Policy and Planning Committee

Tuesday 2 May 2017
10.30am
Taranaki Regional Council, Stratford

Agenda for the meeting of the Policy and Planning Committee to be held in the Taranaki Regional Council chambers, 47 Cloten Road, Stratford, on Tuesday 2 May 2017 commencing at 10.30am.

Members	Councillor N W Walker	(Committee Chairperson)
	Councillor C L Littlewood	
	Councillor M P Joyce	
	Councillor D H McIntyre	
	Councillor B K Raine	
	Councillor C S Williamson	
	Councillor D L Lean	(ex officio)
	Councillor D N MacLeod	(ex officio)
Representatives	Councillor R Jordan	(New PlymouthDistrict Council)
	Councillor G Boyde	(Stratford District Council)
	Councillor P Nixon	(South Taranaki District Council)
	Mrs B Muir	(Taranaki Federated Farmers)

Apologies

Notification of Late Items

Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy and Planning Committee

Subject: Confirmation of Minutes – 14 March 2017

Approved by: A D McLay, Director-Resource Management

B G Chamberlain, Chief Executive

Document: 1853002

Resolve

That the Policy and Planning Committee of the Taranaki Regional Council:

1. takes as read and confirms the minutes of the Policy and Planning Committee meeting of the Taranaki Regional Council held in the Taranaki Regional Council chambers, 47 Cloten Road, Stratford, on Tuesday 14 March 2017 at 11.00am
2. notes the recommendations therein were adopted by the Taranaki Regional Council on 3 April 2017.

Matters arising

Appendices

Document #1832789 – Minutes Policy and Planning Committee

Minutes of the Policy and Planning Committee Meeting of the Taranaki Regional Council, held in the Taranaki Regional Council Chambers, 47 Cloten Road, Stratford, on Tuesday 14 March 2017 at 11.00 am.

Members	Councillors	N W Walker	(Committee Chairperson)
		M P Joyce	
		C L Littlewood	
		D H McIntyre	
		B K Raine	
		C S Williamson	
		D L Lean	(ex officio)
		D N MacLeod	(ex officio)
Attending	Councillor	R Jordan	(New Plymouth District Council)
	Councillor	G Boyde	(Stratford District Council)
	Councillor	C Coxhead	(South Taranaki District Council)
	Mrs	B Muir	(Taranaki Federated Farmers)
Attending	Messrs	B G Chamberlain	(Chief Executive)
		A D McLay	(Director-Resource Management)
		G K Bedford	(Director-Environment Quality)
		S R Hall	(Director-Operations)
		C L Spurdle	(Planning Manager)
		G C Severinsen	(Policy and Strategy Manager)
		M J Nield	(Director-Corporate Services)
		S Tamarapa	(Iwi Communications Officer)
		P Ledingham	(Communications Officer)
		R Ritchie	(Communications Manager)
	Mrs	K van Gameren	(Committee Administrator)
	Mr	J Clough	(Wrightson Consulting)

Apologies There were no apologies.

Notification of Late Items There were no late items of business.

1. Confirmation of Minutes – 31 January 2017

Resolved

THAT the Policy and Planning Committee of the Taranaki Regional Council

1. takes as read and confirms the minutes of the Policy and Planning Committee meeting of the Taranaki Regional Council held in the Taranaki Regional Council chambers, 47 Cloten Road, Stratford, on Tuesday 31 January 2017 at 11.00am
2. notes that the recommendations therein were adopted by the Taranaki Regional Council on 20 February 2017.

Raine/Williamson

Matters Arising

Introducing dung beetles to Taranaki dairy farms

Mr A D McLay, Director-Resource Management, advised the Committee that a report exploring an increased investment in a dung-beetle release programme in Taranaki will be presented to the next Committee meeting.

2. Regionally significant surf breaks

2.1 Mr C L Spurdle, Planning Manager, spoke to the memorandum updating the Committee on work currently being undertaken to develop criteria for determining which surf breaks are regionally significant.

2.2 Councillor C S Williamson sought discussion on the proposed surf break survey, enabling community input into the process, and the composition of the 'expert panel'. It was suggested and agreed that the panel composition be extended to involve all board riding groups in Taranaki to ensure as wide as possible key stakeholder engagement in the process going forward.

Recommendations

That the Taranaki Regional Council:

1. receives the memorandum and notes the work currently being undertaken to develop criteria for determining which surf breaks are regionally significant
2. notes that the consultant report will inform the section 32 evaluation and a revised draft Coastal Plan.

Williamson/Joyce

3. Taranaki Regional Council requirements for good farm management

3.1 Mr A D McLay, Director-Resource Management, spoke to the memorandum introducing a draft booklet outlining the Council's requirements for good farm management in Taranaki.

3.2 Progress on addressing environmental issues has not stopped even though the Council has not notified a proposed plan. Work is ongoing and work on protecting wetlands and moving farm dairy discharges to land will occur using existing policy frameworks set out in the requirements document.

3.2 It was noted to the Committee that the booklet will be widely distributed in hard-copy to all Taranaki farmers and will be available as an electronic copy as well. The Committee suggested the booklet also be distributed to farm consultants, agricultural contractors and livestock/fertiliser agents in Taranaki to assist with promoting the Council's key messages when dealing with landowners.

Recommended

That the Taranaki Regional Council:

1. receives the memorandum *Taranaki Regional Council requirements for good farm management*
2. adopts the document *Taranaki Regional Council requirements for good farm management* incorporating changes agreed to by the Committee if required.

McIntyre/Muir

4. Ministry for the Environment 'Clean Water' consultation document

4.1 Mr G G Severinsen, Policy and Strategy Manager , spoke to the memorandum introducing the Ministry for the Environment's consultation document entitled *Clean Water: 90% of rivers swimmable by 2040* and to seek feedback from the Committee prior to the closing date for submissions. Submissions close on 28 April 2017 and a draft submission will be emailed to Councillors for comment.

4.2 The Council is required to report to the Minister on how it intends to comply with the provisions in the document by October with a final report by March 2018.

Recommended

That the Taranaki Regional Council:

1. receives the memorandum Ministry for the Environment *Clean Water consultation document*
2. notes the Policy and Planning Committee has provided feedback on matters that may be included in a submission.

McIntyre/Lean

5. Resource Management (Exemption) Regulations 2017 – Pest Control

5.1 Mr S R Hall, Director-Operations, spoke to the memorandum providing an update to the Committee on the regulations recently introduced by the Government to streamline the regulatory regime in respect of the use of hazardous vertebrate toxic agents for pest control.

Recommended

That the Taranaki Regional Council:

1. receive the memorandum *Resource Management (Exemption) Regulations 2017 – Pest Control*
2. note that the new regulations come into force on 1 April 2017 and will standardise the national approach for using VTA poisons for pest management as requested through the consultation process undertaken in 2016
3. note that the new regulations broadly align and are consistent with the Council's current approach whereby the application of VTAs in the Taranaki region is a permitted activity.

Joyce/McIntyre

6. Submission on King Edward Park Reserve Management Plan

6.1 Mr G C Severinsen, Policy and Strategy Manager, spoke to the memorandum introducing a submission made to the Stratford District Council on the King Edward Park Reserve Management Plan. The submission was sent by the due date of 17 February 2016, with Councillors able to comment on a draft submission circulated by email.

Recommended

That the Taranaki Regional Council:

1. receives the memorandum *Submission on King Edward Park Reserve Management Plan*
2. endorses the submission.

Williamson/Raine

7. Key Native Ecosystems programme update 2017

7.1 Mr S R Hall, Director-Operations, spoke to the memorandum presenting for Members' information an update on the identification of seven new Key Native Ecosystem sites.

Recommended

That the Taranaki Regional Council:

1. receives this memorandum and the attached inventory sheets for Paul Dodge – Mataro Road; Rewarewa Bush; John Whittington – Stanley Road; Penwarden; McQuoid QEII 5/06/309; Joe Gibbs Reserve; and P G Nops Reserve
2. notes that the aforementioned sites have indigenous biodiversity values of regional significance and should be identified as Key Native Ecosystems.

Joyce/Coxhead

There being no further business, the Committee Chairperson Councillor N W Walker, declared the Policy and Planning Committee meeting closed at 11.55am.

Confirmed

Chairperson _____

N W Walker

Date **2 May 2017**

Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy and Planning Committee

Subject: Resource Legislation Amendment Act 2017

Approved by: A D McLay, Director – Resource Management

B G Chamberlain, Chief Executive

Document: 1852070

Purpose

The purpose of this memorandum is to outline the main changes to the Resource Legislation Amendment Act 2017, which became law on 18 April 2017.

Executive summary

The Resource Legislation Amendment Act 2017 (RLAA) passed into law on 18 April 2017. Some of the changes have immediate effect while others have transitional periods specified in the Act.

The RLAA is a complex piece of legislation containing some 40 significant changes to the Resource Management Act, Public Works Act Conservation Act, Reserves Act and the Exclusive Economic Zone (Environmental Effects) Act along with many other technical, procedural or process changes. It represents the second phase of the Government's resource management reform programme.

Major changes to the RMA arising from enactment of the Resource Legislation Amendment Act concern national level policy making and direction, regional and district plan making and the resource consents process.

Staff will be developing an implementation plan to give effect to the Resource Legislation Amendment Act 2017 over the coming months.

Recommendations

That the Taranaki Regional Council:

1. receives the memorandum *Resource Legislation Amendment Act 2017*
2. notes an implementation plan for the changes will be developed.

Background

The Resource Legislation Amendment Bill was finally passed into law on 18 April 2017. The Act as passed can be viewed on the MfE's website at http://www.mfe.govt.nz/node/21411/ .

Members will recall that the passage of the Bill had been delayed several times since it was first introduced to the House on 26 November 2015.

The Resource Legislation Amendment Act 2017 (RLAA) is a complex piece of legislation containing some 40 significant changes to the Resource Management Act, Public Works Act Conservation Act, Reserves Act and the Exclusive Economic Zone (Environmental Effects) Act along with many other technical, procedural or process changes. It represents the second phase of the Government's resource management reform programme.

The Council made a submission on the Bill and presented verbal submissions to the Select Committee at a hearing in Wellington in May 2016.

While the Council supported a number of positive proposals in the Bill, the Council opposed changes in major areas of reform, particularly in areas concerning plan making and the resource consents process. The Council considered that these changes would likely increase the complexity of RMA processes, apply a 'one size fits all' approach and add costs to processes that are already working well in Taranaki. Many of the proposals have remained unchanged or have been changed with minor amendments.

Significant changes introduced by the new Act are:

- Changes to national policy direction scope and process;
- New national planning standards (renamed from national planning template and narrowed in scope);
- New collaborative and streamlined planning processes;
- New 'boundary activities' deemed to be permitted activities if certain criteria are met;
- Discretion for councils to exempt an activity from the need to obtain a resource consent;
- A new 10-day consent category for minor activities under a district plan (previously included controlled activities under regional plans);
- Changes to resource consent notification procedures;
- New requirements for councils to free up land for housing;
- New provisions to enable stock exclusion from waterways;
- Improved Maori participation arrangements in RMA processes;
- New provisions requiring decommissioning plans for offshore platforms;
- More generous compensation for land required for public works; and
- Better alignment with other Acts such as the Reserves Act, Conservation Act and the EEZ Act.

The most significant changes for resource management are in the areas of national level policymaking and direction, regional and district plan making and the resource consents process. The Minister has increased powers under the Act.

Some of the changes have immediate effect while others have transitional periods specified in the Act.

Discussion

The Ministry for the Environment has released a range of guidance material on the RLAA, including a checklist for councils outlining the changed requirements and from what date they apply.

Most of the changes that relate to plan making have effect from the day after the Act received Royal Assent i.e. 19 April 2017. The majority of the changes to the resource consents process come into force six months after enactment i.e. on 18 October 2017.

The various guidance material can be found on the MfE website and are reproduced for Members here:

Overview of changes introduced by the Resource Legislation Amendment Act 2017:

http://www.mfe.govt.nz/sites/default/files/media/overview-changes-resource-legislation-amendment-act.pdf

Checklist for councils:

http://www.mfe.govt.nz/sites/default/files/media/RMA/Checklist%20for%20councils.pdf

Resource Legislation Amendment Act 2017 fact sheets:

(16 fact sheets that can be selected from the list below)

http://www.mfe.govt.nz/node/21411/

Staff will be developing an implementation plan to give effect to the RLAA over the coming months.

Decision-making considerations

Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy & Planning Committee

Subject: **Estimation of water quality contaminant loads and the likely effect of riparian fencing in Taranaki**

Approved by: G K Bedford, Director-Environment Quality

B G Chamberlain, Chief Executive

Document: 1851848

Purpose

The purpose of this memorandum is to advise the Committee of the preparation of a report for the Council that evaluates the comparative consequences for water quality improvement, of requiring riparian fencing in the dairying areas of Taranaki either according to the recommendations of the Land and Water Forum, or alternatively according to the Council's working policy as drafted in preparation for the next Regional Freshwater Plan. The report, '*Estimation of water quality contaminant loads and the likely effect of fencing in Taranaki*' has been prepared for the Council by Professor RW McDowell, of the Soil and Physical Sciences department of the faculty of Agriculture and Life Sciences, Lincoln University. It is attached in full to this memorandum.

Executive summary

The analysis described in the report and within this memorandum form part of this Council's investment in research and investigations for the benefit of the development of appropriately targeted and effective policies and methods of implementation for sustainable natural resource management. In this case, it also strongly undergirds the Council's submission (see elsewhere in today's agenda) on the workability of the government's proposed stock exclusion regulation as a means to achieving the government's national 'swimmability' targets.

The modelling undertaken by Prof McDowell shows:-
-that the Council's proposed policy of riparian management (fencing and planting) for all waterways, whether permanently flowing or ephemeral, will achieve much greater reductions in pollution loads entering the region's waterways than would either the recent LAWF recommendations or the government's proposed stock exclusion regulation;
-the beneficial effects of riparian management particularly encompass in-stream loadings of phosphorus, suspended solids, and *E coli* indicator bacteria, each of which have particular relevance to the management of water quality in Taranaki;

-that even with the completion of riparian fencing in dairying areas of the region (and further taking into account the additional effects of riparian planting), the government's swimmability targets as drafted would remain completely unattainable in Taranaki.

Recommendations

That the Taranaki Regional Council:

1. receives the memorandum *Estimation of water quality contaminant loads and the likely effect of fencing in Taranaki*
2. receives the report *'Estimation of water quality contaminant loads and the likely effect of fencing in Taranaki',* prepared for the Council by Prof R W McDowell of Lincoln University
3. notes the findings of the report and supports taking account of them in its submission to the Government on the '*Clean Water'* discussion document and in its consideration of policies for the revised *Freshwater Plan for Taranaki.*

Background

As set out in the Council's Long-term Plan, resource investigations and studies are a core activity for the Council. The *Resource Management Act 1991* requires the Council to make policy and decisions based on sound knowledge and information. It further requires the Council to monitor the state of the Taranaki environment and the results of the Council's policies and decisions.

Scientific knowledge is a fundamental prerequisite of effective resource management, at any scale. Environmental science is complex and challenging. Precise, accurate and comprehensive understanding of cause and effect relationships, of interventions and their outcome consequences, and the cost effectiveness of various methods of addressing environmental issues, seldom exist to a totally satisfactory level. The Council seeks to gain and maintain defensible, comprehensive, current and strategic data and information through targeted research and monitoring at an appropriate level. The collection and application of information and data recognises the imperatives of the *Resource Management Act* and the scale and nature of current or potential resource issues in the region. Investigations enable the Council to develop and review effective policies that demonstrably sustain and enhance the state of the region's environment.

Such studies may be undertaken wholly by internal resourcing, or by shared collaborations, or by Council support of external investigations that might utilise the Council's very comprehensive databases, experiences and expertise across a variety of fields. The study reported in this memo is part of the Council's suite of investigative studies.

A separate item in today's agenda sets out the Council's assessment of and submission on the government's discussion document *'Clean Water: 90% of rivers and lakes swimmable by 2040*' (Ministry for the Environment, February 2017). Members will note that the discussion document places great emphasis upon riparian fencing as a means of achieving the government's swimmability targets (which are based solely on a microbiological measure of water quality), by purportedly substantially reducing the transport of *E coli* indicator bacteria into waterways. The Council's view as expressed within the submission is that the implementation of riparian fencing will simply not achieve in practice anywhere near the postulated reduction of indicator bacteria.

Coincidentally but fortuitously, this Council had recently become aware of modelling undertaken by Professor McDowell that examined the potential reductions in contaminant loads across New Zealand's waterways that could arise from implementing riparian fencing. The model lent itself to an examination of effects at a regional rather than a national level, and could also be readily adapted to estimate comparative benefits to water quality from differing degrees of fencing implementation. The Council therefore commissioned Prof McDowell to do an evaluation of the comparative benefits for water quality in Taranaki, if fencing were to be implemented to either the recommendations of the Land and Water Forum (LAWF), or to the Council's preferred degree as expressed within background papers for the revision of the Freshwater Plan. His report has just recently been received by the Council.

