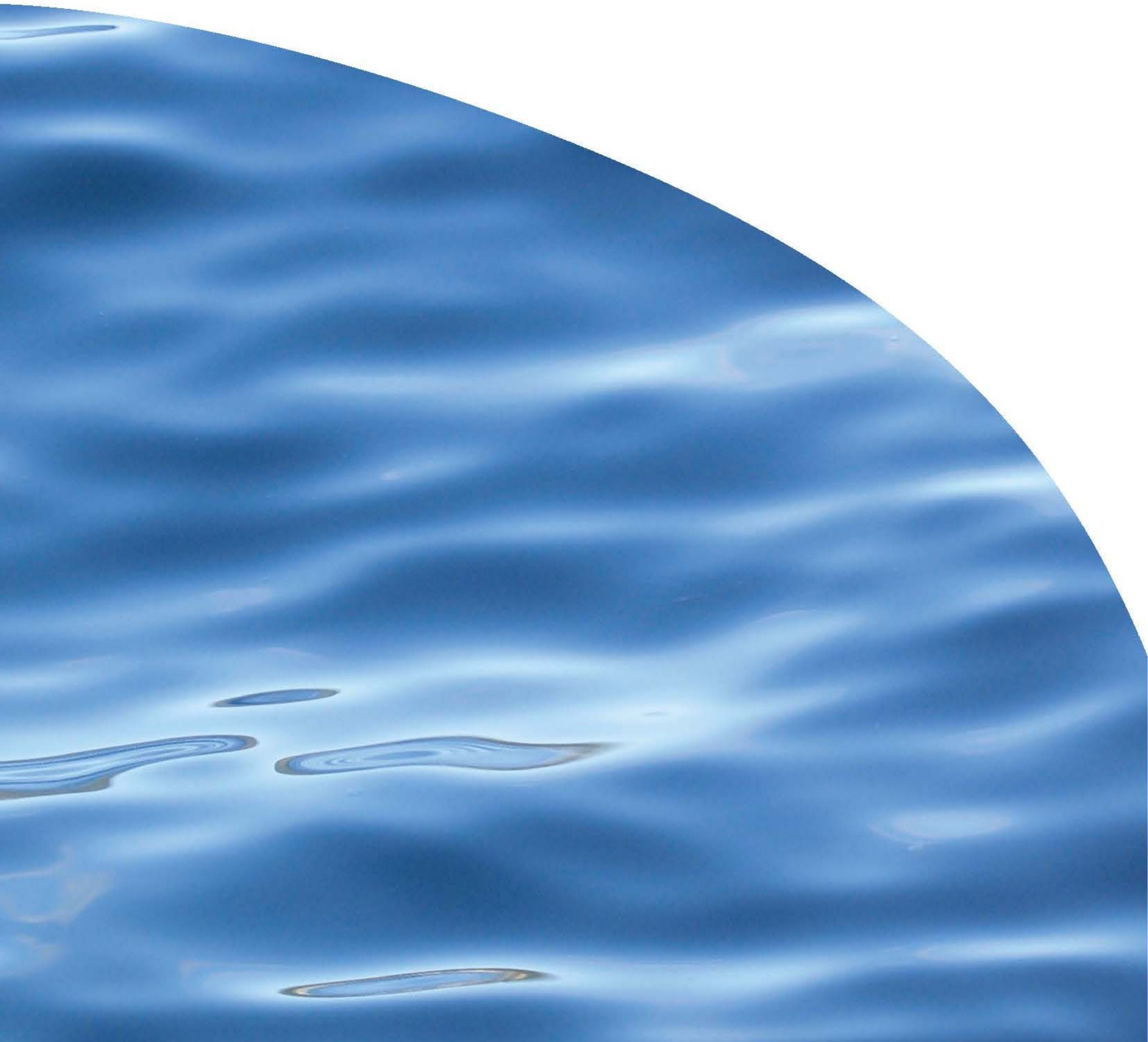
REPORT NO. 2358

ADVICE ON A PROGRESSIVE IMPLEMENTATION PROGRAMME FOR LIMIT SETTING IN THE TASMAN DISTRICT



ADVICE ON A PROGRESSIVE IMPLEMENTATION PROGRAMME FOR LIMIT SETTING IN THE TASMAN DISTRICT

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Prepared for Tasman District Council

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EXECUTIVE SUMMARY

The National Policy Statement for Freshwater Management (2011) (NPSFM) requires that regional councils establish freshwater objectives and set freshwater quality limits and environmental flows for all bodies of freshwater in their regions. The Tasman District Council (TDC) have sought advice from Cawthron Institute (Cawthron) on considerations for implementation of the NPSFM.

Implementation of the NPSFM will involve defining waterbody values, establishing which values take prominence, determine objectives that are required to maintain these values and consider threats that may result in objectives not being met. For some parameters, and in catchments where there are considerable threats, load limits should be calculated for nutrients, sediment, toxicants and potentially faecal bacteria. These load limits can be ‘allocated’ among resource users, so each user is aware of their contribution to the overall catchment load.

A spatial framework is ideally required so common management objectives are applicable within each zone. Spatial frameworks being used by several other councils are reviewed and potential frameworks for the Tasman District based on three different approaches (catchment-based, River Environment Classification (REC)-based and Freshwater Environments of New Zealand (FENZ)-based are discussed. Objectives should be able to be set for entire zones within the management framework, but limits require site-specific flow information, so can only be set at specific locations where flow and water quality data is available.

The parameters used for objective setting are those that are commonly measured in the TDC’s current monitoring programme. A national initiative (National Objectives Framework) being led by government officials is currently attempting to provide guidance on appropriate parameters for objective setting, national ‘bottom line’ values, bands representing fair, good and excellent condition above the bottom line, and appropriate metrics to use.

The threats facing waterbodies in the Tasman District need to be assessed in some way. Changes in land use associated with water augmentation may threaten some waterbodies. Trends in a negative direction at current monitoring sites also suggest threats that need to be considered. Caution should also be taken in areas where current conditions are close to or above appropriate objectives. Detailed modelling to assess the effects of different land use scenarios is only justified in areas where likely land use changes can be predicted with some confidence.

