers increasing the resourcing of aquatic biosecurity monitoring in the Kawatiri FMU.

9.5 Fish passage and habitat

As part of the topic on ecological health, the Group considered some potentially important factors previously overlooked in earlier meetings and workshops, that pertain to fish health and spawning success. One recommendation arose out of discussion about the importance of accommodating fish access around artificial instream structures.

Recommendations

25. Council monitors indigenous fish passage across the FMU. This includes surveying structures and undertaking fish population surveys. Council will continue to collaborate with Poutini Ngāi Tahu and other agencies who have shared responsibility for maintaining fish passage.

9.6 Cost effective data collection and utilisation: Volunteers, web platforms, and use of consent/compliance data

It is widely recognised that there is currently a significant burden upon Council to meet the requirements of many new policies and standards. All of these add to the list of environmental monitoring that needs to be undertaken by Council, yet Council's ability to resource this work does not increase. The use of voluntary input from the community has been increasingly important around New Zealand to fill gaps in government capacity. An example of this is the predator control programmes and track/hut maintenance undertaken by volunteers. A certain degree of expertise and supervision is required when completing much of the water quality monitoring conducted by the WCRC. However, there is definite scope to increase the use of volunteers for collecting environmental data. These volunteers are often near a waterbody that requires monitoring; therefore they often have a vested interest in its welfare, and it is convenient for them to undertake sampling. Training, equipment, and mentoring can be provided to volunteers who wish to commit time to useful monitoring programmes.

A fast developing area, involving voluntary effort, exists around web-based data and information sharing platforms. One example is iNaturalistNZ, which facilitates knowledge transfer and data collection for NZ plants and animals. Another platform is the Australian Governments 'Eye on the Reef' programme, where people are able to contribute observations to a database from the Great Barrier Reef. These initiatives provide significant value for public education, engagement and awareness.

Recommendation

26. The Council investigates some different models that increase utilisation of volunteer assistance with water quality monitoring.

Further on the topic of cost-effective data collection, the Group expressed their desire for those who utilise water resources, particularly for profit, to adequately contribute to the monitoring required for gauging their impact on resource quality. Members of the Group expressed concern that Council is not adequately utilising data submitted as part of consent conditions and compliance monitoring.

Recommendations

27. The Council ensures that those who utilise water resources contribute a fair amount to the monitoring required to manage the resource, relative to their actual and potential impact on that resource.

28. The Council better utilises datasets collected as part of consenting and compliance work.

**9.7 Considerations around some specific key industries and water users:
Aquaculture, hydroelectricity, and water bottling**

The West Coast has abundant water resources available for freshwater aquaculture. Fish farming has potential to generate pollution in the form of excessive organic enrichment and nutrients. Additionally, pathogens that develop in domesticated species can spread to wild counterparts. Therefore, proper controls are required to manage pollution, pests and pathogens. Ideally the quality of water discharged from a freshwater aquaculture venture should be free of pathogens and have similar quality to the water that entered the system. Using smart systems that recycle and utilise nutrients are ideal. The Group supported the development of sustainable aquaculture on the West Coast provided that the correct processes are adhered to, that is, those processes stipulated under the RMA, Regional Plans, and other government policy.

Broad discussion was had within the Group around the impact of large-scale commercial water bottling, touching on ethical and economic considerations. There was discussion around who owns fresh water and where do royalties go for its abstraction. Also, the ethics around people who have made their water unpotable putting pressure on resources elsewhere instead of better managing their own. Many of these concerns are on the fringes of what is within the scope of the NPSFM. It was agreed that rather than worrying about what the water is being used for once removed (via a consumptive take), that the focus should be on the impacts of removing that water.

Hydroelectric power generation was discussed in the wake of the Government's decision to stop the Waitaha hydroelectric power scheme. The Group deemed hydroelectric power generation desirable in that it is non-consumptive but acknowledged its potential to impact ecology and amenity. The magnitude of these impacts depends a lot on a scheme's design, and the West Coast climate is inherently ideal, being wet in winter when electricity demand is at its peak. The Group considered that there needs to be alternatives for local generation if viable schemes are stopped.

Recommendation

29. The Council supports hydroelectric power generation as long as there are controls in place to maintain existing ecological integrity and add value for as many additional uses as possible.