Discussion

It should be noted that this discussion refers only to the potential benefits of riparian fencing. The Council's policy is that riparian margins should also be appropriately planted, in order to maximise the environmental and on-farm benefits of riparian management. Prof McDowell considered there were too many variables involved in riparian planting and re-vegetation, for the effects to be accurately or precisely modelled. It is widely reported within the scientific literature that planting substantially increase the degree of capture and filtration of contaminants otherwise flowing from land into waterways, as well as having benefits for enhancing the ecological condition of streams and stream banks.

The LAWF recommendation[1] re riparian fencing is as follows:-

Recommendation 35: A national stock exclusion regulation should apply to:

a. permanently flowing waterways and drains greater than one metre in width and deeper than 30 cm

b. permanently flowing waterways smaller than those outlined above on the plains (ie within land with less than 3° slope).

c. natural wetlands – as qualified by recommendation 37 of the LAWF report

d. where specific management practices that could result in significant damage to waterways (such as strip-grazing beside a waterway) are being used.

By comparison, the Council's position is that all permanently and also all intermittently flowing waterways and drains on the ring plain should be fenced (and planted). Thus, the Council's requirement would be more widely applicable than those proposed by the LAWF.

Prof McDowell's model utilised water quality data from some 728 regional council water quality monitoring sites across New Zealand, which comprehensively cover a variety of settings. In conjunction with the Rivers Environment Classification, a system that categorises New Zealand rivers by a number of measures but specifically by surrounding predominant land use (indigenous forest, exotic forest, pastoral, scrub, or urban), he was able to establish estimates of the annual yield (pollutant load) for each REC segment of every catchment in New Zealand. The pollutants incorporated in the study are dissolved reactive phosphorus and total phosphorus; ammonium-nitrogen, nitrate-nitrogen, and total nitrogen; suspended solids, and *E coli.*

[1] The Fourth Report of the Land and Water Forum, November 2015, pp 52-54

When Prof McDowell ran the model at a national scale, he found that riparian fencing installed in accord with the LAWF recommendations would capture only about 16% of the total pollutant load entering waterways nationwide (Figure 1 on page 8 in his report). By contaminant, 11% (for suspended solids) up to 21% (for nitrate nitrogen) would be captured. Even if the total loadings from only pastoral catchments were considered, the overall capture rate rose only to 23%: that is, over three-quarters of all contaminants originating from pastoral land would still enter waterways if the LAWF recommendations were fully implemented.

When Prof McDowell ran the model for the Taranaki ring plain, he found there would be substantial differences in residual contaminant load entering waterways, depending on whether the LAWF riparian fencing recommendations or the Council recommendations were followed. His results are set out below in Table 1 (summarising Table 4 in his report).

Contaminant	Taranaki load tonnes/yr (and % of NZ)	% reduction effectiveness of fencing	In-stream residual load under Council policy	In-stream residual load under LAWF recommendation policy (% reduction)	% Additional reduction by Council policy
DRP	133 (4.7%)	52	64	122 (8%)	44%
TP	317 (4.1%)	52	152	296 (7%)	45%
NH4-N	129 (4.2%)	15	110	127 (2%)	13%
NO3-N	4050 (4.8%)	10	3645	3989 (2%)	8%
TN	5995 (4.5%)	15	5095	5866 (2%)	13%
E coli	(6.8%)	38	-	-	-
Susp solids	97,098 (3.3%)	35	63113	93735 (3%)	32%

Table 4 in the report also shows that Taranaki contributes between 3.3% (for suspended solids) and 6.8% (for *E coli*) of the total pollutant loads originating from land in New Zealand. Taranaki represents 2.75% of NZ's land area.

Commentary

It is immediately apparent from Table 1 above, that the Council's proposed approach to riparian fencing (let alone the added degree of diffuse pollution abatement afforded by riparian re-vegetation) will lead to much greater reductions in in-stream contaminant loads than mere adoption of the LAWF recommendations. This arises primarily because the Council's policy would capture first order streams, the small waterways at the head of catchments where experts advise that up to 80% of contaminant transfer from land to water occurs. The figures provide a solid justification for the Council's proposal that these waterways should be included in riparian management.

The benefits for receiving water improvement of riparian management apply particularly to reducing dissolved and total phosphorus (and it is noted in passing that the streams and rivers of Taranaki tend to be phosphorus-limited: that is, periphyton growth is limited by the amount of phosphorus available, rather than the amount of nitrogen, so that a reduction in phosphorus leads directly to constrained nutrient availability for periphyton growth). The benefits are also particularly seen in reduced suspended solids and in reduced *E coli*, so that suitability for swimming will be generally enhanced by the Council's approach to riparian management, over and above the LAWF and indeed the government's proposed stock exclusion regulation (which captures all permanently flowing waterways on plains, but only waterways over 1 metre wide in steeper or hilly country).

Having said that, it is also immediately apparent that stock exclusion alone will not get near to achieving the government's swimmability targets (all weather, all flows, all year, all rivers of more than 30 cm deep), either nationally or more particularly within Taranaki. With less than 20% of the national *E coli* load in New Zealand's waterways originating from pastoral land that would be included in the LAWF recommendations for riparian management, the government's regulation will leave unaddressed by far the greater proportion of the bacterial sources and loadings in our rivers. While the government's regulation would go further than the LAWF recommendations, the inadequacy of the proposed regulation as a means of attaining the targeted reductions in *E coli* remains apparent.

Of particular relevance to this region, a potential reduction of 38% in *E coli* loadings in Taranaki's waterways, when the 95th%iles of *E coli* counts of most of our rivers lie in the range 2300 to 7700 *E coli* per 100 mls, is meaningless with respect to attaining the government targets of all swimmable rivers being below 540 *E coli* year-round.

It also needs to be kept in mind, that the figures in the table above represent the total potential reduction between a scenario of no riparian fencing and a scenario of completed riparian fencing. Because our ringplain rivers are around 85% fenced already, the remaining opportunity gain is negligible. Effectively, only 15% of the 38% reduction remains to be gained. In crude measure, the region could expect to see a future reduction of about 6% in *E coli* counts as fencing is completed. The reduction will be much more when planting is complete, but it remains obvious from the modelling conducted by Prof McDowell, that riparian management simply cannot deliver the government's *E coli* targets as currently formulated. De-stocking or other more drastic economic intervention on land use remains the alternative.

Prof McDowell concludes: *'it should be recognised that the effectiveness of fencing-off stock as a strategy to mitigate contaminant loads is highly site- and contaminant- specific, ranging from highly effective in flat areas and where contaminants are particulate-associated, to very ineffective in steeper areas and where contaminants are mobile'* (pg 9). This validates the Council's adoption of a farm-specific, and indeed a river-reach specific, approach to riparian management in farm plans, so that on a metre by metre basis appropriate and targeted riparian management practices are identified and planned for and can be put in place.

Decision-making considerations

Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Appendices/Attachments

Document 1851826: McDowell R.W. '*Estimation of water quality contaminant loads and the likely effect of fencing in Taranaki',* prepared for the Taranaki Regional Council, March 2017.

Estimation of water quality contaminant loads and the likely effect of fencing in Taranaki.

Report prepared for the Taranaki Regional Council

March, 2017

R.W. McDowell

Soil and Physical Sciences, Faculty of Agriculture and Life Sciences, PO Box 84, Lincoln University, Lincoln 7647, Christchurch, New Zealand

Executive Summary

A national model was developed to estimate the load of contaminants (suspended sediment (SS), nitrate+nitrite nitrogen (NO_3-N), ammoniacal-N (NH_4N), total N (TN), filterable reactive phosphorus (FRP), and total P (TP)) in all catchments classified by the River Environment Classification. The Taranaki Regional Council wished to know if contaminant load from streams currently proposed to be fenced from stock access would be different to that proposed by the Land and Water Forum, which focuses on larger, deeper streams in flat catchments. Across the region the LAWF recommendation applied to streams that carried from 10 (for SS) to 16% (for DRP) of contaminant load across all landuses in Taranaki. When focused on pasture-landuse, more contaminant load was captured (from 14% for SS to 20% for DRP). Hence, 84 to 90% of contaminants across all landuses and 80 to 86% of contaminants generated in pastoral catchments would not likely be captured by LAWF fencing recommendations. Assuming a median reduction in contaminant load (varying from 10% for NO_3-N to 52% for TP), loads under the Taranaki recommendation, which requires all streams to be fenced irrespective of size or location, would be substantively less than those under LAWF recommendations. However, it should be recognised that the effectiveness of fencing-off stock as a strategy to mitigate contaminant loads is highly site- and contaminant-specific, ranging from highly effective in flat areas and where contaminants are particulate-associated to very ineffective in steeper areas and where contaminants are mobile.

Scope of work

The Taranaki Regional Council (TRC) asked for data on the following points:

1. To produce estimate of contaminant loads in streams of the Taranaki region. Contaminants considered are suspended sediment (SS), nitrate+nitrite nitrogen (NO_3-N), ammoniacal-N (NH_4N), total N (TN), filterable reactive phosphorus (FRP), and total P (TP).
2. Loads will be estimated and summed according to stream order across the region (all), in pastoral landuse only (pasture) and only encompass the recommendations of the Land and Water Forum (LAWF). The difference between pasture and LAWF represents the load that is covered by fencing rules of the TRC.
3. An estimate (median and range) will be given of the efficacy of fencing to decrease contaminant load.

Methodology

Data

A database comprising concentrations of: SS, nitrate+nitrite nitrogen (NO_3-N), ammoniacal-N (NH_4N), total N (TN), dissolved reactive phosphorus (DRP), total P (TP) and *E. coli* was collated from McDowell et al. (2013a) and (Larned et al., 2016). The database included 728 sites that are routinely sampled by Regional Authorities from as early as the late 1970s. However, to reduce issues related to changes in water quality analyses and temporal trends I used data from 1998-2009. Data within

the database varied widely in reporting formats, reporting conventions, contaminant names, and sampling frequency or flows. To consolidate these data into a uniform structure and minimise the potential for error, I used a modified version of a MS-Access database (Ballantine and Davies-Colley, 2010) and adopted the following filtering conventions for data quality:

1. Sites were only included in the database if there were 50 or more measurements of a contaminant during the period of record, to ensure reasonable coverage of the flow range at the site;
2. Contaminant concentrations less than the indicated detection limit were set at half the detection limit. The percentage of sites where the median concentration was below the stated detection limit was generally <1% except for SS (3.4%), DRP (4.3%) and NH_4-N (17.4%). For contaminant concentrations greater than a censored value, such as *E. coli* (>20000 MPN $100mL^{-1}$), the numerical extreme was used;
3. Total N was calculated (where possible) as the sum of NO_3-N plus total Kjeldahl N for regions that did not specifically report this variable; and
4. Sites in estuarine waters were omitted to avoid biasing our dataset.

The frequency of sampling varied across the sites represented in the dataset from fortnightly to quarterly. In addition, constraints and objectives associated with the design of regional sampling programmes mean that geographical and environmental coverage of the sites is uneven and variable (Figure 1). The sites in the dataset therefore tended to represent locations where there is a known or anticipated change in water quality due to land use impacts.

I used the New Zealand River Environment Classification (REC) (Snelder and Biggs, 2002) to classify the sites according to the environmental characteristics of the upstream catchment that are strong determinants of their water quality. The first four hierarchical levels of the REC discriminate differences in catchment character based on spatially averaged measures of climate, topography, geology and land cover respectively. The spatial framework for the REC is a digital representation of the New Zealand river network comprising 576,688 segments (between confluences) and catchments with a mean length of ~700m that is contained within a Geographic Information System (GIS). The REC has been shown to discriminate differences in flow regimes (Snelder et al., 2005), nutrient concentrations (Snelder et al., 2004a), general water quality (Larned et al., 2004), and invertebrate community composition (Snelder et al., 2004b). Being hierarchical, the REC enables the classification of all streams and rivers in New Zealand at varying levels of classification detail and associated spatial scales.

Geographic co-ordinates and names were used to assign each water quality monitoring site to a REC class at the first four levels (climate, topography, geology, and land-cover) based on the network segment on which it was located (Table 1).

Table 1. Defining characteristics, categories, and membership criteria of selected classes within the River Environment Classification at each level.

Level	Defining characteristic (level)	Categories	Notation	Category membership criteria
Level 1	(Climate)	Warm-extremely-wet	WX	Warm: mean annual temperature ≥ 12°C
		Warm-wet	WW	Cool: mean annual temperature < 12°C
		Warm-dry	WD	Extremely Wet: mean annual effective precipitation[1] ≥ 1500 mm
		Cool-extremely-wet	CX	Wet: mean annual effective precipitation > 500 and < 1500 mm
		Cool-wet	CW	Dry: mean annual effective precipitation ≤ 500mm
		Cool-dry	CD	
Level 2	Topography[2]	Glacial-mountain	GM	GM: M and % permanent ice > 1.5%
		Mountain	M	M: > 50% annual rainfall volume above 1000m ASL
		Hill	H	H: 50% rainfall volume between 400 and 1000m ASL
		Low-elevation	L	L: 50% rainfall below 400 m ASL
		Lake	Lk	Lk: Lake influence index[2] > 0.033
Level 3	Geology	Alluvium	Al	Category = the spatially dominant geology category unless
		Hard sedimentary	HS	combined Soft-Sedimentary geological categories exceed 25% of
		Soft sedimentary	SS	catchment area, in which case class = SS.
		Volcanic acidic	VA	
		Volcanic basic	VB	
		Plutonics	P	
		Miscellaneous	M	
Level 4	Land-Cover	Bare ground	B	Class = the spatially dominant (> 50% of catchment area) Land-
		Indigenous forest	IF	Cover category, unless P exceeds 25% of catchment area, in
		Exotic forest	EF	which case class = P or U exceeds 15% of catchment area, in
		Pastoral	P	which case class = U.
		Scrub	S	
		Urban	U	

[1] Effective precipitation = annual rainfall – annual potential evapotranspiration.

[2] Called “source of flow” in Snelder and Biggs (2002).

[3] See Snelder and Biggs (2002) for a description.

Flow estimation

Contaminant load calculations require stream flow data; both the flow at the time each water quality sample was taken (e.g., mean daily flow) and a representative time series or flow distribution at the site. However, 447 of the 728 water quality monitoring sites did not have flow observations at the time of sampling or with continuous flow gauging records. I used the methods of Booker and Snelder (2012) to estimate flow duration curves (FDC) and mean daily flows on the date corresponding with each water quality sample at each water quality monitoring site. Briefly, the following steps were taken:

1. A hydrological dataset was acquired from the New Zealand national hydrometric database that consisted of time-series of daily mean flow measured at gauging stations distributed throughout the country (Pearson, 1998). Data was obtained from gauging stations with five or more years of data and that were free from flow modification due to abstractions and dams (n = 379).
2. A flow duration curve (FDC) was generated for each site. For all sites, a generalised extreme value (GEV) distribution was fitted to describe the distribution of flows.
3. The parameters of the GEV distributions were fitted to available catchment characteristics using a random forest model and the model was used to estimate FDCs for all 728 water quality monitoring sites.
4. Mean daily flows corresponding to sample dates were estimated for each water quality monitoring site by substituting flows observed at geographically close gauging stations with similar catchment characteristics (i.e. having the same REC class).

Load and yield calculation

Two methods were used to estimate contaminant yields for each site: regression (viz. rating) and ratio method. Loads were estimated for each site first and then converted to yields by dividing the loads by the area of the catchment upstream of each water quality monitoring site (kg/ha/yr).

The regression method fitted models to the log of concentrations against the log of flow. Following bias correction to account for back-transformation (Ferguson, 1987), regression model predictions were used to in-fill concentrations at each flow percentile of the FDC. The load associated with each percentile of the FDC was calculated as the product of the corresponding estimated concentration and flow. These individual loads were summed and multiplied by a constant to account for the change of units to produce an annual site load (kg/yr).

The ratio method calculated an annual site load, based on the mean of the product of concentration and flow for days when concentrations were observed (Beale, 1962). This average load was then adjusted by the ratio of the mean flow for all days from the FDC to the mean flow on days when concentrations were observed (Webb and Walling, 1985; Quilbé et al., 2006).

To avoid bias associated with poor representation of very low or high flows, sites were only included where concentrations were available for 90% of the flow range at the site. The regression method was used where the concentration-flow relationship was significant ($P<0.05$) and the amount of variance explained was > 60%, otherwise the ratio method was used, as per Quilbé et al. (2006).

Yield variation with stream order, REC class and accord-type

For each of the REC classes (Climate, Topography, Geology and Land-cover), I fitted a restricted maximum likelihood (REML) model (Genstat Committee, 2015) to the log-transformed yields of each contaminant, with order as a linear term along with REC class and their interaction; non-linear order effects were fitted with smoothing splines (Verbyla et al., 1999) on stream order and the interaction of REC class with stream order.

Across REC classes and stream orders there were 13,230 potential combinations for each contaminant. However, only 2,396 occur across the 576,688 stream segments represented in the REC: for example, there are no 8th order streams of hill topography.