It is important to have sufficient information to calculate current loads of nutrients and other contaminants. If loads are based on all flows, then this involves having samples from key sites across a range of flow conditions, so that any relationship between flow and concentration can be determined. Tasman District Council needs to consider the costs and benefits of moving to monthly sampling of water quality for its state of the environment (SOE)

monitoring programme. For any new sites that are set up it will take 3-–5 years of monthly samples to get accurate estimates of loads. Estimates of loads of nitrogen (N) and phosphorous (P) are available from broad nationwide models (Catchment Land Use for Environmental Sustainability; CLUES) for all river segments throughout New Zealand in the FENZ database (Leathwick *et al.* 2010). However, comparisons with measured loads at key monitoring sites are required to determine how much confidence should be given to predicted loads.

Property-based load limits could be assessed using nutrient budgeting models like OVERSEER®. Landowners in areas where load limits are necessary would presumably be responsible for running the OVERSEER® model and demonstrating that their operation is likely to meet their load limit. However, the practicality of individual landowners being able to do this needs to be considered, along with the accuracy of such models and how updates to model versions will affect land use controls.

Key steps for the implementation programme are suggested. Once an appropriate spatial framework is chosen, it will be possible to use national guidance to develop objectives for each management zone in the Tasman District. Choices need to be made on the design and operation of the SOE monitoring programme, and on areas where load limits will be required and how loads will be allocated. We suggest implementing the objectives and limits on a catchment-by-catchment basis, starting with the Waimea catchment where the proposed water augmentation project may result in changes to river flows and water quality.

A collaborative approach among council, iwi, stakeholders and the wider community is recommended for implementation of the NPSFM.

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1. INTRODUCTION

The National Policy Statement for Freshwater Management (NPSFM; Ministry for the Environment 2011) requires that regional councils establish freshwater objectives and set freshwater quality limits and environmental flows for all bodies of freshwater in their regions to give effect to the NPSFM. Councils are required to implement the policy as promptly as is reasonable no later than 31 December 2030.

Using a small Envirolink grant, the Tasman District Council (TDC) sought advice from Cawthron Institute (Cawthron) on elements to be considered within a progressive implementation plan for the NPSFM in the Tasman Region. The advice was specifically required to help decide on:

- The risks to water quality and locations where water quality is poor or compromised
- The parameters that need to be managed through the setting of limits to manage risks to water body values
- The use of generic limits and/or catchment-specific limits
- Potential specific qualitative/quantitative targets for over-allocated waterbodies
- Other critical information that is needed and how long it will take to get it
- The modelling required.

The majority of this report focuses on rivers and streams, but limits are also required for other waterbodies such as lakes, groundwater and wetlands.

2. BACKGROUND/IMPORTANT LINKAGES

2.1. Land and Water Forum

The emphasis on setting limits in the NPSFM can be attributed in part to the Land & Water Forum (LAWF), a multi-stakeholder group that has been discussing water management for the last few years. One of the main recommendations from the LAWF's first report was that limits should be set — without limits there is no guard against over allocation (Land and Water Forum 2010).

In their second report, the LAWF focused on how objectives and limits should be set, and on the decision-making processes required. The LAWF considers that objectives and limits will need to be set at a catchment level to reflect both the geophysical characteristics of each catchment, and the values and interests of the community in each catchment (Land and Water Forum 2012). However, guidance on appropriate objectives is desirable at a national level. The LAWF have suggested that a national framework should be developed that sets national minimum state objectives ('bottom lines') in respect of a limited range of indicators. The national framework should also set out three different bands above bottom lines indicating increasing levels of protection — fair, good and excellent — to assist regional decision making. These bands will also be able to be used to guide regional councils in giving effect to the requirement in the NPSFM that the quality of waterbodies should be maintained or improved. The LAWF have suggested that some objectives will be able to be defined numerically at the national level, but a tight narrative description will be more appropriate for others.

The government has acted on this recommendation from the LAWF and is currently developing a National Objectives Framework to help guide regional council decision making and implementation of the NPSFM (Ministry for the Environment 2013).

2.2. National Objectives Framework

Central government officials are currently leading the development of the National Objectives Framework mentioned above (Ministry for the Environment 2013).

Science steering groups are providing recommendations on potential bottom lines for different parameters, and identifying suitable thresholds in parameter values representing the change from one band (*i.e.* excellent, good, fair, poor) to another. Advice is also being given on the appropriate measurement statistics to determine compliance (*e.g.* median, 95^{th} percentile, at all flows/some flows).

A reference group involving iwi, stakeholders, scientists and government officials is assessing the implications of the proposed objectives and will be informing government on potential options.

2.3. National Environmental Monitoring and Reporting

Over the last few years the Ministry for the Environment (MfE) has been leading an initiative aimed at improving national environmental monitoring and reporting (NEMaR). This work is ongoing, but initial reports have recommended standardisation of parameters and sampling frequency among regional councils (Davies-Colley *et al.* 2012). The most relevant information for TDC is that monthly water quality sampling for state of the environment (SOE) monitoring has been recommended, rather than the quarterly monitoring that is currently conducted by TDC.

A switch to monthly monitoring will provide more robust information for trend analyses across the region, although the increase in monitoring frequency may be matched by a corresponding decrease in the number of sites sampled given that monitoring budgets are unlikely to increase.

2.4. Links with Nelson City Council and West Coast Regional Council

Because waterways cross both the Nelson City/Tasman District (Roding River) and West Coast Region/Tasman District (upper Maruia River, lower Buller River) boundaries, ideally there should be links between the objectives and limits set for these waterways on either side of the boundary.

2.5. Some key concepts and terms

The NPSFM, LAWF and National Objectives Framework have led to the development of some concepts and language that have specific meanings in relation to limit setting and the implementation of the NPSFM.

It is important to distinguish between concentrations and loads. *Concentration* is the amount of material (*e.g.* pollutant) in a given unit volume of solution, usually measured and expressed in milligrams per litre (mg/L). *Load* is the total amount of material (*e.g.* pollutant) entering the system from one or multiple sources; measured as a rate in weight per unit time (*e.g.* tonnes per year). Loads are calculated by multiplying the concentration of material by the discharge.

There is also potential confusion between objectives and limits. An *objective* is a goal that needs to be met to ensure that an identified value is maintained. Objectives can

be narrative (written in words) or numeric (written in numbers). Objectives can potentially relate to ecological responses (*e.g.* periphyton cover < 30%) or to 'driving' variables that will affect ecological responses (*e.g.* dissolved reactive phosphorus concentration < 0.006 mg/L). A *limit* is a level of resource use that is set to meet an objective. Limits may be expressed as loads so they can be allocated to specific uses or they may be concentrations or other numbers (*e.g.* maximum water temperature) that are not so easy to allocate.