9.8 Outstanding freshwater bodies (OFWBs)

Outstanding freshwater bodies (OFWB's) have outstanding values including ecological, landscape, recreational, cultural and spiritual values. The Group devoted a session on considering which waterbodies might be considered as OFWB's.

Criteria for selecting OFWB's is thus far not specific, so there is broad scope for determining which waterbodies qualify. For example, particular land use criteria is not critical and waterways can be in or out of the DOC estate. The Group considered several waterbodies for inclusion as OFWB's but decided that it was unwise to include sites as potential OFWB's in these recommendations without having utilised a more structured, rigorous process.

10. Conclusions

The Kawatiri FMU Group have made recommendations that reflect the intent of the wider community they represent. The process has included familiarising the Group with the content and expectations of the NPSFM, and the health of waterbodies within their FMU. A broad range of values associated with freshwater were identified including those relating to recreation and amenity, Ngāti Waewae cultural value, mahinga kai, drinking, ecological health and commercial/industrial applications.

In the Kawatiri FMU, Te Rūnanga o Ngāti Waewae are partners with Council regarding water resource management, as underpinned by multiple NPSFM objectives. As per Te Mana o te Wai, all water has value regardless of its location, for a range of purposes. It is important to consider the broad interconnectivity of factors affecting water quality under the ki uta ki tai philosophy. The current generation need to pass healthy water onto future generations.

The Kawatiri FMU and West Coast is a large area with a small population, heavily dependent on a narrow range of industries, with tourism, agriculture, and mining being the main ones. All of these industries have potential to impinge on values that have been identified as important by the community. It is important to note that many of the values identified relate to the role water has for supporting people's livelihoods. So a balanced approach was at the forefront of the Group's collective consciousness when considering recommendations.

Another key consideration, associated with a small population/large area, is the Council's and Kawatiri communities' limited means to develop and maintain extensive accounting and regulatory frameworks. Full implementation of the NPSFM won't be possible without gaining resources and/or assistance from industry, central government, and volunteers. The need for balance combined with limited means have played a large part in shaping the nature and extent of the recommendations made.

The extent of emphasis the Group placed on attributes and objectives was influenced by the nature of water state and trends within the FMU, the values of Ngāti Waewae and the community, and the extent of emphasis placed on objectives in the NPSFM itself. Reducing faecal contamination was one of the highest priorities, along with reducing impacts from sediment. Frequent and heavy rainfall is a fact of life in the Kawatiri FMU, and the Group wanted to ensure that intrinsic factors were considered when regulating activities. In saying that, while future climate forecasts are for wetter spring/winters, summer/autumn conditions are predicted to become drier, with more extremes both dry and wet.

Wet conditions present traditional issues with pathogen run-off and sediment erosion, which the Group have addressed with a number of recommendations, but they have also proposed changes to water allocation given that demand is likely to increase in certain areas.

Attempts have been made to make allocation fairer for a broader range of stakeholders, and to create greater adaptability if allocation needs change. There are already policies in place and data being collected that, with better implementation and refinement, could add value to our ability to monitor and manage water takes.

The Group acknowledged that more needs to be done to reduce contamination of waterways (faecal and sediment contamination in particular), but they favoured non-regulatory measures as a means to achieve this. The use of education and environmental plans as a tool to advance environmental mitigation have potentially wider use beyond their traditional role with agriculture.

Consideration was given to nominating Outstanding Fresh Waterbodies, but no recommendations were made regarding these.