The uncertainty of estimated yields depends on the strength of the relationship between yield and order for each REC class, which is influenced by the amount of data (viz. contributing sites) within each class. The REML model does not produce a coefficient of determination that can be used to check of the goodness of fit of the model. However, goodness of fit was assessed using the frequency with which observed yields fall within the mean yield estimated by the model and 95% confidence interval for a class.

Loads from streams recommended to be excluded from fencing

A GIS was used to define the catchment area of each of the 576,688 stream segments represented by the REC. Load predictions were then made for each catchment using the fitted REML models. The methods of Booker (2010) and Jowett (1998) were used within a GIS to isolate those stream segments that were < 1-m wide, <30-cm deep, or had a contributing catchment with a mean slope greater than 15 degrees (i.e. excluded streams). The predicted yields were multiplied by the catchment's contributing area to generate catchment-specific loads for each segment of the REC. The total load (kg/yr) was calculated for each region and nationally for fenced and excluded streams for each contaminant for all catchments, and for only those catchments that were dominated by the REC pastoral land-cover class, indicative of intensive land use.

Estimates

Uncertainties

After applying data filtering rules, sufficient data was available to estimate yields for between 243 (SS) and 481 (DRP) sites (Table 2). For TP, NO_3-N, TN and SS yields, more sites were estimated using the regression than the ratio method, while for DRP and *E. coli* the ratio method was used more frequently (Table 2). A plot of yields estimated by the two methods across all contaminants yielded a coefficient of determination of 0.98 (regression = $0.94.\text{ratio}^{1.0038}$; $P<0.001$), indicating the outputs from yield calculation methods were, on average, similar.

Table 2. Number and percentage of sites (in parentheses) using the two different yield calculation methods.

Contaminant	Regression	Ratio	Total
DRP	207 (43)	274 (57)	481
TP	233 (50)	229 (50)	462
NH_4N	176 (37)	294 (63)	470
NO_3-N	347 (73)	129 (27)	476
TN	328 (72)	131 (28)	459
SS	158 (65)	85 (35)	243
E. coli	119 (27)	329 (73)	448

Yield estimates were generated across the climate, geology, topography and land-cover REC classes using the REML procedure. The fit of the modelled yields to those calculated for each site is indicated by the frequency with which the data fell within the modelled estimate plus or minus the confidence interval. Across all contaminants, 84% of sites fell within the modelled estimate and respective 95% confidence interval, varying from 80% for *E. coli* to 91% for SS (Table 3).

Table 3. Fit of the restricted maximum likelihood model fitted to each contaminant, expressed as the number and percentage of predicted yields that fell within the mean and 95% confidence interval.

Contaminant	Number of sites with yield data	Number of sites within 95% confidence intervals	Percentage of sites within 95% confidence intervals
DRP	703	589	84%
TP	675	571	85%
NH_4N	687	581	85%
NO_3-N	694	611	88%
TN	670	587	88%
SS	364	332	91%
E. coli	655	526	80%

Contaminant loads

The mean proportional load accounted for all land uses across New Zealand by fenced streams was 16% across all contaminants, varying from around 11% for SS to 21% for NO_3-N; meaning 84% of loads were not captured from excluded streams. Regional variation for the load likely captured by fencing across all land uses was greater ranging from <1% for all contaminants in the West Coast region to 40% for NO_3-N in the Auckland region. The same calculation catchments dominated by pasture land-cover (i.e. intensively farmed), showed more would be captured by fencing, on average 23% across all contaminants. However, this means that in catchments dominated by pastoral land, 77% would not; varying from 73% for DRP and TN to 84% for SS (Figure 1). Inter-regional variation was greater still in pasture-dominated catchments, varying from 48% for DRP and TN in the Otago region to 99% for most contaminants in the West Coast region. Agriculturally productive regions such as Canterbury, Southland, and Hawkes Bay also exhibited large contaminant loads from excluded streams.

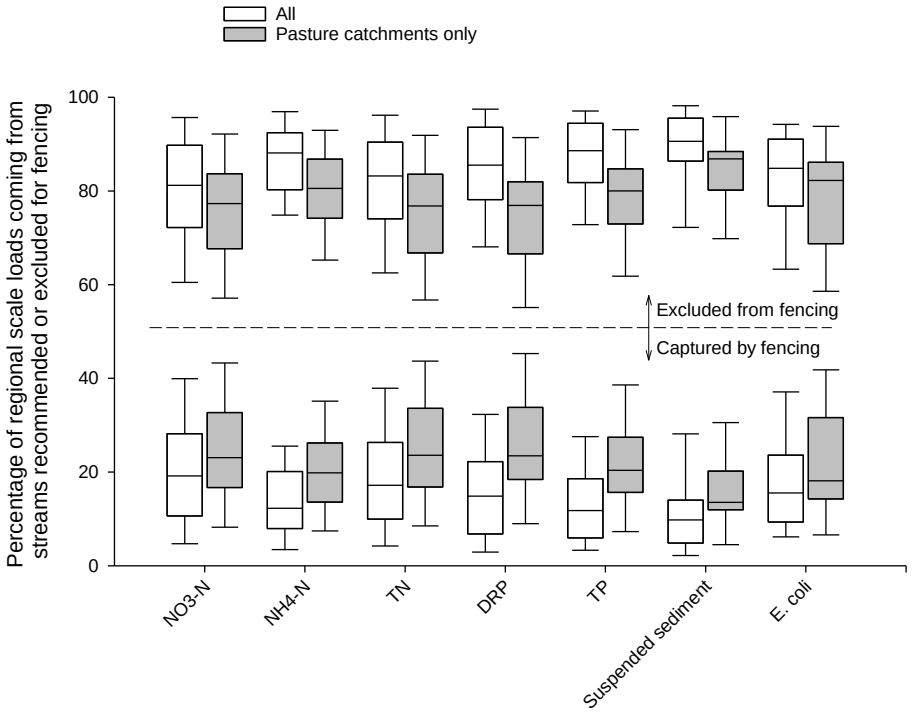

Figure 1. Box plots showing the percentage mean loads contributed by all streams recommended (captured) and excluded for fencing-off from stock access for all land uses and only those under pasture across the 16 regional authorities of New Zealand. The 25th and 75th percentiles as the lower and upper end of the box, with 10th and 90th percentiles as whiskers.

The LWAF fencing recommendation captured from 10% for SS to 16% for DRP across all landuse in Taranaki, while the pasture-specific component varied from 14% capture for SS to 20% for DRP (by difference in Figure 2). This means that 84 to 90% of contaminants across all landuses and 80 to 86% of contaminants generated in pastoral catchments were not likely captured by the fencing recommendations (Figure 2). Taranaki accounted for between 3 and 7% of the national load of contaminants (Table 4).

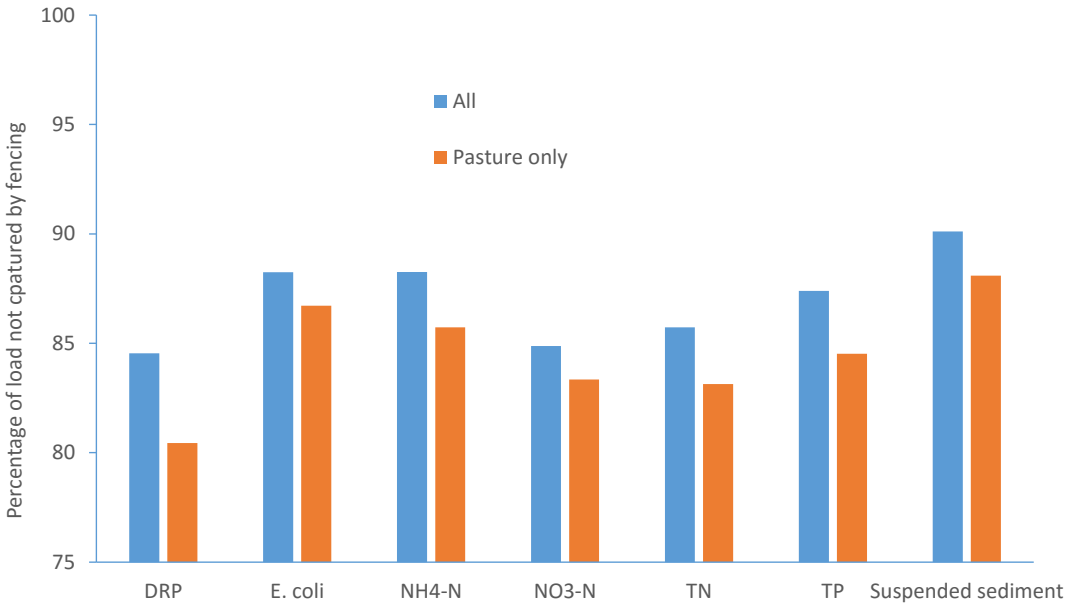

Figure 2. Percentage of contaminant load not likely to be captured by the LWAF fencing recommendation under all landuses and only in pasture-dominated catchments.

A previous stocktake of strategies to mitigate contaminant loads identified the potential for stream fencing to decrease the loads of N, P, SS and *E. coli* (McDowell et al., 2013b). A wide range of effectiveness has been recorded caused by different edaphic conditions (e.g. slopes, soil types), varying number of already-fenced streams and stream density among measurement sites. These data (range and median decreases) were applied to the load of N and P fractions and suspended sediment generated from streams and rivers in Taranaki. This is compared to the load potentially mitigated under the LAWF recommendations for all landuses and in catchments dominated by pasture (Table 4). Loads under the Taranaki recommendation, which requires all streams to be fenced irrespective of size or location, would be substantively less than those under LAWF recommendations. However, it should be recognised that the effectiveness of fencing-off stock as a strategy to mitigate contaminant loads is highly site- and contaminant-specific, ranging from highly effective in flat areas and where contaminants are particulate-associated to very ineffective in steeper areas and where contaminants are mobile (McDowell et al., 2013b).

Table 4. Contaminant loads (tonnes) as reduced by fencing according to regulation proposed by the Taranaki Regional Council and those recommended by the Land and Water Forum (Land and Water Forum, 2015).

	Taranaki load (% of NZ load)	Taranaki load	% Effectiveness of fencing[1]	Load under Taranaki recommendations	Load under LAWF recommendations (All landuses)	Load under LAWF recommendations (Pasture only)
DRP	4.7	133	52 (32-82)	64 (91-24)	122 (127-112)	120 (125-112)
E. coli[2]	6.8		38 (10-65)			
NH_4-N	4.2	129	15 (5-25)	110 (122-97)	127 (128-124)	126 (128-124)
NO_3-N	4.8	4050	10 (2-15)	3645 (3969-3443)	3989 (4038-3949)	3983 (4037-3949)
TN	4.5	5995	15 (5-25)	5095 (5695-4496)	5866 (5952-5742)	5843 (5944-5742)
TP	4.1	317	52 (32-82)	152 (215-57)	296 (304-277)	291 (301-277)
Suspended sediment	3.3	97098	35 (20-50)	63113 (77678-48549)	93735 (95176-91316)	93051 (94785-91316)

[1] Median percentage effectiveness and range (in parentheses) taken from (Hicks, 1995; Line et al., 2000; James et al., 2007; McDowell, 2007; McKergow et al., 2007; McDowell, 2008; Muirhead et al., 2011; Basher, 2013).

[2] Loads for *E. coli* are not carried through into recommendations as the percentage mitigation effectiveness relates only to median concentrations, not loads.

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Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy & Planning Committee

Subject: Stream macroinvertebrate community responses to adoption of land management mitigation practices

Approved by: G K Bedford, Director-Environment Quality

B G Chamberlain, Chief Executive

Document: 1851841

Purpose

The purpose of this memorandum is to advise the Committee of the publication of a report that evaluates the benefits for in-stream ecological health and overall water quality of various practice and management options in dairy catchments. The Waiokura Stream catchment in south Taranaki is one of the five subject catchments. The report, '*Responses of stream macroinvertebrate communities and water quality of five dairy farming streams following adoption of mitigation practices'* has been published in the *New Zealand Journal of Marine and Freshwater Research*. It is attached in full to this memorandum.

Executive summary

The Council has been a partner in a national research project, the 'best practice dairy catchments' study, since its inception in the mid 1990s. The catchments were part of a joint CRI-regional councils monitoring study of dairy catchments that sought to determine linkages between land use/farm practice and water quality, in order to derive appropriate mitigation practices and to monitor changes in water quality and stream health as these practices were adopted by farmers in each study catchment. In the Waiokura catchment, the fencing and planting of stream banks and the diversion of dairy pond effluent discharges from surface water to land were identified by farmers and researchers as key measures that should promote stream health.

In the latest report, the authors have examined the extent of the recovery of degraded stream ecosystems that have followed the implementation of improved land management practices, and the time scales over which this has occurred.

In summary, the Waiokura Stream sites are showing ongoing improvements in their macroinvertebrate index scores. Other ecological metrics show increases in the proportion of 'sensitive' species at sites within this catchment. Variations in nitrogen were significantly associated with a percentage of the variations in MCI (decreasing nitrogen led to increasing MCI scores), but the study notes that this association may be correlation (of seasonal effects

in both MCI and nitrogen) rather than causation. The report also noted that **increases** in nitrogen in the Toenepi catchment in the Waikato region led to increases in the macroinvertebrate communities, and the report concludes '*The inconsistent results found between catchments caution interpretation of the relationships between macroinvertebrate metrics (and therefore stream health) and total nitrogen as causative….changes probably reflected indirect factors associated with TN concentrations were responsible*'.

The Waiokura Stream has no upstream 'natural' site to act as a source for recolonization of downstream sites; this means that community improvements in the stream may be continue to be progressive over some extended period of time rather than occur rapidly.

The report finds '*Notably, improvements in MCI and %EPT* (ie the percentage of the most sensitive macroinvertebrate species) *were greatest at the Waiokura catchment where active planting of riparian vegetation was greatest*'. That re-confirms the critical importance of integrating planting with riparian fencing as a management tool to improve in-stream health

The analysis described in the report and within this memorandum form part of this Council's investment in research and investigations for the benefit of the development of appropriately targeted and effective policies and methods of implementation for sustainable natural resource management. The findings will support the Council in its consideration of appropriate policies and interventions that can be incorporated within the next *Regional Freshwater Plan for Taranaki.*

Recommendations

That the Taranaki Regional Council:

1. receives the memorandum *Stream macroinvertebrate community responses to adoption of land management mitigation practices*
2. receives the report '*Responses of stream macroinvertebrate communities and water quality of five dairy farming streams following adoption of mitigation practices',* (A E Wright-Stow and R J Wilcock) published in *New Zealand Journal of Marine and Freshwater Research*
3. notes the findings of the report and supports taking account of them in its consideration of policies for the revised *Freshwater Plan for Taranaki*

Background

As set out in the Council's Long-Term Plan, resource investigations and studies are a core activity for the Council. The *Resource Management Act 1991* requires the Council to make policy and decisions based on sound knowledge and information. It further requires the Council to monitor the state of the Taranaki environment and the results of the Council's policies and decisions.

Scientific knowledge is a fundamental prerequisite of effective resource management, at any scale. Environmental science is complex and challenging. Precise, accurate and comprehensive understanding of cause and effect relationships, of interventions and their outcome consequences, and the cost effectiveness of various methods of addressing environmental issues, seldom exist to a totally satisfactory level. The Council seeks to gain and maintain defensible, comprehensive, current and strategic data and information, both through targeted research and monitoring at an appropriate level and through accessing relevant studies by others. The collection and application of information and data recognises

the imperatives of the *Resource Management Act* and the scale and nature of current or potential resource issues in the region. Investigations enable the Council to develop and review effective policies that demonstrably sustain and enhance the state of the region's environment.

Such studies may be undertaken wholly by internal resourcing, or by shared collaborations, or by Council support of external investigations that might utilise the Council's very comprehensive databases, experiences and expertise across a variety of fields.

The study reported in this memo is part of the Council's suite of on-going investigative studies. The Council has partnered in research conducted within the Waiokura Stream catchment, located within the south Taranaki ringplain, since the mid 1990s. The catchment is one of five catchments across New Zealand that were selected for the 'best practice dairy catchment' project, in which researchers from NIWA, AgResearch, DairyNZ and the local regional council work together with local landowners and farmers to identify those practices that promote farming practice and economic performance while reducing or mitigating any adverse effects on the receiving environment.

Council staff selected the Waiokura catchment when approached to nominate a suitable catchment for the 'best practice' study, because it was an impacted stream with a number of factors militating against it. The Waiokura Stream is not and was never intended to be used as a stream broadly typical of Taranaki ringplain streams. The Waiokura is a lowland stream, fed by groundwater originating from beneath dairy pasture, rather than by springs fed from Mt Taranaki. The stream has been highly modified, and flows through some of the most intensively farmed pasture in the region. Dairying is a traditional land use practice in the area. Essentially, the view was that if 'best practice' could adopted and applied to make a difference in this catchment, then it could make a difference anywhere in the region.