A key concept to grasp is the 'objectives limits cascade' (Figure 1). Council will need to determine values associated with their waterbodies (*e.g.* swimming). Specific objectives are then related to these values. These can be expressed in words as a broad narrative objective (*e.g.* safe swimming), followed by a tight narrative objective (*e.g.* maintaining faecal indicator bacteria below safe levels for swimming), and then in numbers as a numeric objective (*e.g.* annual median faecal indicator bacteria < 550/100 ml). Council can then set limits at a catchment or sub-catchment scale so these objectives can be met. Limits are likely to be expressed in terms of resource use loads, which can be allocated among users (*e.g.* runoff in the Motupiko catchment above Christies Bridge must be < X faecal bacteria/ha/day). Some knowledge of the proportion of contaminant that moves from the land to waterways, and likely attenuation rates within the waterways, is required to match resource use loads to numeric objectives. A worst-case scenario is that all contaminants reach waterbodies and no material is assimilated. Predictions of current resource use loads and current in-stream loads can be used to estimate the assimilation of pollutants as they move from the land into and along waterbodies.

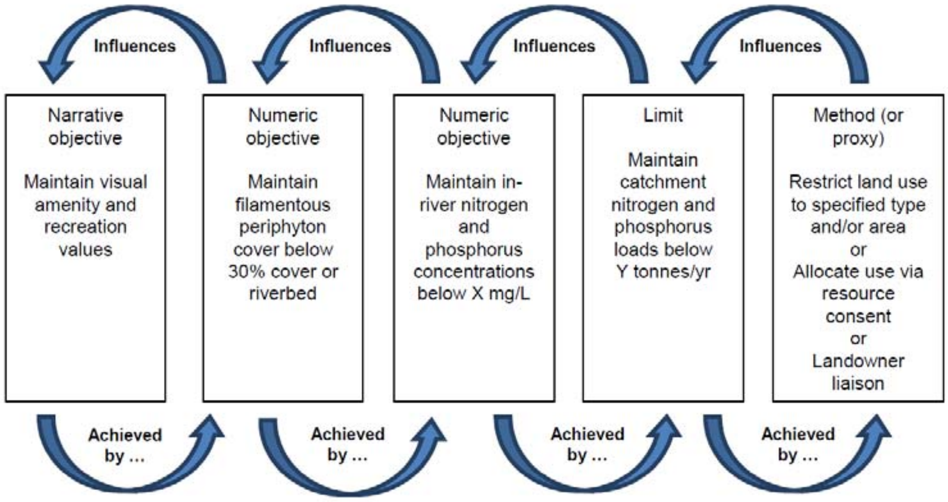

Figure 1. Objective limits cascade example.

3. POTENTIAL APPROACH FOR LIMIT SETTING

A potential approach for setting limits is shown in Figure 2.

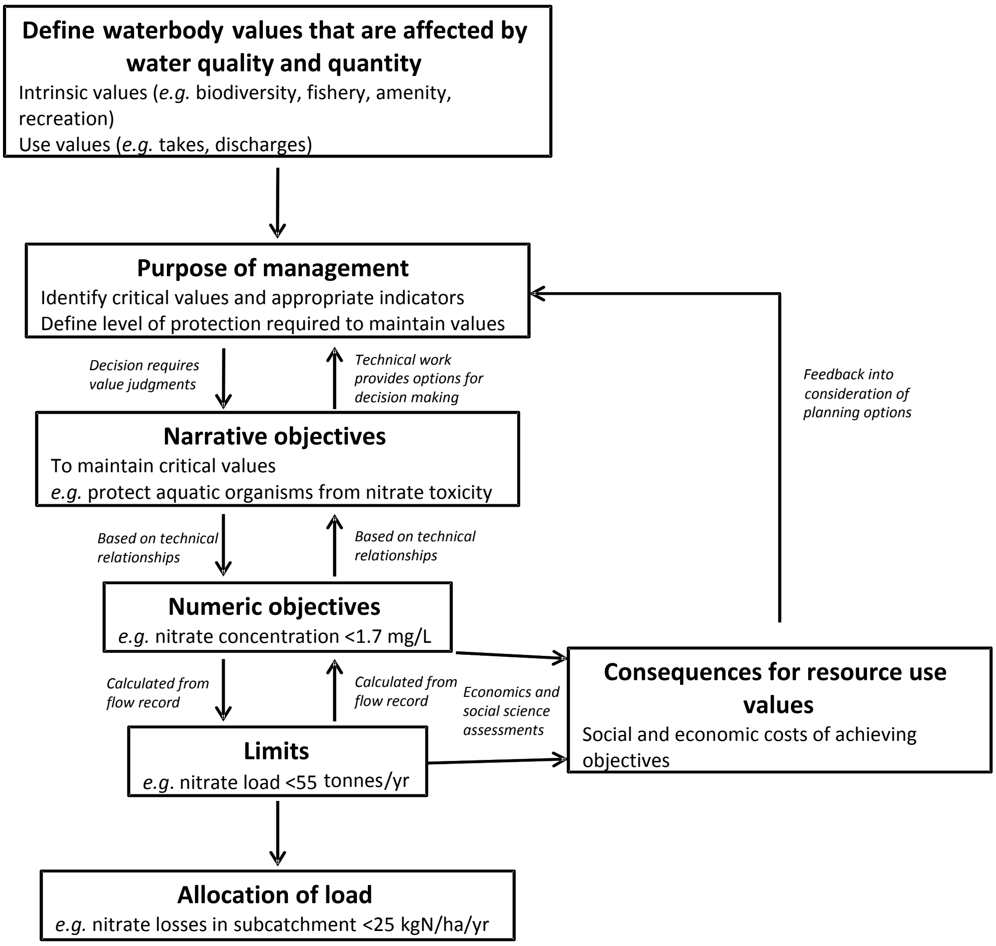

Figure 2. A potential approach for setting limits. Modified from Norton & Kelly (2010).

This approach involves the following steps:

Step 1 Identify values specific to river classes or water management zones (*e.g.* Wangapeka Management Zone has high biodiversity, high scenic values and is an important area for whitewater kayaking). An appropriate water management zone framework needs to be developed for the Tasman District so this can be done (this is discussed further in Section 4 below).

The Land and Water Forum have strongly advocated the need for a collaborative approach to implementation of the NPSFM. There are a large number of decisions to be made during the implementation process and the outcomes will potentially be more enduring if the reasons for the decisions are widely understood. We recommend that the values will be determined as part of a collaborative governance and/or community engagement and participation to work through the implementation process with the council, such as suggested in Berkett *et al*. (in press).