11. List of Recommendations

- 1 The Group recommends targeted regulation for specific areas in the future where required, providing there is thorough consultation with local iwi and stakeholders prior to development of policy.
- 2 NPSFM national bottom line numerical objectives should be observed for all attributes consistent with the NPSFM concept of “maintain or improve”.
- 3 Include provisions in the Regional Land and Water Plan to ensure freshwater is managed so that:
 - a) Mahinga kai is safe to harvest and eat;
 - b) Species are plentiful enough for long term harvest; and
 - c) The range of species is present across all life stages.
- 3A. Include provisions in the Regional Land and Water Plan to protect the mauri of freshwater and ensure that fresh waterbodies are available and able to be used for customary **use**.
- 4 Include provisions in the Regional Land and Water Plan that ensure a cultural allocation for the values of Te Rūnanga o Ngāti Waewae is provided for in the allocation of water.
- 5 Amend timeframes of water permits to 10 years from 35 years. Amend consent status to controlled for renewal of water take permits for the first and second renewals of 10-year water permits.
- 6 Permitted takes need to be recorded in a schedule which ensures their continuity is periodically confirmed to Council, so Council are aware how much is being taken, and where these takes occur.
- 7 The review of water takes consents and the allocation management structure, within a catchment, are triggered once flow goes below 80% of MALF. If this does not occur via a trigger, then a review of the consent or the allocation management structure will be undertaken every 10 years.
- 8 If a waterway goes below 80% of MALF as a result of water takes this would trigger an ecological assessment undertaken by the Council with costs recovered from water users. The results from the ecological assessment should be used to guide further management actions.
- 9 All owners of takes that require metering under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2020 submit their results according to the requirements of these regulations. The format the data is supplied in should be consistent with that stipulated by these regulations or a format specified by the Council that allows the Council to efficiently compile this data.
- 10 Telemetry is utilised for takes, as specified under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2020 so Council can ensure that data collection is occurring, takes are compliant, and there is real time knowledge of resource use.
- 11 Water take consents are to stipulate that suitable data needs to be supplied to Council, as per regulation requirements, in order for the consent to remain valid.

- 12 Council initiates catchment groups to address significant water quality issues within affected areas.
- 13 The Group supports the Council amending regional rules to make discharging faecal contaminants directly to water more restrictive than discharging to land. They also support the use of treatment systems such as constructed wetlands, providing they are effective.
- 14 The Council assists with financial and practical support for implementing Farm Plans on the West Coast.
- 15 The Group would like Central Government to support the development of farm plan templates that can be adjusted to the West Coast context e.g. climate and geology.
- 16 The Council works with Poutini Ngāi Tahu and organisations such as Westland Milk Products to help create farm plans.
- 17 The Council promotes the use of Environmental Plans for industries other than commercial farming e.g. lifestyle blocks, water bottling plants, gold and coal mines, forestry.
- 18 The Council ensures septic tank effluent discharges are compliant with regional rules and the RMA and do not cause pathogen contamination of waterways.
- 19 The Council works collaboratively with District Council's for the maintenance, upgrading, and connection of properties to separate reticulated sewage and stormwater systems.
- 20 When managing sediment effects on freshwater, there needs to be efforts made to differentiate between what is erosion exacerbated by human activity, and what is natural.
- 21 Council should promote best practice for managing sediment. Part of this should include web-based links to a range of information that covers the good practice measures required to meet the NPSFM.
- 22 Council approaches central government for assistance to meet the NPSFM.
- 23 Council should help facilitate applications made by parties that seek support for implementing NPSFM requirements.
- 24 Council facilitates an audit of aquatic biosecurity/pests, and Council considers increasing the resourcing of aquatic biosecurity monitoring in the Kawatiri FMU.
- 25 Council monitors indigenous fish passage across the FMU. This includes surveying structures and undertaking fish population surveys. Council will continue to collaborate with Poutini Ngāi Tahu and other agencies who have shared responsibility for maintaining fish passage.
- 26 The Council investigates some different models that increase utilisation of volunteer assistance with water quality monitoring.
- 27 The Council ensures that those who utilise water resources contribute a fair amount to the monitoring required to manage the resource, relative to their actual and potential impact on that resource.
- 28 The Council better utilises datasets collected as part of consenting and compliance work.
- 29 The Council supports hydroelectric power generation as long as there are controls in place to maintain existing ecological integrity and add value for as many additional uses as possible.

12. Appendices

12.1 Kawatiri FMU Community Group biographies

John Hill

John Hill graduated with a degree in chemistry (1971) and went on to complete a post graduate research project leading to Licentiate of the Royal Institute of Chemistry (LRIC, now the Royal Chemical Society).

John spent several years in Research and Development with large international companies. He has been involved in the development of several technologies such as Superglue, wipeless hard surface cleaners and residual efficacy hard surface disinfection.