A number of reports presenting the research on the Waiokura Stream have been provided to this Council previously, the last in February 2014. At that time it was reported that trend monitoring of water quality in the Waiokura was showing no change in total nitrogen or total phosphorus, but there were clear improvements in clarity (increasing) and *E coli* bacteria and total suspended solids (both decreasing).

There had been an increase in the length of stream bank protected by riparian works during the study period. There had also been a reduction in phosphate fertiliser application and conversion of dairy shed pond discharges from the stream to land. While nitrogen fertiliser usage and supplementary feeding had increased, nitrogen concentrations in the stream had not. It was observed that nitrogen lost per tonne of milk product (whether by leaching or by emission as nitrous oxide) had actually been reduced substantially (12% less)- ie applied nitrogen was being utilised far more efficiently.

The MCI values in the stream were indicating a good to excellent ecological community, notwithstanding that national nutrients' guideline values were exceeded. Council staff advised at the time that there were indications (although not statistically rigorously demonstrable) that MCI values within the stream were actually increasing, although the NIWA report in 2014 stated that they were not showing a trend (based on a rigorous statistical test for a 'significant' trend).

Both environmental performance and farm productivity were improving during this period, an important consideration for farmer adoption of best practices.

Discussion

The report discussed herein updates briefly the physico-chemical water quality data and trends that have been reported previously, but more particularly focuses on the stream ecologies for the five study catchments and the responses of the in-stream communities to changes in land management and water quality.

The levels of total nitrogen and nitrate nitrogen in the Waiokura Stream are both now reducing at a significant rate. Up to the time of the 2014 study, nitrogen was not showing any significant trend. That is, these trends have recently emerged, and are in spite of increased use of urea within the catchment.

There is no significant trend in dissolved or total phosphorus in the Waiokura Stream. However, both *E coli* and suspended solids are also reducing (*E coli* concentrations by an average of 85 counts per year for 12 years; suspended solids by a little under 1 gm/m^3 per year), and clarity is improving. These changes highlight the importance of an appropriate width and continuous length of selected riparian planting as a core component of water quality management intervention, over against a riparian fence along the water's edge.

MCI scores show increases at all 3 sites in the Waiokura (Figure 2 of the report). As noted earlier, to 2014 the macroinvertebrate trends could not be deemed significant, but are now emerging more definitively and are considered significant. The Waiokura Stream was the only study catchment of the five to show statistically significant trends for the various macroinvertebrate metrics (Table 7 of the report), with improvements demonstrated in MCI scores (community richness), SQMCI (community abundance), % EPT (the proportion of individuals that are very sensitive to water quality) and % grazers (the proportion of individuals that feed on organic layers of stones, and are thus very sensitive to changes in suspended solids and clarity). The report notes that reduced sedimentation is commonly associated with more sensitive macroinvertebrates; the corollary is that land and streambank management practices that reduce sedimentation will have consequent benefits for in-stream health.

The report notes a statistically significant association between nitrogen (decreasing) and MCI (improving), but notes that in the Toenepi study catchment in Waikato, **increases** in nitrogen {emphasis added) led to an improved MCI score; the report suggests that the association between MCI and nitrogen in the Waiokura is therefore likely to be an association driven by seasonal changes in both, rather than causation of one acting on the other. In discussion, the report further notes: '*The inconsistent results found between catchments caution interpretation of the relationships between macromvertebrate metrics (and therefore stream health) and TN as causative. Rather we suggest that, while TN had the strongest correlation with macroinvertebrate species composition, changes probably reflected indirect factors associated with TN concentrations were responsible.*' Councillors will recall previous advice from officers that the Council's own studies show little or no correlation between nutrient trends and macroinvertebrate health in the region.

Across all study catchments, the Waiokura Stream was showing the strongest reduction in suspended solids; and as noted it also was the only catchment showing a significant improvement in the percentage of grazing individuals; the report concludes*: 'Noteably,*

improvements in MCI and %EPT were greatest at the Waiokura catchment where active planting of riparian vegetation was greatest.'

The study shows that macroinvertebrate metrics are now showing significant improvement in the Waiokura catchment, a change from only a few years ago when the indications of improvement were not yet definite enough to be deemed significant. The report notes that this trend could continue for some decades due to the absence of a nearby source of colonisers to bring about speedy restoration to the highest potential state.

The study brings independent validation to the Council's focus on a full suite of riparian management practices as an effective and efficient means of stream health enhancement.

Decision-making considerations

Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Appendices/Attachments

Document 1850680: A.E. Wright-Stow & R.J. Wilcock (2017) *Responses of stream macroinvertebrate communities and water quality of five dairy farming streams following adoption of mitigation practices,* published in New Zealand Journal of Marine and Freshwater Research 51:1, pp127-145

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RESEARCH ARTICLE

Responses of stream macroinvertebrate communities and water quality of five dairy farming streams following adoption of mitigation practices

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ABSTRACT

Five streams in catchments with pastoral dairy farming as the dominant land use were monitored for periods up to 13 years after adoption of mitigation practices (MPs) to detect changes in stream macroinvertebrate communities and water quality. Water quality and macroinvertebrate community condition was degraded at the start with respect to N, P, suspended solids (SS), *Escherichia coli* concentrations, and a number of macroinvertebrate metrics, and were typical of catchments with intensive pastoral land use. Trend analysis showed a decrease in SS concentrations for all streams, generally increasing water clarity, and lower *E. coli* concentrations in two streams. The improvements, attributable to improved stream fencing and effluent disposal, were only sometimes associated with improved macroinvertebrate metrics, and suggest constraints of connectivity, habitat, time, and/or MP effectiveness. Macroinvertebrate species composition had the strongest correlation with total nitrogen at two sites, but changes probably reflected indirect factors associated with TN concentrations were responsible.

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Macroinvertebrates; water quality; riparian management; restoration; dairy farms; constraints; N

Introduction

Pastoral dairy farming is an intensive form of agriculture that is characterised by high levels of inputs (e.g. fertiliser, energy, livestock) into farming systems to produce more output per unit area of land (Dietrich et al. 2012). Increased profitability of dairy farming in New Zealand has resulted in a doubling of the total number of dairy cattle between 1990 and 2014. Over the same period, the total area in dairy farming grew by 70% and an intensification of pastoral land use (e.g. increased inputs of fertiliser, density of livestock units) with average dairy stocking rates rising from 2.4 to 2.9 cows per ha (Wilcock et al. 2013a; LIC 2014). A consequence of the rapid change in land-use intensity has been a lowering of surface water quality characterised by high concentrations of nutrients (N and P), sediment and faecal microbes, and poor visual clarity (Wilcock et al. 2007, 2013a; Quinn et al. 2009). Heavy grazing of the riparian areas of seeps, springs, and rivers have damaged habitats for many freshwater species through trampling, increased release of sediment, and loss of riparian canopy cover (Matthaei et al. 2006).

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Increased land-use intensification caused by dairy farming is often associated with the degradation of freshwater ecosystems resulting from: (i) increasing sedimentation and its associated effects (e.g. reduction in visual clarity, reduction in dissolved oxygen (DO) and habitat degradation within stream beds through sediment deposition) and (ii) nutrient enrichment and eutrophication symptoms (e.g. (RanÅKer et al. 2012; Wilcock et al. 2013a). The dairy industry and government agencies in New Zealand have responded to these issues over the last decade by implementing the Dairying and Clean Streams Accord in 2003 (van der Hayden et al. 2003) and Sustainable Dairying: Water Accord in 2014 (DairyNZ 2013) to exclude cows from streams, bridge or culvert regular stream crossings, and improving management of farm effluent and fertiliser application. Ten-year trends (2004–2013) indicate recent improvements in some water quality variables in pastoral land-use classes in New Zealand, possibly reflecting improved land management (Larned et al. 2016). It is, however, important to know the extent of recovery of degraded ecosystems following implementation of improved land and stream management practices specifically in dairy catchments, and the time scales over which this occurs.

Biological monitoring provides a tool for assessing an integration of multiple environmental stresses, at different temporal and spatial scales (Nichols et al. 2016). Understanding the impacts of human-induced disturbances on the health of rivers and streams has generally been derived from macroinvertebrates for a number of reasons. They are normally abundant, easy to sample and identify, relatively sedentary (cf. fish) and have a diversity of feeding habits, refuge and habitat requirements and life-cycles, and as a result exhibit a range of tolerance to changes in environmental condition (Resh 2008; Buss et al. 2014).

In this study, we examine how methods adopted by farmers to mitigate adverse effects on water quality in five monitored dairy catchments have affected stream macroinvertebrates. The catchments were part of a monitoring study of dairy catchments that sought to define linkages between land use and water quality in order to derive mitigation practices (MPs), and to monitor changes in water quality as MPs were adopted by farmers. A key finding of previous work undertaken in the same catchments has been that greater stock exclusion from river banks as a result of riparian fencing (a MP), increasing on average from about 50% to more than 80% during 2000–2013, has resulted in 10–46% (average 34%) lower average total suspended solids (TSS) concentrations and 10–235% (167%) increased visual clarity in the five streams (Wilcock et al. 2013a). The effects of sedimentation and reduced visual clarity on aquatic biota are well known (Steel & Neuhausser 2002; Bilotta & Brazier 2008), so the improvements observed in all five monitored dairy catchment streams were thought likely to produce a measurable response in macroinvertebrate assemblages of the respective streams. In this study, we seek to develop causal linkages between on-farm MPs that produced measurable improvements in water quality in the five dairy catchment streams, and associated benefits to macroinvertebrate assemblages in these streams.

Methods

Study sites

Catchments from five contrasting dairy farming areas of New Zealand (Figure 1) were selected as being representative of regional soils, rainfall and climate, topography and farming methods (Monaghan et al. 2007; Wilcock et al. 2007, 2013a). Catchment areas

ranged from 6 to 63 km^2 and mean annual discharge ranged from 220 to 590 $L\ s^{-1}$ (Wilcock et al. 2013a). Further catchment characteristics are given in Table 1. Distance to potential sources of sensitive macroinvertebrate colonists from native forest reaches such as stoneflies and mayflies were determined to be >10 km for all but one site (Inchbonnie, <1 km).

Sampling methods

Water quality and flow

Stream flows were monitored continuously using a level recorder at the outlet of each catchment, with ratings checked 8–10 times each year. Water quality sampling was

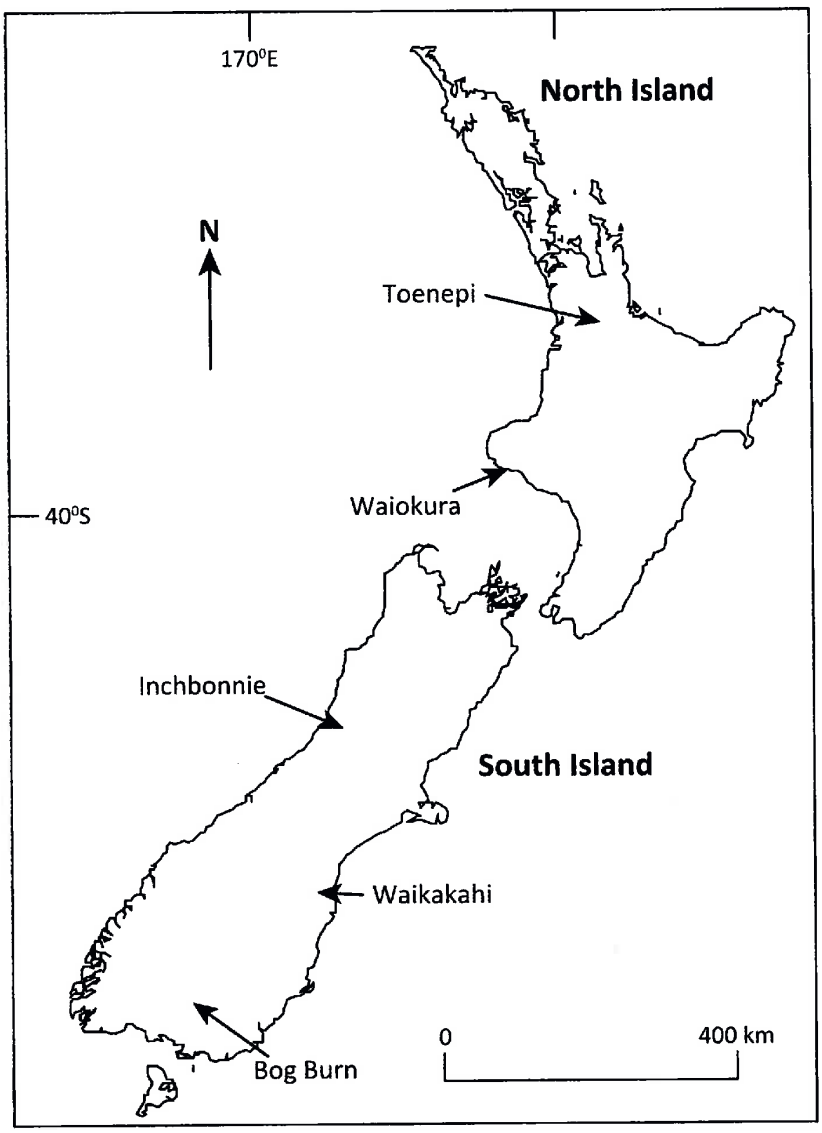

Figure 1. Map of New Zealand showing the approximate location of the five monitored dairy catchments.

Table 1. Characteristics of the five dairy catchments and streams. Mean values for 2001–2011 for Toenepi, Waiokura, Waikakahi, and Bog Burn catchments and 2004–2011 for the Inchbonnie catchment.

	Toenepi	Waiokoura	Waikakahi	Inchbonnie	Bog Burn
Catchment					
Area (ha)	1580	2090	2290[a]	598	2400
Rainfall (mm year^{-1})	1160	1250	520	4800	900
Topography[b]	Flat-rolling	Flat	Flat	Flat	Flat
Area in dairying (%)	83	99	90	100	37
Average stocking rate (cow ha^{-1})	3.0	3.4	2.8	1.9	2.8
Stream					
Flow (L s^{-1})					
Range	0–7000	70–7300	30–3700	10–2100	10–12,000
Mean	220	430	590	360	290
Median	64	360	570	95	140

[a]Approximation of the flat area that is extensively modified by drainage channels connecting with the Waitaki River. The total catchment area including non-irrigated hill slopes is 63.2 km^2.
[b]Flat = 0–7°; Rolling = 8–15°.

initially either weekly (Toenepi) or 2-weekly, and thereafter at monthly intervals (Wilcock et al. 2013b). Monthly sampling was adopted because of associated analytical and travel costs, and in some cases so they matched routine maintenance of hydrological sites. A comparison of the merits of monthly versus fortnightly water quality sampling showed that analyses were generally in agreement for dissolved constituents, but with some loss of fine detail when going to monthly total phosphorus (TP) measurements, because of some flood flows that were not included in the monthly sampling (Wilcock et al. 2013b). Stream water was analysed *in situ* for pH, temperature (°C), water clarity by black disc (m) (Davies-Colley 1988) and DO (g m^{-3} and % saturation). Samples were analysed in the laboratory using standard methods for turbidity (nephelometric turbidity units), TSS and volatile suspended solids, nitrate + nitrite N (NO_X–N), ammonium N (NH_4–N), total N (TN), filterable (0.45 μm) reactive P (FRP) and TP (Wilcock et al. 2007, 2013a). Sites in different catchments were sampled across different sampling periods and, therefore, some caution should be applied to direct comparisons between catchments.

Field study outline

Macroinvertebrate samples were taken from representative reaches at each site between 1995 and 2014. Two sampling regimes were developed to determine trends through time and state before and after MPs. Firstly, at three sites, annual (Toenepi (1995–2014)) or biannual (Waiokura (2003–2014), Waikakahi (2000–2014)) samples were collected by Regional Councils at downstream catchment locations from the beginning, or prior to, MP implementation to record long-term *trends* through time. Secondly, at four sites (excluded the Waiokura), a more detailed before-after-control-impact (BACI) sampling regime was undertaken to determine *state* with respect to pasture-control (no MPs) and native reference sites, before and after MPs. Three MP reaches were sampled within each catchment (except the Inchbonnie) at lower, mid, and upper catchment locations. The Inchbonnie was sampled at mid-catchment only. Pasture-control sites (lacking MPs) were sampled in adjacent catchments at matched lower, mid, and upper locations in the Waikakahi, Inchbonnie, and Bog Burn catchments. Reference sites were sampled (where available) in the Inchbonnie and Bog Burn catchments at mid and

Table 2. Change in adoption of MPs and fertiliser use in the five dairy catchments.