Step 2 Establish which values take prominence (critical values) and how those values will be measured (*e.g.* maintaining the high biodiversity values of the Wangapeka Management Zone is critical and will be measured by the presence of breeding whio/ blue duck). Consider the level of protection given to each value (*e.g.* whio are nationally threatened, so a high level of protection is appropriate).

Step 3 Determine objectives that are required to maintain the critical values. These can be narrative (*e.g.* control nuisance periphyton accumulations) or numeric (*e.g.* periphyton chlorophyll-*a* < 50 mg/m^2).

Step 4 Consider threats that may result in objectives not being met (*e.g.* most of Wangapeka Management Zone is in Conservation Estate, so low risk of an increase in nutrient load).

Step 5 Assess different options for critical concentration standards considering the likelihood that management objectives can be met. Also consider whether standards should apply at all flows in all seasons, or just under certain circumstances, for example:

- Option 1: Dissolved inorganic nitrogen (DIN) concentration < 0.02 mg/L, dissolved reactive phosphorous (DRP) < 0.001 mg/L applying at all flows — management objective will be met
- Option 2: DIN concentration < 0.2 mg/L, DRP < 0.01 mg/L applying at all flows — management objective possibly met
- Option 3: DIN concentration < 1.7 mg/L applying at all flows — management objective won't be met.

Step 6 Calculate load limits relating to each concentration option, for example:

- Option 1: Wangapeka (at Walters) DIN load 12 tonnes/year

- Option 2: DIN load 232 tonnes/year
- Option 3: 2365 tonnes/year.

Step 7 Compare different load limits with observed loads (*e.g.* Current annual DIN load 35 tonnes/year).

Step 8 Decide on appropriate load/concentration limit for management zone considering social/cultural/economic implications of achieving different standard options (*e.g.* Annual DIN load at Wangapeka at Walters Bluff shall be < 50 tonnes/year)

Step 9 Allocate load on a property basis within the zone. If over allocated consider how reduction in load will be achieved. (*e.g.* Joe Bloggs property shall leach no more than 30 kgN/ha/year until 2016 and no more than 15 kgN/ha/year after 2018.

It is possible that Steps 5–9 could be by-passed if the perceived risk to the critical values is considered to be minor (Step 4). If that was the case then the objective set in Step 3 could be used as a limit. However, it would not be possible to allocate this limit among resource users, since it is not expressed as a load. An appropriate management response to exceedance of an objective-based limit (such as completing Steps 5–9) would need to be defined.

4. SPATIAL FRAMEWORKS

The spatial framework for limit setting is an important step in the proposed approach mentioned above. Management zones within a framework enable a diverse region to be divided up, so common management objectives are applicable within each zone. There are a variety of purposes to zone development, and different councils around New Zealand are currently considering / applying different approaches. If the management zones are representative for a certain value in this zone, then consistent objectives can be set for all waterways within each zone. However, limits, which are based on loads, require site-specific flow information, so would need to be calculated for specific locations within zones. There are also some values that would apply equally across some or all spatial areas, particularly Maori values such as mauri. In this case, there will have to be an over-arching framework developed that includes such values across several zones.

As part of the water management framework for their Proposed One Plan, Horizons Regional Council (Horizons) defined 44 water management zones and 117 subzones in the Manawatu-Wanganui region (McArthur *et al.* 2007). These zones are catchment or sub-catchment based and encompass the waterways within the zone and the surrounding land (Figure 3). Values have been determined for each water

management zone and relevant objectives for the zones have been applied. Since the Horizons water management zones/subzones are detailed and catchment-based then load-based limits have been calculated for each zone. To assess compliance with the objectives and limits, a monitoring site is required at the downstream end of each zone. It is anticipated that some management purposes will occur at the subzone level (*e.g.* surface water allocation), while other management purposes will occur at the zone level (*e.g.* water quality), or across multiple zones (*e.g.* groundwater).

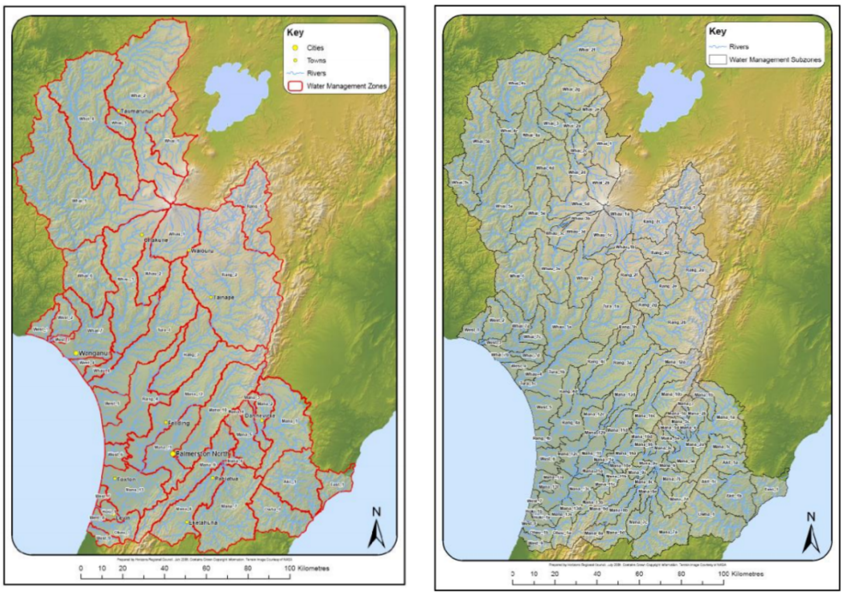

Figure 3. Water management zones and subzones proposed for the Manawatu-Wanganui region by Horizons Regional Council.

Environment Canterbury has identified management units that were initially based on the River Environment Classification (REC; Snelder *et al.* 1998) and subsequently modified (Hayward *et al.* 2009) (Table 1). The management units are not tied to catchments, but the values are consistent within classes. Load-based limits, however, are being calculated on a site/catchment specific basis (*e.g.,* Norton & Kelly 2010; the proposed Hurunui Waiau River Regional Plan (http://ecan.govt.nz/news-and-notices/news/pages/proposed-hw-plan-on-agenda.aspx, 21.06.13), but it seems that there are no plans to allocate these loads to individual land owners or even sub-catchments.