Following emigration to New Zealand he has been involved with water and environmental industries. He operated and owned SAFE NZ, which manufactured filter systems for commercial air conditioners. During this period John was a leader in research relating to 'sick building syndrome'. John has also been involved with water treatment systems for healthcare, beverage and food sectors. He is currently on the governance board of Clean Streams Karamea.

Colin Hope

Colin has worked as an Electrical Design Engineer on power stations, involving electrical design, construction, commissioning and maintenance. He has undertaken this work in both the North and South Islands of New Zealand, including the Bay of Plenty, Central Otago, and Manapouri. Colin currently works as a line design engineer with Buller Electricity Ltd.

For Colin, water is one of the most important elements required for our survival, and the health of the environment in which we live, therefore, any human activity that impacts on the quantity and quality of water needs to be managed carefully. We do not own water or have exclusive rights to it, yet we are its guardians -we should exercise that responsibility wisely.

Caroline Jones

Caroline has lived in Karamea for 30 years and is part of a family that has farmed in the area since the late eighteen hundreds. Caroline's children, and generations of their family, have swum in nearby Granite Creek, as well as utilising the recreational opportunities provided by the surrounding rivers and estuaries. Caroline is acutely aware of the challenges involved in maintaining sustainable farming communities in the face of a dynamic environment and ever-changing environmental policy. Her family wish for surrounding communities to remain sustainable and to enjoy the benefits of the area.

Nathan Keoghan

Nathan has multiple interests in freshwater management and comes from a sixth-generation dairy farming family. Nathan grew up swimming, boating and fishing in his Awa the Orowaiti River.

A career in forestry and rural fire fighting has exposed him to different freshwater management issues. In 2006 Nathan and his wife Rebecca returned to manage, and later purchase, the family farm. This involved two specific water related activities; firstly, the Buller District Council's backup water supply weir on the farm, and the development of a commercial gold mine on the property. Nathan has an MBA from Massey University, extensive governance and leadership training, and experience having chaired the West Coast Focus Farm Trust. He is currently deputy chair of the Livestock Improvement Corporation's Shareholders Council.

For fun Nathan is Musical Director of the Westport Municipal Band where he is joined with members of his family, his wife Rebecca, and two children Amelie and Spencer.

Michael Kingsbury

Michael has an interest in water quality through his recreational interests, including rowing, kayaking and whitebaiting. His employment history includes managing environmental impacts from land use activities, specialising in rehabilitation of mine sites, and in particular site revegetation. Michael has tertiary qualifications in geology, geography, engineering geology and natural resource engineering.

Douglas Phillips

Douglas has a degree in Agriculture and a Masters degree from the University of Cambridge in Land Economics. Douglas is also a Member of The Institute of Agricultural Management. Before coming to New Zealand, Douglas worked for a number of years as an Agricultural Advisor in the United Kingdom and was also Operations Director for the Tyne Rivers Trust in England – a charity responsible for monitoring, maintaining and improving the Tyne Catchment.

Douglas is an avid fly fisherman and has a passion for utilising "green engineering" as a low cost, environmentally responsible method for improving water quality and reducing flood risk.

Campbell Robertson

Campbell Robertson is currently the Environmental Manager with Bathurst Resources, based in Westport. He holds a BSc (Zoology), and MSc (Hons) in Resource Management. Campbell has a passion for outdoor recreation and values opportunities to enjoy the Buller District's natural resources. This includes fishing, swimming, and boating in Buller's waterbodies, as well as appreciating their overall intrinsic value. Campbell is actively involved with a range of community interest groups via his work duties and personal interests.

Di Rossiter

Di Rossiter holds an MSc from Canterbury University and tries to make use of this by thinking analytically in both her professional and personal life. Di is interested primarily in being useful and kind. She thinks that recognising the Te Mana o te Wai - freshwater's intrinsic value - in the NPS for Freshwater Management, represents a paradigm shift in the way we think about our place in the world that is long overdue.

Lisa Steenhauer

Lisa is a biology and science teacher at Buller High School. She has a MSc and a PhD in freshwater ecology, specialising in the effects of land use and environmental change on microbes (viruses, bacteria, algae and zooplankton), in lakes and wetlands. Lisa has worked in a commercial lab in Australia counting harmful algae in drinking water supplies, studied lakes, and the North Sea Ocean in the Netherlands. Lisa grew up on the West Coast.