Catchment, year	Effluent management (%)		Stream fencing (%)	Average fertiliser use (kg ha^{-1} year^{-1})	
	Land irrigation	Discharge to stream		*N*	*P*
Toenepi, 1995, 2001, 2008	5, 14, c. 75	95, 86, c. 25	46, 50, >80	65, 77, 120	78, 60, 37
Waiokura, 2001, 2008	44, 53	56, 47	42, >80	87, 151	65, 41
Waikakahi, 1995, 2001, 2008	100, 100, 100	0, 0, 0	ND, 18, 96	ND, 172, 177	ND, 60, 34
Bog Burn, 2001, 2008	100, 100	0, 0	40, >80	71, 97	67, 30
Inchbonnie, 2004, 2008	60, 100	40, 0	40, >80	178, 103	50, 37

Abbreviation: ND, not determined.

upper locations, respectively. BACI samples were collected in summer in 2001 and 2011 at Waikakahi and Bog Burn sites, in 2005 and 2011 at Inchbonnie, and 1995 and 2005 in Toenepi.

Mitigation practices

Table 2 lists changes in MP adoption within each catchment that were detected in farm surveys undertaken in 1995, 2001, 2004, and 2008 and Table 3 lists the MPs adopted. Some MPs were common among catchments (e.g. stream fencing, nutrient management) while others (e.g. irrigation efficiency, effluent treatment) were more site-specific.

Macroinvertebrate sampling

To allow for direct comparison of samples collected from both sampling regimes, benthic macroinvertebrates were collected following the same State of the Environment sampling protocols undertaken by each Regional Council within their respective region (Table 4). For the BACI sampling regime, replicate ($n = 2–5$) samples were collected at each catchment location. For all sites, a kick-net sampling technique was used to collect macroinvertebrates from an area not more than 0.5 m upstream of the net. Total study reach length, area sampled and flow type (riffle/run, hard- or soft-bottomed) differed between stream types and regions (Table 4).

All samples were preserved prior to identification using the keys listed in Quinn and Hickey (1990). Macroinvertebrates were identified using a binocular microscope (10–50x magnification) to at least the resolution needed to produce Macroinvertebrate Community Index (MCI) scores (Stark 1985). Identification was generally to genus, but only to tribe for Eriopterini and Tanytarsini; subfamily for Orthocladiinae, Tanypodinae, and Acarina; family for Elmidae, Hydrophilidae, Chironomidae, Culcidae, Empidadae, and

Table 3. MPs adopted within each catchment.

Site	MPs
Toenepi	Irrigation of farm dairy effluent (FDE), riparian fencing or planting, and improved grazing management, including the use of standoff pads
Waiokura	Irrigation of FDE, riparian fencing, or planting
Inchbonnie	Riparian fencing, diverting laneway runoff from streams to pasture, laneway bridges, or culverts across streams and improved effluent irrigation (lower rates and increased size of irrigation areas)
Waikakahi	Better irrigation management (including using low earth-barriers (bunds) to reduce surface runoff to streams), upgraded irrigation infrastructure to spray technology, and riparian fencing and planting
Bog Burn	FDE storage during wet conditions, low application-rate FDE irrigation, use of herd shelters or off-site grazing in winter, reducing P fertiliser use to maintain soil Olsen P test levels in their optimum range and riparian planting and livestock exclusion

Table 4. Comparison of macroinvertebrate sampling techniques, processing methods, and collection of samples at each of the five dairy catchments.

	Toenepi	Waiokura	Waikakahi	Bog Burn	Inchbonnie
Invertebrate sampling technique	Kick-net, composite	Kick-net, composite	3-minute kick-net, composite	Kick-net, composite	Kick-net, composite
Mesh size (μm)	500	500	500	500	500
Habitats sampled	Aquatic vegetation and submerged wood (soft-bottomed)	Riffle	Run	Riffle/run	Run
Study reach length (m)	100	<50	100	50	50
Max. distance upstream of kick-net sampled (m)	0.5	0.5	0.5	0.5	0.5
Area, volume or time period sampled	0.6–1.0 m^2	400 ml volume	3 runs, 3 min per run	0.6–1.0 m^2	3 runs, 3 min per run
Invertebrate processing	200 fixed count + scan for rare taxa	Full count coded abundance	100 fixed count + scan for rare taxa	200 fixed count + scan for rare taxa	Full count coded abundance
SoE sampling period and frequency	Dec–Mar, 1999–2014 (annually)	Feb and Oct–Nov, 2007–2014 (biannually)	Nov–Dec and Jan–Feb, 1999–2014 (biannually)	BACI only	BACI only
BACI sampling years	1995 and 2005	SoE only	2001 and 2011	2001 and 2011	2005 and 2011

Abbreviations: SoE, state of the environment; BACI, before-after-control-impact.

Muscidae; and phylum for Platyhelminthes. Unidentified macroinvertebrates were excluded from analysis.

Five different invertebrate indices were calculated from the data. These related to diversity and community composition, and biotic index interpretation (see Table 5 for rationale

Table 5. Descriptions and rationale for the macroinvertebrate indices.

Macroinvertebrate index	Description	Rationale
MCI and QMCI or SQMCI	The MCI and its QMCI and SQMCI variants were developed to assess organic pollution. They combine taxonomic richness (and abundance or relative abundance; QMCI and SQMCI) with the known pollution tolerance of individual taxa into a single score	These metrics produce indices that were selected for their ability to respond to a complex of environmental factors including, but not limited to, water quality (Stark 1985)
%EPT	The proportion of total individuals that are EPT	%EPT has been found to be very sensitive to changes in water quality and less variable than total taxa richness in relation to between-year changes in flow (Lenat & Barbour 1994)
Taxa richness	The number of taxa identified in a sample	Useful for measuring macroinvertebrate responses to changes in habitat conditions (Collier et al. 1998). Maintaining invertebrate biodiversity within waterways also provides many ecosystem services
% grazers	The proportion of total individuals that belong to grazing functional feeding groups (following the classification of Cowie 1980), that is, taxa that feed on the organic layers of stones in New Zealand streams	To test whether observed decreases in TSS levels and increases in water clarity following MPs had improved quality of food resource for invertebrates that graze organic films on submerged surfaces

for each index). Indices of diversity included taxa richness and the proportions (by number) that were Ephemeroptera, Plecoptera, and Trichoptera (%EPT). Biotic indices included the MCI and Quantitative or Semi-Quantitative MCI (QMCI/SQMCI). Additional invertebrate indices included the proportions of taxa whose predominant feeding mode was grazing organic layers off substrate (grazers) (Table 5). The indices were selected to define stream state and changes through time in response to MPs.

Data analysis

Water quality data were analysed using non-parametric statistics to show central tendency (median) and dispersion (interquartile range) for non-normally distributed data. Trend analyses were computed using the Seasonal Kendall test on suspended solids (SS), TN, TP, and *Escherichia coli* concentrations with LOWESS smoothing (Hirsch & Slack 1984) at monthly intervals for each data set, standardised to the period over which invertebrate samples were taken (c.f. Wilcock et al. 2013b). Where appropriate, data were flow-adjusted to normalise differences among data collected during different hydrological conditions (Helsel & Hirsch 1992; Wilcock et al. 2013a). Non-parametric statistics were used for water quality analysis because of highly skewed data sets for variables such as SS, TP, and *E. coli* (Helsel 1987).

Trend analyses were computed using the Seasonal Kendall test on the macroinvertebrate indices calculated for the three sites with long-term monitoring. Differences in macroinvertebrate indices between the land-use groups were examined for each site individually across both before and 6–10 years after MP implementation (BACI) using generalised linear mixed effect models with Tukey's pairwise comparisons. *T*-tests were used to test for differences between before and after MP implementation where no reference or pasture-controls sites were available (Toenepi). Regions were treated individually to account for differences in sampling regime, time of collection, and regional site characteristics. Samples from upper-, mid-, and lower-catchment locations were treated as levels of replication for the BACI testing to provide a whole-catchment condition and increase statistical testing power.

Distance-based linear models (DISTLM, Anderson et al. 2008) was used to test for relationships between the macroinvertebrate species composition (for sites with annual or biannual sample collection) and water quality variables taken from the nearest date to macroinvertebrate sampling (average separation = 7 days, range = 0–15 days). DISTLMs make no particular assumptions regarding the distributions of the original data, as *P*-values are obtained by 9999 permutations. Because DISTLM generates *P*-values through a permutation procedure, it avoids assumptions of parametric statistical procedures, such as normality and independence of residuals. The linear model was constructed using forward selection of environmental variables with results being presented with distance-based redundancy analysis (dbRDA) ordination. To visualise the relationship between macroinvertebrate species composition and the water quality variables, a dbRDA was plotted. Only environmental variables that contributed significantly ($P < .05$) to the relationship with macroinvertebrate data in the DISTLMs were plotted in the dbRDA.

Univariate analyses were conducted using DataDesk (Velleman 1997) or the Time Trends analysis (Jowett 2008) package (Version 3.0) while multivariate analyses were performed using R (Version 3.0; R Development Core Team 2013) or PRIMER V.6 (Clarke &

Warwick 2001) with the additional add-on package PERMANOVA+ used to produce the DISTLM models and dbRDA plots. Data were tested for normality through normal probability plots in DataDesk. For all statistical tests, P-values < .05 were considered significant.

Results

Water chemistry and macroinvertebrate temporal trends

Statistically significant changes ($P \leq .05$) in water quality following the adoption of MP for the five dairy catchment streams may be summarised as follows: (i) inconsistent change was observed in TN concentrations, (ii) little change was observed in total P concentration, (iii) SS concentrations trended downward in all five streams, (iv) black disc visual clarity trended up in four streams but no change in the fifth, and (v) *E. coli* concentrations declined in two of the five streams and increased at one, with the other two streams showing no change (Wilcock et al. 2007, 2013a) (Table 6). Close inspection of the data indicates that other than ongoing declines in *E. coli* concentrations in the Waiokura Stream and increasing TN and NO_X–N in Bog Burn, water quality variables have remained steady since 2008.

Few consistent temporal trends were noted for most macroinvertebrate metrics calculated across sites with long-term annual or biannual monitoring after adoption of MPs (Table 6). Increases through time ($P < .05$) were observed at only 6 of 35 possible catchment/site/metric combinations. Examples of change in MCI score through time are given in Figure 2. The positive relationships across multiple metrics at the upper Waiokura site suggests increases in the proportion of sensitive species through time following MP implementation.

A comparison of macroinvertebrate indices calculated from samples collected at MP sites before and after land-use mitigation, and in relation to pasture-control and reference sites (where available), showed some improvements at MP sites through time (Figure 3). At the Inchbonnie MP site, QMCI and %EPT scores improved through time and relative to pasture-control and reference sites sampled at the same time. No reference or pasture-control sites were available at the Toenepi sites, however, significant improvements were observed for four metrics after MPs despite generally poor conditions remaining. Only one metric (taxa richness) improved after MP implementation at the Bog Burn MP site, but was not significantly different than either the reference or pasture-control sites following the mitigations (Figure 3). At the Waikakahi, the MP sites generally showed healthier conditions relative to the pasture-control streams both before and after MP implementation. No statistical change was observed through time for any of the metrics calculated in the Waikakahi ($P > .05$).

Macroinvertebrate responses to MPs and water chemistry at sites with annual or biannual monitoring

The water quality parameters measured accounted for between 51% and 61% of the total variation in the species-derived macroinvertebrate data for sites with long-term annual or biannual invertebrate monitoring (Table 7). At the Toenepi site, none of the water quality parameters individually accounted for significant ($P > .05$) amounts of the variability

Table 6. Summary of water quality trends in the five dairy streams.

Catchment	Date (switch to monthly sampling)	TN	NO_X–N	FRP	TP	*E. coli*	SS	Black disc
Toenepi	1995–2013 (1998)	NST 0.01, 0.51,	NST 0.01, 0.21	NST 0.00, 0.01	NST 0.00, 0.88	NST −6.44, 0.12	↓ −0.21, 0.02	↑ 0.05, 0.03
Waiokura	2001–2013 (2002)	↓ −0.02, 0.02	↓ −0.02, 0.03	NST 0.00, 0.01	NST 0.00, 0.01	↓ −85, 0.01	↓ −0.89, 0.01	↑ 0.03, 0.01
Waikakahi	1994–2013 (1996)	↑ 0.06, 0.01	↑ 0.07, 0.00	NST 0.00, 0.53	NST 0.00, 0.20	↓ −12, 0.02	↓ −0.61, 0.01	↑ 0.04, 0.01
Bog Burn	2001–2013 (2002)	↑ 0.04, 0.01	↑ 0.04, 0.00	NST 0.00, 0.01	NST 0.00, 0.12	↑ 44, 0.02	↓ −0.28, 0.01	NST 0.01, 0.70
Inchbonnie	2004–2011 (2006)	↓ −0.08, 0.00	↓ −0.02, 0.03	↓ −0.01, 0.00	↓ −0.01, 0.00	NST −21, 0.00	↓ −0.42, 0.00	↑ 0.11, 0.00

Notes: Arrows indicate significant ($P < .05$) upward or downward trends over the entire sampling duration. NST is either no significant trend or a zero-trend slope. Dates in parentheses show the year that sampling reduced from weekly (Toenepi) or fortnightly, to monthly. $n = 105–320$. Each column gives the median annual Sen slope (*Sk*) and the *P*-value (adjusted for serial correlation if datasets are longer than 10 years). Units for *Sk* are g m^{-3} $year^{-1}$ for TN, TP and SS; m $year^{-1}$ for black disc water clarity and MPN (100 ml)$^{-1}$ $year^{-1}$ for *E. coli*. Meaningful trends are shown with arrows.

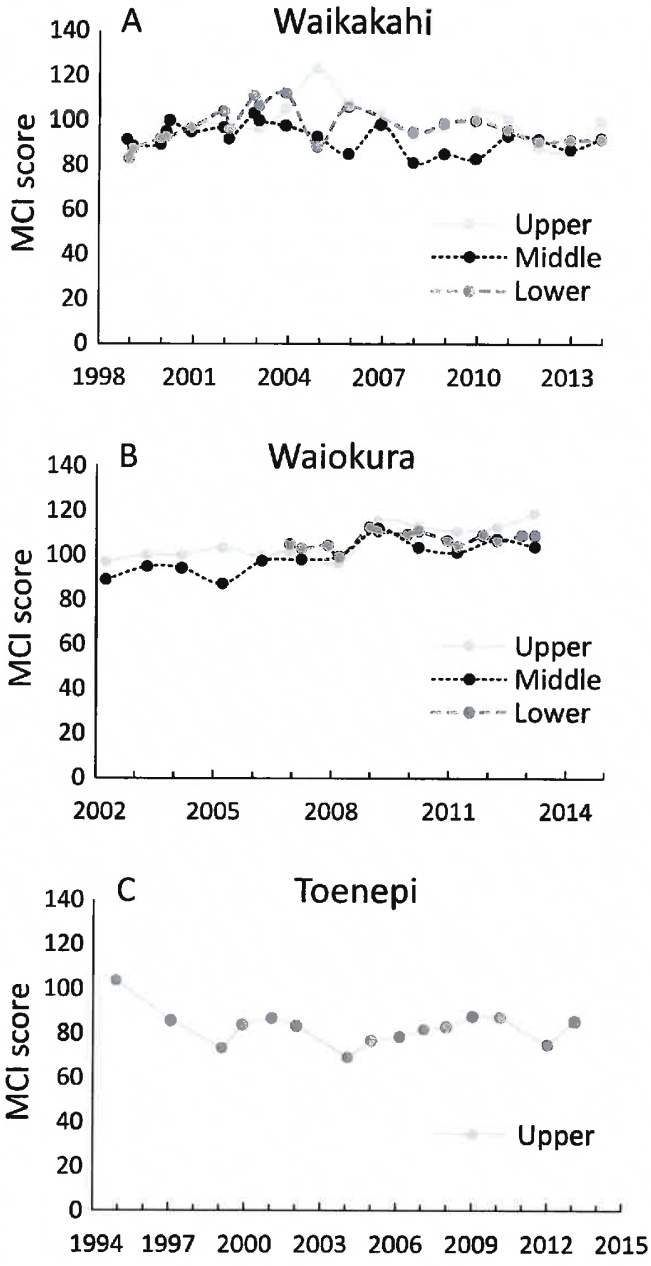

Figure 2. Changes in MCI score at sites with long-term annual or biannual macroinvertebrate sampling.