Table 1. River management units proposed by Environment Canterbury for their Natural Regional Resource Plan.

Broad grouping	River management units	Description
Natural State	Natural state	Mostly alpine rivers, will include hill-fed and inland spring-fed streams within Department of Conservation, public conservation land
Upland rivers – high water quality, high values	Alpine- upland	Upper reaches of alpine rivers and their tributaries
	Hill-fed - upland	Upper reaches of many, but not all, hill-fed rivers
	Spring-fed upland	Spring fed streams of inland basins and upper river valleys
	Lake-fed	Lake-fed rivers *e.g.* Hurunui Nth Branch below Lake Sumner, Waitaki River
Rivers of lower hills and plains – moderately to highly impacted	Alpine – lower	Lower reaches of alpine rivers as they interact and flow across the plains
	Hill-fed – lower	Rivers fed from the foothill areas—will incorporate some volcanic streams around Timaru
	Hill-fed – lower – urban	Urban streams within Timaru City
	Banks Peninsula	All streams running off Banks Peninsula
	Spring-fed – lower basins	Spring fed streams of lower elevation basins Amuri basin, Hanmer Springs basin, Hakataramea basin, Lees Valley
	Spring-fed – plains	Spring fed streams emerging on the main plains and downlands areas.
	Spring-fed – plains – urban	Spring-fed streams of the plains - urban

Greater Wellington Regional Council (GWRC) is currently developing technical recommendations to support its second generation regional plan. The FENZ classification (Leathwick *et al.* 2010) has been adapted for the region and used to develop a spatial framework for setting objectives. It is not clear what process GWRC will use to set load-based limits for specific sites/catchments.

Tasman District Council could develop a spatial framework with management zones using any of these contrasting approaches, or a combination of all three. Initial discussions with TDC staff were focused on a catchment-based approach similar to that employed by Horizons Regional Council. A potential spatial framework was developed using the existing water allocation zones, information available in Schedule 30 of the Tasman Resource Management Plan (TRMP), and native fish zones arising

from an evaluation of native fish values in the Tasman District (Table 2). This zoning system is relatively detailed with 21 potential catchment management units identified. Some management units are not represented in the current monitoring programme, which may be a problem if compliance with objectives is being assessed. There is also some potential for different values to occur within different parts of catchment management units. For example, whio and the high biodiversity values present in the upper reaches of waterways in the proposed West Bank Motueka and Wangapeka catchment management unit will not be present in the lower reaches of these waterways.

Table 2. Potential catchment-based management units for the Tasman District, including an incomplete assessment of values. Some current monitoring sites are also shown.

High level	Intermediate level	Catchment management unit (CMU)	Values—CMU	Monitoring sites
Golden Bay	West Coast	West Coast (Mangarakau, Rakopi wetlands, Lake Kaihoka and other dune lakes)	Indigenous forest land cover, diverse fish communities/native fish habitat, blue duck habitat (Anatori), water allocation and groundwater take, aquatic ecosystem, water fowl, cultural, spiritual, intrinsic and landscape values, water quality improvement function, flood mitigation, recreational.	
	Aorere	National Park (Aorere Upper, indigenous forest — above Brown Hut)	Regionally significant whitebait habitat, eel habitat, giant kokopu habitat, alluvial gold resources, kayaking, water allocation and groundwater take.	Aorere at Devil's Boots
		Aorere Plains (agriculturally used land — downstream of Brown Hut)		Aorere at Le Comps
	Coastal Golden Bay	National Park	Indigenous forest land cover, diverse fish communities.	Onekaka at Shambala, Onekaka at Ironstone
		Other		Winter Creek
	Takaka	Upper Takaka River and tributaries	Indigenous forest land cover, high water quality, DOC estate, kayaking, water allocation and groundwater take, regionally significant hydro-electric power generation.	Takaka at Harwoods Anatoki at Happy Sams Waingaro at Hanging Rock
		Lower Takaka River and Plains	Water allocation and groundwater take.	Takaka at Kotinga, Waikoropupu at Springs, Motupipi at Reillies

High level	Intermediate level	Catchment management unit (CMU)	Values—CMU	Monitoring sites
Tasman Bay	Abel Tasman	Abel Tasman (Otuwhero, Marahau Coastal Margins, Marahau Coastal, Kaiteriteri, Holyoake, Marahau Plains)	National Park, Torrent Bay / Awaroa (community water take), Native fish values.	
	Motueka/Riwaka	Riwaka River catchment	Karst geology, trout fishery, native fish habitat and aquatic ecosystem, (non-) contact recreation, kayaking, cultural/spiritual/landscape values, human consumption, irrigation, community water, stock/farm supply.	Riwaka at North Branch, Riwaka at Hickmotts
		West Bank Motueka and Wangapeka	**West Bank Motueka** = Karst geology, separation point granite geology, high water quality, human consumption, irrigation, community water supply, stock/farm water supply **Wangapeka** = Nationally significant black fronted-tern/ black-billed gull nesting sites, kayaking, blue duck habitat, alluvial gold resources, water allocation and groundwater take.	Baton at Baton Flats Wangapeka u / s Dart Wangapeka at Walters Sherry at Cave Sherry at Blue Rock
		East Bank Motueka	Moutere gravel, trout spawning habitat, human consumption, irrigation, community water supply, stock/farm water.	Stanley Brook at Barkers
				Waiwhero at Cemetery
		Tadmor	Water allocation and groundwater take	Tadmor and Mudstone
		Motupiko	Hill-fed and Moutere gravel geology, water allocation and groundwater take.	Motupiko at Quinneys Bush Motupiko at Christies, Kikiwa, Graham, Hunters
		Upper Motueka		Motueka u / s Wangapeka Motueka at Gorge
		Lower Motueka (Motueka Coastal Plains including Brooklyn and Little Sydney)	Spring-fed streams.	Motueka at Woodmans Bend Little Sydney
	Moutere	Moutere		Tasman Valley Stream

High level	Intermediate level	Catchment management unit (CMU)	Values—CMU	Monitoring sites
	Waimea	Waimea Plains (includes Eastern Hills, Reservoir, Borck, Jimmy Lee, Saxton (top half), Redwood and Eve's Valley, Pearl, O'Connors Creek, Neiman)	Hill-fed / Moutere gravel, residual pools, remnant giant kokopu populations, water allocation and groundwater take.	Borck Creek Waimea at Appleby, Reservoir Creek at Salisbury Rd
		Upper Waimea	Native fish and trout habitat, contribution to Waimea River flows, (non-) contact recreation, cultural, spirit, landscape values, water allocation and groundwater take.	Wairoa at Irvines, Lee at Meads, Roding at Twin Bridges
		Wai-iti	Trout spawning, contributes to Waimea River flows, contribution to groundwater, irrigation, community water, stock/farm water supply, water allocation and groundwater take.	Wai-iti at Livingston

High level	Intermediate level	Catchment management unit (CMU)	Values—CMU	Monitoring sites
Buller		Upper Buller	Nationally significant black-fronted tern and black-billed gull nesting area, alluvial gold, including water allocation and groundwater take.	Buller at Longford
		Nelson Lakes (Rotoiti, Rotoroa, lake tributaries)	National Park, regionally significant blue duck/ water fowl habitat, fisheries, wildlife habitat, nationally significant aquatic vegetation values, kayaking, rafting, boating, (non-) contact recreation, cultural, spiritual, landscape values & natural character.	Black Valley Stream
		Rest	Kayaking, rafting, nationally significant black-fronted tern and black-billed gull nesting areas, hydro power, alluvial gold, Northern flathead galaxias pops.	Matakitaki
			Trout spawning, significant landscape/natural character value, kayaking, rafting, alluvial gold.	Mangles

An alternative spatial framework based on the REC system is shown in Figure 4. This zonation is based on the climate and source of flow classes in the REC and in this configuration results in 12 zones across the Tasman District. The classification is reasonably self-explanatory and is based on two factors that are considered likely to influence aquatic ecosystems and the values that they support. Further refinements could be made if necessary, such as including spring-fed streams, or using additional REC classes like geology or stream order to guide the classification. General water quality objectives could be set for each zone, but load-based limits would have to be set for specific locations within each zone. Modifications to the current monitoring system may be required to adequately assess compliance with objectives/limits.

A third potential zonation system based on the FENZ system is shown in Figure 5 and in this configuration includes only five zones across the Tasman District. The mechanics behind the classifications within the FENZ system are based on multivariate statistics and are not as transparent as the REC, but using the configuration of classes chosen for Figure 5, the zonation is somewhat similar to that provided by the REC and also appears to incorporate aspects relating to stream size/distance from the coast. Once again, objectives could be set for each zone, but load-based limits would have to be set for specific locations within each zone. Modifications to the current monitoring system may be required to adequately assess compliance with objectives and limits.

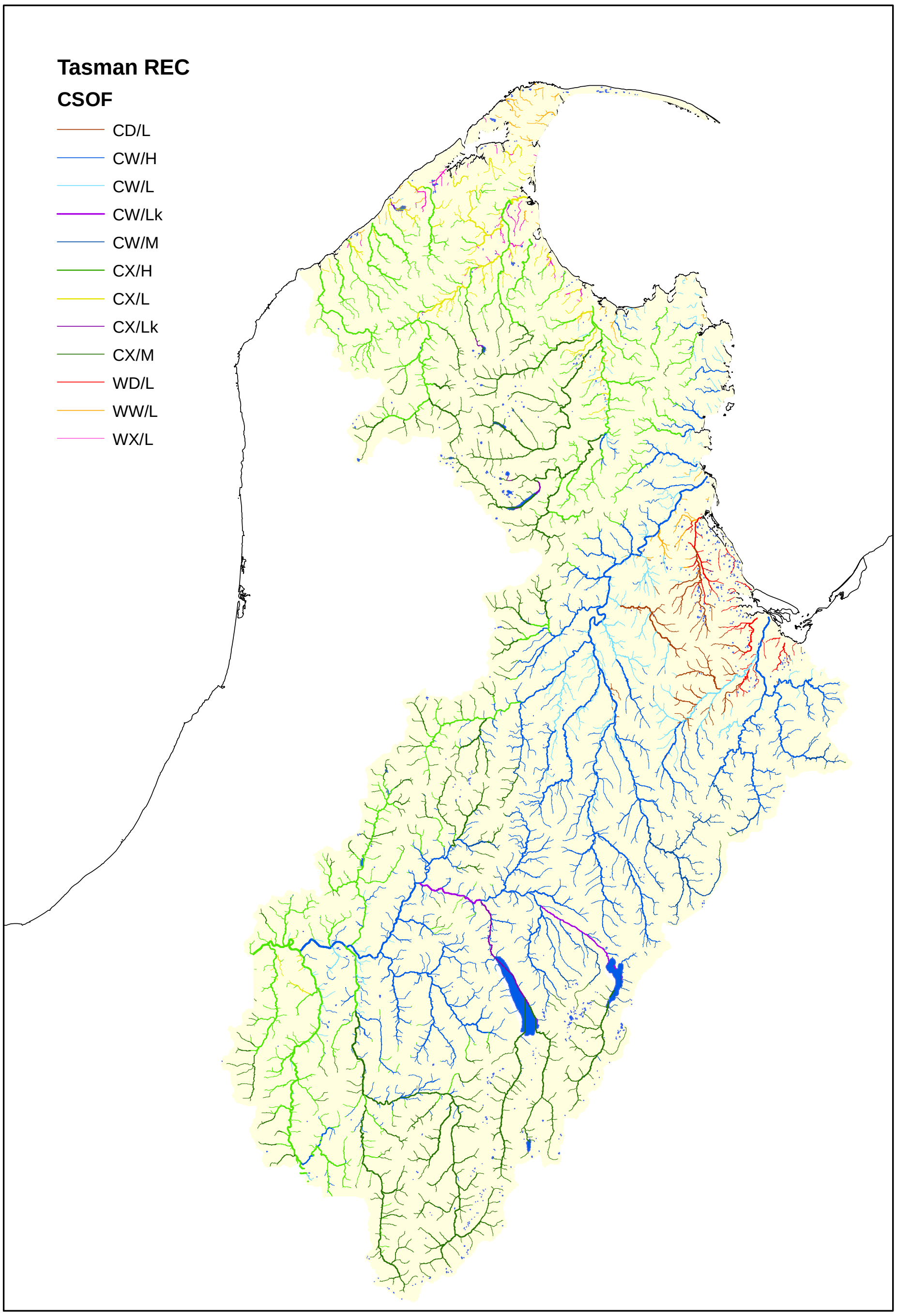

Figure 4. Potential catchment management units for the Tasman District based on climate (C) and source of flow (SOF) classes from the River Environment Classification system. Climate: CD cool dry, CW cool wet, CX cool extremely wet, WD warm dry, WW warm wet, WX warm extremely wet; Source of flow: L lowland, H hill, Lk Lake, M mountain.