(Table 7). However, TN concentrations accounted for 19% and 12% of the variation at the Waiokura and Waikakahi sites ($P < .05$, Table 8). Individually, NO_X–N concentration also accounted for significant amounts of variation in the macroinvertebrate species composition at the Waiokura site (Table 8). At the Waikakahi site, changes to species composition through time were generally associated with increases in TN (Figure 3). At the Waiokura site, macroinvertebrate community structural changes were associated most

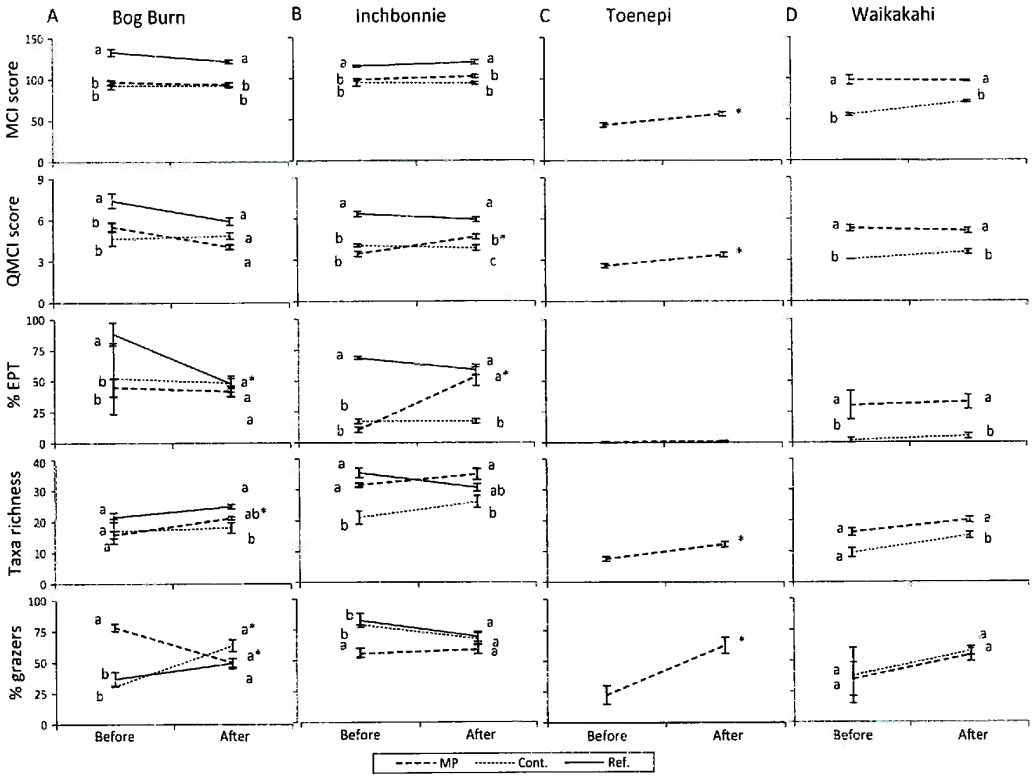

Figure 3. Mean (±SEM) values for MCI, QMCI, %EPT individuals, TR, and % grazers before and after MP implementation for the three land-use types (MP, pasture-control, native reference) at the four catchments where BACI sampling took place. BACI samples were collected in summers of 2001 ($n = 6$) and 2011 ($n = 12$) at Waikakahi, 2001 ($n = 6$) and 2011 ($n = 15$) at Bog Burn, in 2005 ($n = 4$) and 2011 ($n = 4$) at Inchbonnie, and 1995 ($n = 14$) and 2005 ($n = 12$) in Toenepi. Points with different letters, or an * adjacent to the 'after' letter indicate significant differences between land-use groups, and between before and 6–10 years after MP implementation, respectively (Tukey's $P < .05$).

strongly by changes in TN and NO_X–N concentrations. However, this association appeared to be related to seasonal timing of sample collection, rather than time since MPs (left to right separation in ordination space): TN and NO_X–N were generally lower in February than October/November regardless of time since MP implementation (Figure 4).

Discussion

We were able to determine water quality and macroinvertebrate responses 7–13 years after adoption of MPs in dairy catchment streams. Stream water quality was degraded at the beginning of monitoring for most water quality variables, and macroinvertebrate diversity and sensitivity metrics were low, reflecting catchments with intensive pastoral agriculture land use. Trend analysis over the monitoring period showed decreases in SS for all streams, generally increasing water clarity, and decreases in *E. coli* concentrations in two streams. N concentrations decreased at two sites and increased at two. Little change was observed in P concentrations, or macroinvertebrate metrics at most sites. However, macroinvertebrate

Table 7. Summary of macroinvertebrate metric trends in the dairy streams with long-term annual or biannual monitoring (Waikakahi ($n = 14–21$), Waiokura ($n = 12–14$), Toenepi ($n = 15$)).

Catchment (location)	Date	MCI	(S)QMCI	%EPT	Taxa richness	% grazers
Waikakahi (upper)	2001–2014	NST −0.87, 0.22	NST 0.02, 0.58	NST 0.19, 0.5	NST 0.5, 0.3	NST 1.17, 0.43
Waikakahi (middle)	2000–2014	NST −0.43, 0.61	NST 0.01, 0.87	NST 0.53, 0.31	NST 0.77, 0.09	NST 0.64, 0.61
Waikakahi (lower)	2000–2014	NST −0.76, 0.29	NST 0.08, 0.34	NST 1.78, 0.39	NST 0.31, 0.33	NST 0.53, 0.63
Waiokura (upper)	2003–2014	↑ 1.82, 0.02	↑ 0.1, 0.04	↑ 1.23, 0.04	NST 0.17, 0.64	NST 1.21, 0.09
Waiokura (middle)	2003–2014	↑ 1.44, 0.01	NST 0.03, 0.73	NST 0, 0.95	NST −0.1, 0.94	↑ 5.57, 0.01
Waiokura (lower)	2007–2013	NST 0.8, 0.58	NST 0.3, 0.58	NST −1.57, 0.78	NST 1.36, 0.89	NST −0.06, 0.58
Toenepi (upper)	1995–2014	NST −0.12, 0.84	NST 0.01, 0.49	NST −0.32, 0.23	↑ 0.66, 0.01	NST 1.92, 0.11

Abbreviations: MCI, Macroinvertebrate Community Index; (S)QMCI, (Semi) Quantitative Macroinvertebrate Community Index, %EPT, the proportion of total individuals that are Ephemeroptera, Plecoptera or Trichoptera (EPT) (excluding *Oxyethira albiceps*); % grazers is the proportion of total abundance from the grazing functional feeding group.

Notes: Arrows indicate significant ($P < .05$) upward or downward trends over the entire sampling duration. NST is either no significant trend or a zero-trend slope. Each column gives the median annual Sen slope (*Sk*) and the *P*-value. Meaningful trends are shown with arrows.

community improvements were apparent relative to pasture-control sites and pre-adoption of MPs at some locations, and at two of the streams with long-term monitoring variability in macroinvertebrate community composition was associated with TN concentrations.

Table 8. Relationship between macroinvertebrate species composition based on the Nonmetric Multidimensional Scaling Bray Curtis similarity matrix distance measure and measured water quality variables analysed with an individual selection procedure using DISTLM, for each of the three catchments where water quality and macroinvertebrate samples were collected from the same site ($n = 11–18$).

Site (total variation explained by all variables)	Variable	R^2	SS(trace)	Pseudo-*F*	*P*
Toenepi (51)	NO_X–N	0.08	1898.4	1.36	.201
	Log *E. coli*	0.07	1659.2	1.18	.287
	TP	0.06	1434.6	1.01	.388
	Black disk	0.05	1219.8	0.85	.573
	TN	0.05	1177.3	0.82	.555
	FRP	0.04	1086	0.75	.609
	SS	0.02	483.4	0.33	.977
Waikakahi (53)	**TN**	0.12	1716.4	2.10	**.0435**
	NO_X–N	0.09	1368.2	1.63	.1156
	FRP	0.09	1363.5	1.62	.1173
	TSS	0.09	1294.9	1.53	.1432
	TP	0.08	1209.9	1.42	.177
	Turb.	0.07	1048.8	1.22	.2725
	Log *E. coli*	0.04	648.49	0.73	.6728
Waiokura (61)	**TN**	0.19	1387.5	2.85	**.012**
	NO_X–N	0.18	1275.1	2.57	**.020**
	E. coli	0.07	511.8	0.91	.576
	Black disc	0.06	417.5	0.73	.677
	FRP	0.05	328.04	0.57	.841
	SS	0.04	320.87	0.56	.847
	TP	0.04	283.48	0.49	.901

Note: *P*-values were obtained by permutations of residuals (9999) under a reduced model technique (Freedman & Lane 1983).

$P < .05$ shown in bold.

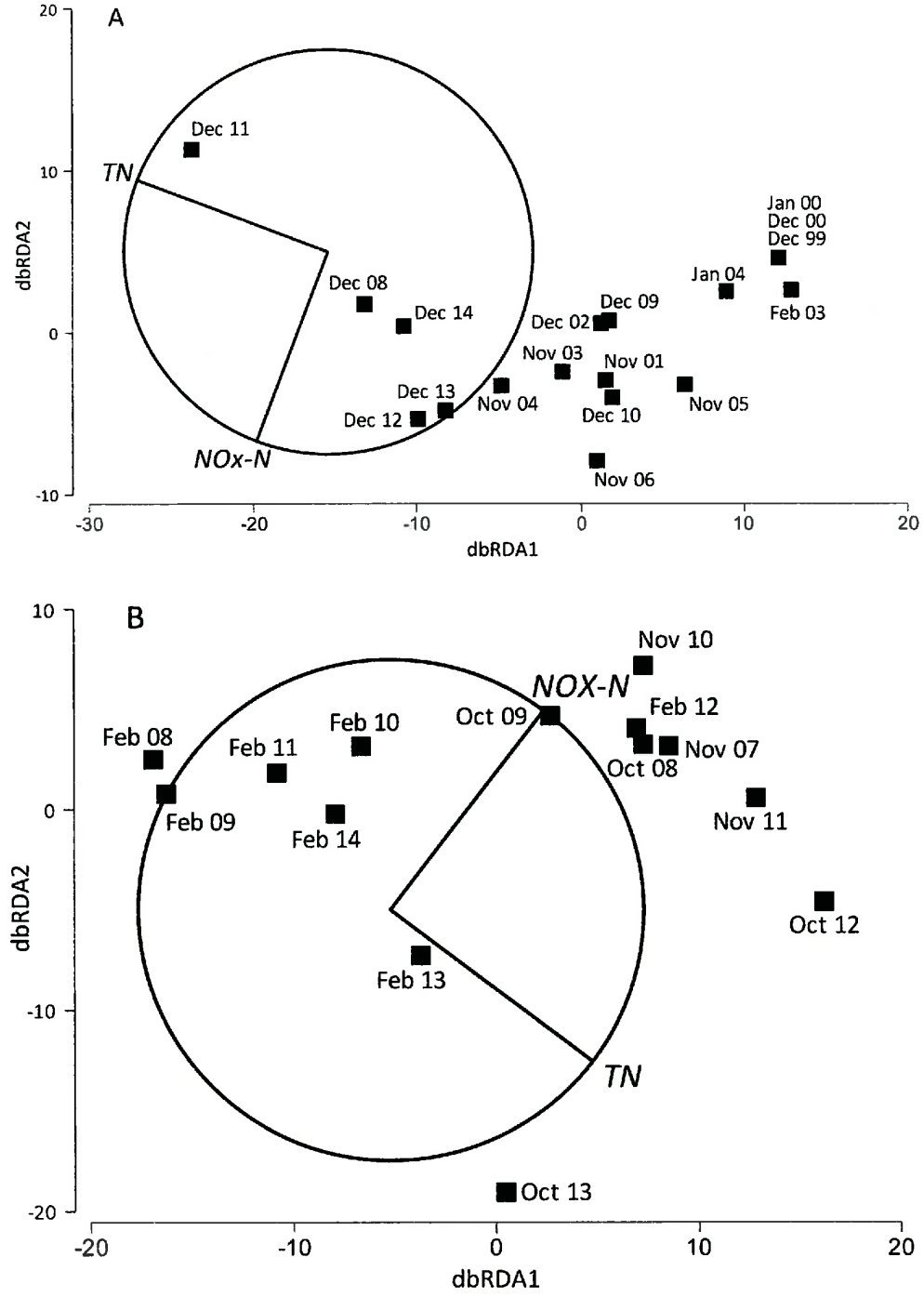

Figure 4. Relationship between measured water quality parameters and changes in macroinvertebrate community composition from sites where annual or biannual samples were taken at (a) Waikakahi (n = 18) and (b) Waiokura (n = 14). Plots represent a dbRDA ordination of macroinvertebrate composition data generated from a Manhattan distance matrix with individual water quality variables considered alone and ignoring all other variables. Only water quality parameters that explained a significant amount of variation in the macroinvertebrate data ($P < .05$) are plotted as vectors. No significant relationships were observed at the Toenepi site. For visualisation, water quality variables were correlated with the dbRDA plot using multiple partial correlations. The strength of correlation is indicated by the length of the blue lines for the respective variable, with the radius of the blue circle representing 100% correlation. The axes plotted (x and y) account for 14.6% and 28% of the fitted variation explained by all variables plotted as vectors at the Waikakahi and Waiokura sites, respectively.

Water quality

Water quality in all five catchments stabilised after initial reductions in TSS and associated variables (namely, clarity and faecal indicator bacteria) associated with major increases in streambank fencing and reductions in point-source input of pollutants. Nutrient (N and P) inputs continued largely unabated at some sites because of the high hydraulic loading and connectivity in dairy catchments and the concomitant nutrient runoff (Wilcock et al. 2013a). The comparative instability of pasture stream banks relative to forest streams means that inputs of stored sediment may continue even when stock have been excluded (Davies-Colley 1997). Although water quality in the five dairy streams improved somewhat when simple changes in farm management were made, there is still more that needs to be done for the dairy catchment streams to comply with guidelines for slightly disturbed lowland river ecosystems or contact recreation (Wilcock et al. 2013a). Furthermore, intermittent gross disturbances (e.g. channel clearance) in farmed catchments may periodically cause stream habitat degradation, despite implementation of on-farm mitigation measures.

Invertebrate communities

Land-use changes from native forest to pasture have had marked influences on macroinvertebrate communities throughout New Zealand (Quinn & Hickey 1990; Quinn et al. 1997). The neutral ecological responses to MP application in many cases in our study are consistent with other studies that found generally longer lag response times following MPs for benthic macroinvertebrates than water quality (Parkyn et al. 2003; Meals et al. 2010). Few studies have examined the timescales required for macroinvertebrates to recover following land-use mitigation. Quinn et al. (2009) and Jowett et al. (2009) found significant improvements in MCI scores 6–8 years after riparian fencing and planting in small hill-country agricultural streams, where colonist sources existed upstream or in adjacent catchments. However, Parkyn et al. (2003) found that QMCI scores improved in only three of nine streams with riparian buffers between 8 and 24 years old, and Leps et al. (2016) found few macroinvertebrate responses to riparian restoration projects. Parkyn et al. (2010) speculate recovery of MCI scores to reach 'clean water' levels could take around 30 years, considerably longer than observed at these dairy sites.

One of the principles for restoration is that the re-establishment of historical abiotic conditions will result in the recovery of the biological communities present before degradation. However, changes in landscape conditions, catchment connectivity, and resulting new biotic interactions can cause lasting changes (Bouleau & Pont 2015). It is likely that a century of pastoral land use in the dairy catchments has left a legacy of lasting impacts on the stream communities. Habitat and dispersal constraints are the focus of much research in stream ecology (Parkyn & Smith 2011) and other studies have found that decadal time scales are simply not long for recovery following >100 years degradation (Parkyn et al. 2003). Both habitat and dispersal constraints are likely to have affected the recovery of macroinvertebrates at the MP sites. Generally, there is evidence that recolonisation of sensitive taxa cannot occur quickly if the distance between source populations of 'sensitive' species is greater than a few kilometres (Sundermann et al. 2011; Tonkin et al. 2014). Apart from the Inchbonnie Stream, all MP sites were >10 km from likely sources of

sensitive macroinvertebrate colonists and our findings showed colonisers at these sites were more similar to pasture-control sites than reference sites, suggesting they mainly stemmed from degraded conditions that lacked sensitive colonists. However, the Inchbonnie site was located <1 km from native forest and increases in sensitive species (QMCI, % EPT) following MP implementation at this site suggests proximity to clean water taxa was likely contributing intolerant taxa. Wood and leaf retention are also important for restoring diversity of habitat and food resources that encourages the recolonisation of macroinvertebrates, particularly in locations lacking coarse substrate and habitat diversity (Lester et al. 2007; Parkyn et al. 2009). However, the maturation of riparian vegetation and the addition of dead wood and leaf litter requires much longer periods of time than has past at these sites (Davies-Colley et al. 2009). Noteably, improvements in MCI and % EPT were greatest at the Waiokura catchment where active planting of riparian vegetation was greatest.

Based on previous findings, we hypothesised that the reduction in SS over time observed at all sites would increase the relative abundance of grazers by improving quality of food (i.e. reducing periphyton sediment content) for this functional feeding group (Broekhuizen et al. 2001). However, increases in grazers were only observed at two sites, and on the Bog Burn, declines were observed at the MP site despite increases at the pasture-control site. The inconsistent lack of associated improvement may reflect a lack of improvement in food quality, or simply that grazers were impacted by a range of other stressors. Indeed, a combination of multiple stressors is likely to be more important than any one factor in isolation in influencing species composition (Matthaei et al. 2010).

Nevertheless, significant macroinvertebrate improvements following MP implementation were observed for some metrics at some sites, particularly the Inchbonnie, Toenepi, and Waiokura dairy streams. Frequent high flows at the Inchbonnie may help increase the speed at which this site responds to MPs. With 4–5 m of rainfall per year (McDowell 2008), and surrounding paddocks re-shaped into humps and hollows for good drainage, flows capable of flushing instream sediment are expected to be common. Reduced sedimentation are commonly associated with more sensitive macroinvertebrates (Jowett 2003; Greenwood et al. 2012). In the Toenepi catchment, four of the five calculated metrics improved following MPs implementation. These improvements on very poor conditions resulted in better, but still moderately degraded, conditions following MPs and suggest still more needs to be done to improve and protect the stream from surrounding land-use pressures.

Variation in macroinvertebrate composition attributable to water quality parameters

Using DISTLM, we were able to estimate the variation in macroinvertebrate community composition attributable to a number of water quality variables at sites with long-term macroinvertebrate monitoring. Of the descriptor variables used in this study, TN had the strongest association with macroinvertebrate species composition. While not reported here, NO_3–N concentrations recorded from the MP sites in this study (medians < 3 g m^{-3}; Wilcock et al. 2013a) were all below levels found to be toxic for most freshwater

macroinvertebrates (Camargo et al. 2005; Hickey & Martin 2009). This implies that non-lethal factors associated with TN concentration were affecting species composition at those sites.

At the Waiokura, changes in species composition associated with TN, corresponded with overall decreasing TN concentrations, and increasing MCI, SQMCI, and %EPT metrics through time. Similarly, stream macroinvertebrate metrics were found to increase along with NO_X concentrations following application of integrated catchment management to Waikato hill catchments (Hughes & Quinn 2014). Hughes and Quinn (2014) postulated that the increase in NO_X was driven in part by reduced instream uptake of N due to increased shading that reduced stream temperatures and instream plants biomass (Quinn et al. 2009). In the absence of shade, increases to the availability of nitrogen can increase the abundance of primary producers and through impacts on DO, pH, and benthic habitat, affect macroinvertebrate communities (Collier et al. 1998; Wilcock et al. 1999). The inconsistent results found between catchments caution interpretation of the relationships between macroinvertebrate metrics (and therefore stream health) and TN as causative. Rather we suggest that, while TN had the strongest correlation with macroinvertebrate species composition, changes probably reflected indirect factors associated with TN concentrations were responsible.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy and Planning Committee

Subject: Submission on Clean Water consultation document

Approved by: A D McLay, Director – Resource Management

B G Chamberlain, Chief Executive

Document: 1849889

Purpose

The purpose of this memorandum is to introduce a submission made to the Ministry for the Environment on their *Clean Water* consultation document and to recommend its endorsement by the Council.

A copy of the submission is attached to this memorandum.

Submissions closed on Friday 28 April 2017. A draft submission was circulated to Members for comment prior to the closing date.

Executive summary

The Government has released its latest proposals for reform of freshwater management in its consultation document *Clean Water 90% of rivers and lakes swimmable by 2040*, and is seeking public feedback on the proposals.

Members received a briefing on the proposals at the last meeting of the Committee on 14 March 2017.

The major new announcement is the proposal to have a Government target of 90% of rivers and lakes meeting swimmable water quality standards by 2040. The target applies to rivers that are deep enough to swim in (nominally more than 0.4 metres deep) and to lakes with perimeters longer than 1,500 metres. The total length of rivers and lakes covered by the target is 54,000 kilometres.

Other proposals contained in the consultation document concern web-based swimmability maps that are intended to help communities make decisions about improving water quality in local rivers and lakes. Changes to the *National Policy Statement for Freshwater Management* (NPS-FM) are also proposed that will require councils to implement the changes while changes to proposed compulsory national stock exclusion regulations will apply (in stages) to all livestock on all classes of land across New Zealand. The extension to the Freshwater

Improvement Fund of $100 million comes with eligibility criteria that will apply for the next 10 years.

The submission raises the need for a clear problem definition on swimmable rivers and lakes before changes are made to the NPS-FM. The submission raises a number of other issues in relation to the swimmability targets contained in the consultation document, including the inappropriate or misleading use of data.

The Council has also raised in its submission, a number of concerns with proposed amendments to the NPS-FM and the proposed national regulations for stock exclusion from waterways, including economic impacts which are likely to be significant.

Recommendations

That the Taranaki Regional Council:

1. receives the memorandum *Submission on clean water consultation document*
2. endorses the submission.

Background

The Government has released its latest proposals for reform of freshwater management in its consultation document *Clean Water 90% of rivers and lakes swimmable by 2040*, and is seeking public feedback on the proposals.

Members will recall receiving a briefing on and discussing the proposals at the last meeting of the Committee held on 14 March 2017. This followed release of the consultation document in late February 2017. Staff noted at that time that a detailed analysis of the document had not been undertaken but that this would be done in putting together a submission.

Some of the proposals have been consulted on before and following public submissions have again been put forward for consultation with amendments.

The major new announcement is the Government's intention to have 90% of rivers and lakes meeting swimmable water quality standards by 2040. The target applies to rivers that are deep enough to swim in (more than 0.4 metres deep) and lakes with perimeters longer than 1,500 metres. The total length of rivers and lakes covered by the target is 54,000 kilometres.

The Minister for the Environment has estimated that it will cost the Government, farmers and councils $2 billion over the next 23 years to achieve the target. This figure has been derived based on the estimated cost of riparian fencing along 'swimmable' rivers and lakes.

Other proposals contained in the consultation document concern web-based swimmability maps that will help communities make decisions about improving water quality in local rivers and lakes. Changes to the *National Policy Statement for Freshwater Management* (NPS-FM) are also proposed that will require councils to implement the changes while changes to proposed compulsory national stock exclusion regulations will apply (in stages) to all livestock on all classes of land across New Zealand.

The submission

The submission raises a number of issues in relation to the swimmability targets contained in the consultation document. Many of the points raised relate to what are considered inappropriate or misleading use of data in which swimmability in New Zealand's rivers and lakes is assessed.

The first matter raised concerns the need for a clear definition of the problem, supported by robust evidence. No evidence is provided in the consultation document on the extent of illness as a result of swimming in waterbodies with elevated *E.coli* levels. An inquiry is recommended that would provide the appropriate evidence base for an informed response. Certainly, in Taranaki, the Council is not aware of any evidence that illness or death can be directly attributable to elevated *E.coli* levels while swimming.

The submission also responds to a letter sent to regional councils from the Minister for the Environment requiring all councils to advise how the Government's national swimmability target can be supported at the regional level. The Minister has imposed a deadline for a draft report to be prepared by October 2017 with a final report by March 2017.

The Council considers that these deadlines do not provide sufficient time for the Council to undertake the necessary research, analysis of costs and benefits as well as consultation with its community regarding the development of regional water quality targets that properly reflect local community aspirations. The Council has suggested more realistic targets that enable thorough technical work to be done and meaningful consultation with the community to be completed in developing sound policy responses.

The submission notes that the redrafted NPS-FM requires a higher frequency of regular sampling regardless of prevailing weather conditions and river flow with a further increase in sampling intensity should any sample not meet the standard. This requirement will mean a significant increase in resourcing requirements for the Council at times when river and weather conditions are not suitable for swimming in any case and thus, there is no benefit to any party from the extra work and cost.

Furthermore, the redrafted NPS-FM also requires that a maximum of 20% of samples can fail to meet the standard of 540 *E.coli* per 100 ml, if a site is still to be deemed 'swimmable'. The submission refers to recent research, which raises doubts about the *E.coli* standard adopted in the proposed changes to the NPS and notes that it is being revisited nationally. Also, given the cumulative duration of rain affected days during even the driest summer months exceeds 20% in Taranaki, this means there is a corresponding low likelihood that any site in Taranaki could meet the minimum percentage of complying samples under the new sampling regime.

These and other matters are discussed at some length in the submission and a number of appendices have been included which set out the Council's own scientific data in support of the Council's position.

The submission strongly opposes the selective use of data that has gone into producing the swimmability maps. These will form the basis of an on-line tool that will enable councils and the community to track water quality for swimming in local rivers and lakes. The MfE modelling that has been used to produce the maps largely reflects geography, climate and land use and underlying data are based on yearly averages rather than health risks at the time of year when people want to go swimming. Few of the rivers included in the maps

correspond with the Council's monitored freshwater bathing spots as used by the community.

There are also new requirements around managing for periphyton which relate to maximum concentrations of nutrients such as dissolved inorganic nitrogen (DIN) and dissolved reactive phosphate (DRP). The submission notes that nutrients in water only become an issue when other environmental conditions are simultaneously favourable such that they lead to excessive periphyton growth. The Council's current periphyton monitoring programme (which does not include site-specific nutrient sampling) shows that excessive periphyton levels are only exceeded rarely in Taranaki.

Given changes driven by Council policy, both the likelihood and potential for excessive periphyton growth in Taranaki is very low. In any event, our current data readily lends itself to determining maximum concentrations for monitoring of DIN and DRP.

The Council also raises questions around the obligation in the NPS-FM to maintain and enhance overall water quality. The Council's understanding is that the Ministry's interpretation of the proposed changes to the NPS-FM is that an 'unders and overs' approach will meet the objectives of the NPS-FM provided overall water quality is maintained within each FMU, rather than across the region as is currently the case. However, the Courts have taken a different view to date. The Council's submission seeks greater specificity and certainty around the meaning of the requirement to 'maintain and enhance overall water quality' and suggests that a Crown Law opinion or a declaration from the Environment Court be obtained to ensure that councils are not exposed to future legal challenge.

We have also commented on the proposed change to the NPS-FM to make it clear that regional councils must consider the implications for economic wellbeing before setting environmental limits. The Council's submission supports this change. We have noted that options to reduce bacterial levels in intensively farmed areas, as required, are limited in practice and reducing livestock numbers may be the only significant option in some circumstances with attendant social and economic impacts that will need to be taken into account.

The submission repeats earlier submissions that the Council has made on national regulations for excluding stock from waterbodies. We have provided information on the Council's highly successful and award-winning riparian management programme and have made strong submissions that the national regulations must not undermine or detract from local programmes such as the Taranaki riparian management programme. The submission questions the effectiveness of the stock exclusion regulation as a means of achieving the Government's national swimmability targets (see also item elsewhere in the Agenda on the *Estimation of water quality contaminant loads and the likely effect of fencing in Taranaki*). The potential for perverse outcomes from the proposed exclusion regulation is also high.

The Council is also opposed to the application of compulsory stock exclusion regulations on steeper land and maintains that other measures such as soil conservation measures are more effective for addressing water quality issues in hill country areas.

The Council raises a number of other points that are set out in the attached submission.

In summary, the submission raises serious concerns about the absence of first principles analysis and the lack of rigorous scientific analysis underpinning much of the proposed NPS-FM.

Decision-making considerations

Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Attachment

Document 1839295: Submission on Clean Water consultation 2017

26 April 2017
Document: 1839295

Clean Water Consultation 2017
Ministry for the Environment
PO Box 10362
Wellington 6143

Clean Water Consultation 2017

Introduction

1. The Taranaki Regional Council (the Council) thanks the Ministry for the Environment for the opportunity to make a submission on the Ministry's latest consultation document for freshwater *Clean Water 90% of rivers and lakes swimmable by 2040*.

2. The Council makes this submission in recognition of the purpose of local government set out in the Local Government Act 2002, and the role, status, powers and principles under that Act relating to local authorities. In particular, the Council's comments are made in recognition of its:

    - functions and responsibilities under the *Resource Management Act 1991*; and
    - its regional advocacy responsibilities whereby the Council represents the Taranaki region on matters of regional significance or concern.

3. The Council has also been guided by its Mission Statement *'To work for a thriving and prosperous Taranaki'* across all of its various functions, roles and responsibilities, in making this submission.

4. The Council makes some general comments in relation to the reform proposals before making specific comments on matters raised in the consultation document.

General comments

5. The major new announcement of the reform proposal is to have 90% of rivers and lakes meeting swimmable water quality standards by 2040. Regional swimming maps which cover the whole country are contained in the consultation document. The costs to business, landowners and councils of achieving this standard for all

targeted waterways and undertaking enforcement and monitoring to ensure it is being achieved will be significant.

6. The Council submits that there must be a very clear definition of the problem to be addressed by these changes (supported by robust analysis and unequivocal evidence) before there is a policy shift to 'swimmability' standards for all rivers and lakes in New Zealand. The benefits of intervention must clearly outweigh the considerable costs that will be involved to reach and maintain the standard nationwide.

7. Good problem definition is critical here. All other public interventions whether it be in roading or medicine or other areas where there is a major commitment of public expenditure, require evidence that the intervention will lead to a reduction of injury, illness, suffering or death sufficient to justify the intervention. No such evidence has been provided in this case. As it stands, a major intervention targeting all rivers at a national level cannot be justified on public health grounds. Certainly in Taranaki, the Council is not aware of any evidence that illness or death can be directly attributable to elevated levels of *E.coli* present in waterways used for swimming.

8. The Council considers that a full inquiry should be undertaken into the actual rates of illness or death caused by people swimming in waterways that have varying levels of *E.coli.* This should investigate where people swim and when and would need to show spikes in illness (or even death) that come with swimming in waterways with elevated *E.coli*. Once this information has been collected, the nature and extent of responses can be considered from an informed position.

9. The consultation document states that further work will be required to clarify the costs and impacts of improvements on communities. Water quality for swimming varies for different water bodies within regions and many water bodies are simply not suitable for swimming year round because of natural limitations associated with water temperature, rainfall, access etc.

10. The Council strongly agrees that it should be up to councils working with their local communities to decide what rivers and lakes are most important to them for swimming, what improvements (if any) are required, under what conditions it is important to the local community that rivers be swimmable, and how quickly they will be made.

11. The Council will return to these points later in the submission.

Swimming targets

12. The Government has set a goal that 90% of rivers and streams will reach a swimmable standard by 2040. The target applies to rivers that are deep enough to swim in (more than 0.4 meters deep) and lakes with perimeters longer than 1,500 metres. The total length of rivers and lakes covered by the target is 54,000 kilometres. A media release from the Minister for the Environment estimates it will cost the

Government, farmers and councils $2 billion over the next 23 years to achieve the goal.

13. The consultation document makes it clear that the national goal is to increase the proportions of swimmable rivers and lakes from the current 72% to 80% by 2030 and to 90% by 2040, but also to improve water quality across all categories ('excellent', 'good' and 'fair') to an average of 90% across the country (i.e. to increase the proportion of rivers in all three swimmable categories). This will mean that some councils will have targets that exceed 90% while others (where the target will be more difficult to achieve) will be less.

14. The consultation document states that these targets are comparable with European standards.

15. The Council understands that while these targets in themselves have no legal status, the Government proposes that regulatory approaches via compulsory stock exclusion regulations combined with amendments to the NPS-FM, will be the primary means of achieving the targets.

16. Notwithstanding the above, the Minister for the Environment has written to all regional councils requiring them to advise how the national swimmability target can be supported at the regional level, including the water bodies identified for improvement and the likely costs and impacts on their communities. The deadline for this report is October 2017 (draft) and March 2018 (final).

17. The Council considers that the October 2017 and March 2018 deadlines do not provide sufficient time for the Council to undertake the necessary research, intervention effectiveness and cost analyses and consultation with its regional community regarding the development of mutually agreed regional water quality targets. Furthermore, the Council would be required to understand the criteria by which swimmability is assessed, the selection of rivers and lakes and the methods of sampling etc proposed in the consultation document before it could begin to develop targets.

18. The Council suggests more realistic targets that enable thorough technical work to be done and meaningful consultation with the community in developing sound policy responses.

19. It is also unclear how MfE intends to monitor progress towards achieving the national swimmability target and who will pay for this additional monitoring. If this is to be undertaken for national monitoring and reporting purposes then resourcing for this function should also come from the national level.

20. The Council has concerns regarding the assessment of the current swimmability of New Zealand rivers and lakes contained in the consultation document. It comes as no surprise to this Council that Taranaki is included in the same grouping as the Waikato and Manawatu-Wanganui regions where geography and climate as well as land use greatly influence the results which are largely based on modelling. We have consistently reminded the Government of the problems with relying on data based

on large-scale land use and climate modelling, rather than actual measurements from monitoring sites in the field, and the use of year-round data regardless of river flows or prevailing weather conditions or likely actual recreational usage.

21. Our state of the environment monitoring of popular freshwater bathing sites in Taranaki, conducted according to the Ministry for the Environment's (MfE) own 2003 protocols shows over 90% of bathing water samples are within Ministry guidelines and the vast majority of samples that lie outside of the guidelines are due to faecal contamination from wildfowl and seagulls. Furthermore, many sites samples are in the middle or lower end of catchments where water quality could be expected to be lower.

22. The Council notes that the redrafted NPS-FM requires a high frequency of regular sampling that is regardless of prevailing weather conditions and river flow, with a further increase in sampling intensity should any sample not meet the standard. This will mean a significant increase in resourcing requirements for the Council. Our current assessment is that at this stage it is anticipated that to deliver a 7-days per week monitoring programme, four additional staff would be required for the November to April period each year (i.e. 2 FTE equivalents), with attendant costs for field sampling, equipment, vehicles and laboratory processing in the order of $200,000 per year.