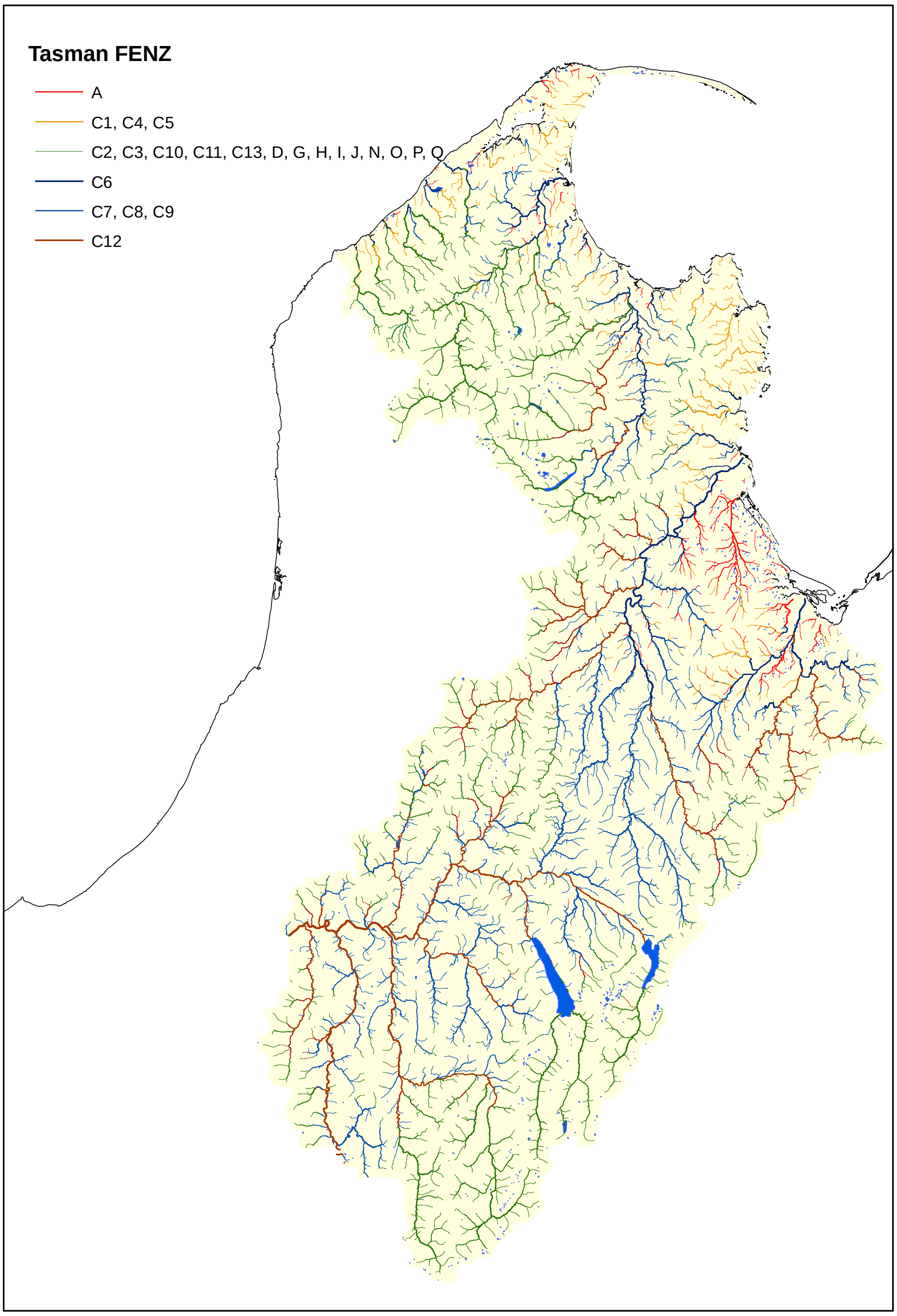

Figure 5. Potential catchment management units for the Tasman District based on classes from the Freshwater Environments of NZ (FENZ) classification system.

5. PARAMETERS FOR OBJECTIVE AND LIMIT SETTING

Parameters for objective setting will be those that are commonly measured in the current monitoring programmes run by TDC. As mentioned above, objectives can potentially be biological responses (*e.g.* periphyton cover) or drivers of these responses (*e.g.* nutrient concentrations). Suitable parameters for objective setting include:

Water quality:

- Faecal indicator bacteria concentrations
- Cyanobacteria cover/concentration – both planktonic and benthic
- Toxicants, including nitrate and ammoniacal nitrogen
- Water clarity/turbidity/suspended solids
- Deposited fine sediment cover/resuspendible sediments
- Water temperature
- Dissolved oxygen
- pH
- Periphyton cover/biomass
- Macroinvertebrate community composition (MCI/QMCI/%EPT)
- Dissolved nutrients (DIN/DRP)

Water quantity:

- Extend and duration of low flows
- Flow variability
- Allocation level

As mentioned earlier, the national objectives framework programme is attempting to provide national guidance on appropriate parameters for objective setting, along with national bottom line values, bands representing fair, good and excellent above the bottom lines, advice on metrics that could be used to deal with natural environmental variability (*e.g.* 95th percentiles, medians, all flows, only flows < 3 X median).

It is not appropriate to set load-based limits for some of these parameters, such as temperature, pH, dissolved oxyden (DO), Macroinvertebrate Community Index (MCI) – these are best left as objectives in the plan. Load-based limits are only suitable for parameters such as nutrients, suspended solids, toxicants, and potentially faecal indicator bacteria.

Limits could be defined in a table similar to Table 3. The river management unit and associated values could be included along with key parameters and the limits for each management unit.

Table 3. Potential structure of limits table for multiple river management units, including comments on appropriate measurement statistics.

Management Unit	**Subunit**	**Critical Values**	**QMCI**	**Dissolved oxygen [minimum daily saturation] (%)**	**Temperature [daily max] (°C) to apply from October to April inclusive**	**Temperature [max] (°C) to apply during May to September inclusive**	**Filamentous algae >20mm [max. cover of bed](%)**	**Benthic cyanobacteria [max cover of bed] (%)**	**Fine Sediment < 2mm diameter [max. cover of bed](%)**	**Contact Recreation Grade**	**pH**	**Toxicants (Protection level)**	**DIN (mg/L)**	**DRP (mg/L)**	**Clarity black disk (m)**
A	A1	High biodiversity Salmonid fishery	6	90	19	11	10	50	10	Good	Maintain between 6 and 8.5	99%	0.08	0.005	1.6
A	A2	Salmonid fishery Amenity		90	20		20	50		Good to Fair		95%	0.18	0.007	1.6
B		High biodiversity Salmonid fishery		90	19		10	50	15	Good		99%	0.21	0.006	4

Measurement statistics

DO and temperature

DO: The 5th percentile of daily minimum DO saturation from 24 hour continuous monitoring over the previous three years shall be greater than…..

Temperature: The 95th percentile of daily maximum temperature from 24 hour continuous monitoring over the previous 3 years shall be less than …..

Explanation: Both of these parameters vary widely on a daily basis. While we strongly recommend that measurement statistics for these parameters are based on continuous monitoring data, we recognise that in most cases only spot measurements of DO and temperature are available. The criteria/limits presented in the table above are based on the recommendations of Hayward *et al*. (2009), and are based on spot measurements. Therefore, there will be a need to refine the numbers in the table above based on continuous monitoring data if/once it becomes available.

Toxicants

Nitrate and other toxicants: The 95th percentile of monthly measurements shall be less than….., OR The annual median of monthly measurements shall be less than

Explanation: The specific numbers to apply for each toxicant and the appropriate measurement statistic (95th percentile or annual median) are defined in the ANZECC and ARMCANZ (2000) and updated versions of this (*e.g.*, Hickey 2013 for Nitrate toxicity). Note the important difference between the species protection level indicated in the above table (99% or 95% protection level) and the measurement statistic (95th percentile or median of measurements).

Measurement statistics, *continued*

pH, water clarity, nutrients and biological measures	**QMCI:** Three year rolling mean of annual measurements is greater than…..
	Filamentous algal cover: The 95th percentile of monthly measurements over the previous three years shall be less than…..
	Benthic cyanobacteria: The 95th percentile of monthly measurements over the previous three years shall be less than……
	Deposited fine sediment: Three year rolling mean of annual measurements is less than …..
	pH: The 95th percentile of monthly measurements over the previous three years shall be less than…..
	Clarity: The 5th percentile of monthly black disc clarity measurements over the previous three years shall be greater than…..
	DIN: The 95th percentile of monthly measurements over the previous three years shall be less than…..
	DRP: The 95th percentile of monthly measurements over the previous three years shall be less than…..

6. OTHER INFORMATION REQUIRED

6.1. Threats

The potential threats facing waterbodies in the district needs to be assessed in some way. However, we don't consider that this should be an intensive effort. The main threats to freshwater values are probably associated with an increase in the intensity of land use. Water supply is currently limiting land use intensity in many parts of the district, so potential threats will primarily be associated with areas where water augmentation projects are possible/proposed. Obvious areas where this may occur is the Waimea Plains, Motupiko Valley and Takaka Valley.

Threats are also present in areas where current monitoring shows trends in the wrong direction. For example, there has been a significant and meaningful increase in nitrate nitrogen concentration at the Motueka at Woodstock site over the last 20 years.

Threats are also present where current conditions are close to or above appropriate objectives. For example, the nitrate nitrogen concentrations in the Waimea aquifers and in the spring-fed streams that are fed by these aquifers are often above guidelines for protection from nitrate toxicity.

Detailed land use modelling to assess potential threats could be conducted in situations where likely land use scenarios can be predicted (*e.g.* change in intensification associated with Waimea Water Augmentation Project). However, even in these situations it is difficult to predict how land use patterns might change, since factors like global economic conditions and commodity prices are highly influential in land use decisions.

6.2. Load calculations

For parameters where load-based limits are appropriate and required, it is important to have sufficient information to calculate current nutrient loads at specific locations. This involves having good measurements of the water quality parameters (*e.g.* nutrient concentrations) across a range of flow conditions and good measurements, or estimates, of flows.

Therefore some thought needs to be given to locations where loads could be set and if these locations are not current monitoring sites then monitoring should be commenced. As mentioned earlier, monthly water quality sampling, across a range of flow conditions, has been indicated as the preferred approach to monitoring. Such sampling will allow concentrations across a range of flows to be determined — and assessments of whether there is a relationship between flow and concentrations. TDC needs to consider the costs and benefits of moving to monthly sampling for its SOE

monitoring programme. Even with monthly sampling, it may take 3–5 years to gain sufficient information on the relationship between flows and concentrations to get accurate estimates of loads.

Calculating loads at sites where there is no data is clearly problematic and not advised. Predictions of annual nitrogen loads derived from the CLUES model are available for all segments in the FENZ pressure layer database. We understand that CLUES has been undergone further development and predictions of annual phosphorus loads are also potentially available. There are also estimates of mean flows in the FENZ database. This information could be used to develop preliminary load estimates, but we imagine that there would be considerable uncertainty in these estimates.

Property based compliance with load-based limits cannot be measured directly, so needs to be assessed using the OVERSEER® nutrient budgeting model (http://www.overseer.org.nz), or a similar model such as SPASMO. OVERSEER® is run on an individual property basis and incorporates information on climate, soils, fertiliser application, stocking rates, farm management activities *etc.* to estimate annual nutrient losses. In priority catchments, where TDC considers that nutrients should be controlled, the landowners would be allocated their proportion of the catchment nutrient load. Landowners would be responsible for running the OVERSEER® model and demonstrating that their operation is meeting the load limit.

7. IMPLEMENTATION PROGRAMME

7.1. Requirements from the National Policy Statement Freshwater Management

The implementation plan for the NPSFM needs to define time-limited stages so that implementation is completed by 31 December 2030.

Tasman District Council needs to publicly report, in every year, the extent to which the programme has been implemented.

7.2. Potential approach to implementation programme

The implementation programme could include the following steps:

- Define an appropriate spatial framework
- Use national guidance on parameters, parameter values and appropriate measurement statistics and an understanding of the values to develop objectives for each management zone in the Tasman district
- Consider the efficacy of the current SOE monitoring network for implementation of the NPSFM.
- Collect appropriate concentration and flow information at these sites to estimate current loads and help guide load-based limits
- Consider options for how loads will be allocated
- Start on implementation of objectives and limits in one major catchment and then subsequently move to the next major catchment (or group of smaller catchments) in the District. We suggest implementation could start in the Waimea catchment, given the current plans for a water augmentation scheme.

8. REFERENCES

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