23. The accompanying MfE analysis notes that on a national scale, there is no clear relationship between *E.coli* and river flow levels. However, when this region's data is examined, there is a very strong association between *E.coli* concentrations and wet weather and higher river flows – periods when it will be highly unlikely that people will be swimming or even potentially dangerous for them to be doing so. What is particularly frustrating is that the additional sampling required by the NPS-FM over the 2003 guidelines is to be undertaken at times when river and weather conditions are not suitable for swimming and indeed, are likely to be hazardous for reasons other than water quality. This will require a very high level of additional expenditure, but serves little purpose or community good.

24. Further information is contained in Appendix A.

25. The redrafted NPS-FM also requires that a maximum of 20% of samples can fail to meet the standard of 540 *E.coli* per 100 ml, if a site is still deemed to be 'swimmable'.

26. With respect to the standard of 540 *E.coli* per 100 ml, recent research (for example, from Northland) suggests there are elevated levels of *E.coli* in rivers which are not totally attributable to faecal sources. Some strains of faecal derived *E.coli* have developed the capability to persist in the environment far removed from an animal's intestines. It is now recognised that some faecal indicator bacteria in water may not be associated with faecal contamination, and therefore may overestimate health risk.

27. This has been confirmed by ESR in a recent publication:

> *'Faecal Indicator bacteria (FIB), which include Escherichia coli, live primarily in the gut of humans, animals and birds. It was thought that FIB deposited into the*

> *environment in faeces would not persist but die-off quickly making them ideal indicators of recent faecal contamination in a waterway.* ***However, it is now established that FIB can persist and multiply in/on temperate water habitats such as sediments and aquatic plants. The presence of environmental FIB is likely to confound the correlation between indicator and pathogen making it difficult to determine the health risk represented by elevated FIB.'***[1] (Emphasis added).

28. The Council notes that the basis for the standard of 540 *E.coli* per 100ml is currently being revisited and therefore questions why this standard has been adopted in the NPS-FM.

29. The 20% of samples threshold is also problematic for Taranaki. Given the cumulative duration of potentially rain-affected days during even the driest summer months exceeds 20% in Taranaki, this means there is a corresponding low likelihood that any site in Taranaki could meet the minimum percentage of complying samples.

30. Further information is contained in Appendix B.

31. Furthermore, there is a lack of evidence that riparian management has a significant influence on *E.coli* concentrations and given that stock exclusion from waterways will be the predominant means of reaching the swimmability targets (along with the NPS-FM) raises questions about the adequacy of the science behind the policy and the achievability of the targets.

32. Further information is contained in Appendix C.

33. The consultation document states that the new criteria by which 'swimmability' is assessed and graded are comparable with European standards. The Council has looked at the European standards and found that this statement is misleading and is not the case on two major grounds: (i) applying each set of criteria to real sets of results from water quality monitoring in Taranaki results in quite different grading and pass/fail ratings and (ii) the datasets on which gradings are to be based radically differ between the NPS-FM and the European approaches.

34. In summary, the compulsory NPS-FM regime is considerably more stringent in the number of samples required and the acceptable conditions under which they are gathered than the European standards, yet offers little added value to the regional community. The NPS-related information gathered has been based on sampling and analyses that have not been undertaken according to long-established guidelines applying in New Zealand and similar countries. The Council considers there would be merit in adopting the European standards with appropriate changes where necessary.

35. The Council has completed an analysis of these issues and would welcome an opportunity to discuss its findings with Ministry scientific staff.

[1] Dr. Megan Devine. Living water *He Puna Wai Ora*. ESR Issue 2 March 2017

Swimmability maps and website

36. The consultation document proposes that swimmability maps will form the basis of an on-line tool that shows water quality for swimming and which will provide up-to-date information that will help councils and communities make decisions about improving water quality in local rivers and lakes.

37. As has already been noted, the MfE modelling used to produce the maps largely reflect geography and climate, as well as land use. Furthermore, the MfE information is based on a yearly average and therefore does not represent an accurate picture of the current state of the region's waterways. In the real world, the health risk to people swimming in our rivers changes daily and it is very simplistic and misleading to show a simple pass/fail labelling based on historic or modelled data. People are more interested in the risk at the time when they want to go swimming at locations that are suitable for this purpose. Few of the rivers included in the maps correspond with the Council's monitored freshwater bathing spots as used by the community.

38. As previously indicated, the Council's monitoring of recreational bathing carried out according to MfE protocols is showing excellent results during the bathing season. These, together with data from other regional councils, can be viewed on the LAWA website which provides real-time information based on the latest sampling that complies with established guidelines.

39. In Taranaki, our trend analysis from state of the environment monitoring tells us that recreational freshwater quality as measured by *E.coli* has been consistently improving over at least the last two decades, with ecological health (using separate indicators from *E.coli* that are regarded as more reliable) also showing strong improvements.

40. The Council therefore strongly opposes the use of the data that has gone into producing the swimmability maps. All of the Council's programmes are committed to improving water quality and the community has spent millions of dollars to protect and enhance waterways within the region and this will continue into the future. Industries and communities have eliminated or considerably reduced the impact of point-source outfalls, and farmers are fencing and planting thousands of kilometres of streambanks (see comments under 'Stock exclusion' later in this submission). This Council is also requiring farmers to move to land disposal of dairy effluent.

41. To then have this large scale public and private sector investment in improving water quality undermined by misleading and inaccurate 'swimmability' criteria applied across the region does not assist the Council and community going forward.

Freshwater NPS amendments

42. Several changes are proposed to the NPS-FM to support the new 90% by 2040 swimmability target. Changes include replacing 'wadeable' with 'swimmable'

adding macroinvertebrate monitoring for ecological health, strengthening references to 'Te Mana o te Wai', clarifying the consideration of economic opportunities, requiring the determination of instream maximum concentrations for nitrogen and phosphorus, clarifying inclusion of coastal lakes and lagoons, clarifying the policy on exceptions and strengthening the requirement for monitoring and improving water quality.

43. The Council has commented on a number of these proposals as part of the *Next steps for freshwater* consultation carried out last year (refer to Taranaki Regional Council submission dared 22 April 2016, Document number 1661032).

Swimming and recreational values

44. Changes to Objective A1, a new Objective A3 and a new Policy A5 essentially introduce a new legal requirement for every regional council to improve water quality for swimming in their region. The details of where this is to be done, how and within what timeframes, and the likely costs of these interventions, have yet to be worked through with regional councils. This is clearly the intent lying behind the Minister's letter to regional councils in late February 2017 requiring proposed regional targets by October 2017 and finalised targets by March 2018.

45. In Policy A5 the Council has to identify whether our 'large rivers and lakes' meet the 'swimmable' test in Appendix 2 and what the Council is going to do to ensure our large rivers and lakes meet the test more often than they currently do, at what cost and over what timeframe the Council will make the improvements.

46. The MfE has already produced maps deeming to show our large rivers and lakes and whether or not they are 'suitable for immersion'. The Council has already commented on the credibility, validity and usefulness of these maps. There will be much more work required by the Council in identifying areas that are suitable for immersion, what is required to improve water quality over what time and at what cost to whom.

47. This will be worked on in the coming months.

Managing nitrogen and phosphorus

48. The current NPS-FM requires councils to manage for periphyton but does not specifically require direct management of dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP). The Government proposes to change the NPS-FW to clarify that regional councils must determine maximum in-stream concentrations of DIN and DRP when they are managing for periphyton.

49. Nutrients in water are only an issue where they lead to excessive periphyton growth. Our state of the environment monitoring is showing continuing overall declines (reductions) in nitrogen and phosphorus levels in our waterways and the Council's current periphyton monitoring programme demonstrates that accepted guidelines for excessive periphyton growth are exceeded only rarely in Taranaki. This monitoring has not been accompanied by site–specific nutrient sampling. However,

the Council has a separate year-round region-wide water quality monitoring programme that incorporates nutrients, and has recently undertaken additional sampling at a number of additional sites to demonstrate the representativeness of its long established monitoring sites and added two new state of the environment sites to provide for representative monitoring across all proposed freshwater management units (FMU).

50. Furthermore, given the frequency of higher flows in Taranaki, the effect of our extensive riparian management programme and increasing trends towards land application of farm dairy effluent, both the likelihood and the potential for excessive periphyton growth in Taranaki is very low – and amongst the lowest of any region in New Zealand.

51. In any event, our current data readily lends itself to determining maximum concentrations for the monitoring of DIN and DRP.

52. On the basis of the above discussion, a NPS-FM compliant periphyton monitoring programme could be established in Taranaki.

Monitoring macroinvertebrates

53. The Council commented on this issue during the *Next Steps* consultation process. At that time the Council submitted that the Macroinvertebrate Community Index (MCI) (which had been developed in Taranaki) was not appropriate as a national tool to determine compliance with national standards or criteria, for example, as an attribute in the National Objectives Framework.
54. The Government is now proposing to include a new policy in the NPS-FM (Policy CB1(aa)) that would require councils to monitor macroinvertebrates in appropriate rivers as part of a monitoring plan and to respond to the results where they indicate that freshwater objectives will not be met in a FMU.

55. There is no prescription in the NPS-FM as to how the monitoring will be undertaken.

56. The Council considers that monitoring macroinvertebrates is a very useful means of assessing water quality trends and supports the proposal.

Maintain or improve overall water quality

57. The Council commented on this issue during the *Next steps* process.

58. The Government is proposing to limit the obligation to 'maintain or improve overall water quality' to within a FMU rather than the region as a whole. The consultation document states that FMUs are usually catchments or parts of catchments. However, in Taranaki there is a very high drainage density on the ring plain with more than 130 catchments so it is not feasible to have an FMU for each. Taranaki is unique in its hydrology and is unlike other parts of the country where there are large catchments. Therefore in Taranaki we are proposing to have only four FMUs covering the whole region.

59. Notwithstanding the above, the Council seeks greater specificity around the meaning of 'maintain and enhance overall water quality'. If one measure of water quality is deteriorating but another is improving, then how is the 'overall' judgement to be formulated and applied? For example, MCI values across Taranaki are improving significantly but if a nutrient or a sediment or a bacteriological measure deteriorates, then has the Council achieved the NPS objective?

60. The Council is also concerned at the implication that an 'improvement' can be claimed only if a site moves from one band to another, higher band for any attribute. Many of the band categories are quite broad. Statistically and ecologically significant improvements can well occur while a parameter remains categorised within an existing band. Such improvements should surely in some way be recognised without ambiguity. Conversely, the reality of nature is that natural variability eg by year to year variations in rainfall, will cause a parameter sitting close to the bottom or top of a band to fluctuate between categories in a way that has nothing to do with water quality management interventions.

61. The Council supports the policy intent of maintaining or improving overall water quality in the region but wants to ensure that there is some flexibility in how this is done. The Council considers that certainty on this issue will be needed before councils notify their plans under the RMA as the prospect of legal challenge represents very real risks for many councils.

62. The Council submits that proposed changes to Policy CA2(e)ii(a) and Objective A2 be subjected to a legal opinion from the Crown Law office to ensure that the changes are not *ultra vires* the Act. Indeed, in light of the Environment Court decision in the Hawkes Bay a declaration should be sought.

Economic wellbeing

63. The Council commented on this issue during the *Next steps* process.

64. The Council supports proposed changes to the NPS-FM to make it clear that regional councils must consider the implications for economic wellbeing before establishing environmental limits.

65. This must be a factor at every stage of the decision-making process and cover all aspects of a decision, for example, decisions on water quality objectives, policies and methods, the timing of water quality improvements and considerations of who bears the costs and benefits.

66. For example, the options available to address the bacterial effects of storm runoff from intensively farmed areas are very limited and reducing livestock is the only real way. This would have significant economic impact to potentially provide water that is swimmable during times when nobody will be doing so due to water safety reasons. Furthermore, the number of other animals and wildlife could need to be reduced and many of these in Taranaki are in the DOC estate. As noted in previously, the majority of bathing water samples outside the MFE Guideline are due to faecal contamination from wildfowl and seagulls. These are protected species.

As noted above riparian management will not address bacterial levels from storm runoff from intensively farmed land.

The effect of national bottom lines on infrastructure

67. The Council commented on this issue during the *Next steps* process.

68. The Government is proposing further clarification of the intent and effect of the current policy. The Council supports the proposed changes.

Te Mana o Te Wai

69. The Government concedes that the meaning and effect of Te Mana o Te Wai, as introduced in the NPS-FM in 2014 is unclear.

70. Further clarification of the meaning of Te Mana o Te Wai is provided for in the NPS-FM along with a new objective and policy requiring councils to consider and recognise Te Mana o Te Wai when giving effect to the NPS-FM. The Council welcomes these changes.

71. However, despite the added clarification that the changes bring, the Council considers that further guidance on how the policies can be implemented in practice would assist all regional councils.

Stock exclusion

72. The Council has commented on proposed national regulations for excluding stock from waterbodies on two occasions in the last year. On both occasions the Council has expressed its opposition to national regulations addressing stock exclusion. The reasons for this remain unchanged.

73. Regional programmes such as this Council's comprehensive Riparian Management Programme, supported by regional plans where appropriate, are much better placed to tailor stock exclusion and riparian management to their local situations.

74. National regulations on the other hand impose a 'one size fits all' solution to freshwater quality issues. Some of the proposals in the consultation document pose a significant risk of undermining current successful regional programmes and environmental outcomes.

75. National regulations are also not likely to be to be easy to implement and enforce. Proposed regulations involving different timelines for different land uses on different classes of land are likely to be difficult to understand for both farmers and Council staff who will have to enforce them. The cost of implementing the regulations will fall to regional councils and this will be another significant cost burden for regional ratepayers.

76. The Council's world class, award-winning Riparian Management Programme has seen a voluntary approach to riparian management, including stock exclusion from waterways, achieve exceptional results.

77. It is the largest environmental enhancement planting scheme on privately owned land in New Zealand. As at June 2016, some 99.5% of the region's approximately 1,760 dairy farms have a Council prepared riparian management plan in place. About 2,500 riparian management plans in total cover 14,464 kilometres of streambank and more than 4.3 million plants have been supplied to landowners since the scheme began. Over 84.4% of streambank covered by riparian plans is fenced and more than 69.5% of streambank recommended for vegetation is protected by existing or new plants.

78. The Council's planning phase is now largely completed and the focus is strongly on encouraging and assisting plan holders to implement the fencing and planting recommendations within their riparian plans. The Council anticipates that at current rates of fencing and planting the task will be nearing completion on dairying land in Taranaki by 2020 by which time the Council has proposed a regulatory response (through a regional plan review) to bring about final and complete implementation of the programme.

79. The Council is therefore concerned that a national regulation focused on stock exclusion will detract from the Taranaki Riparian Management Programme. As noted above, our Riparian Management Programme addresses not only the fencing of waterways but also the planting and revegetation of riparian margins so as to intercept, trap, and filter contaminants on land in order to prevent or minimise their entry to water. As riparian plants mature there are additional benefits such as carbon capture, the shading of waterways and improved instream habitats for native flora and fauna.

80. The Council is concerned that there is a serious risk that farmers' efforts will focus solely on meeting minimum fencing requirements rather than fencing and planting. There is also a risk that farmers will focus on retiring the minimum required to meet the national exclusion requirements and will not provide for the establishment of effective riparian buffers.

81. If national regulations for stock exclusion are introduced they must recognise and must not undermine existing programmes such as this Council's Riparian Management Programme. Regional councils must be able to set more stringent requirements than what are provided for in the regulations.

82. The Council is also opposed to the application of compulsory stock exclusion on steeper land (16 degrees and over).

83. While there are significant water quality benefits from stock exclusion on the intensively use flatter land of the Taranaki ring plain and coastal terraces, on steeper land in the eastern hill country, the farmer compliance costs of stock exclusion will significantly outweigh the environmental benefits of these measures. In the eastern hill country sedimentation from natural and accelerated erosion is the primary

pressure on water quality and is more effectively addressed through soil conservation measures.

84. Notwithstanding our opposition to the proposed stock exclusion regulations, and on the assumption that the Government is determined to proceed with national regulation, the Council provides the following specific comments on details in the consultation document.

Stock crossings

85. The requirement to install culverts or bridges for stock crossings should only apply to flat and undulating land and there should not be a blanket requirement to install culverts or bridges for all land types.

86. Direct stock access to a waterbody for the purpose of crossing should only be permitted where this occurs less frequently than once a month rather than the once a week as proposed in the consultation document.

Water bodies

87. The Council is opposed to the description under subparagraph (a) that a waterway be permanently flowing and the active channel is over 1 metre wide at any point. If any part of a river is over 1 metre wide then to effectively address the water quality issue, the regulations should apply to the whole waterway. However, any requirements should only apply to flat to rolling land within the intensively farmed area of Taranaki.

88. The Council also seeks that lakes (in subparagraph (b)) less than one hectare but surrounded by wetland vegetation, also be covered by the regulations. Again, any requirements should only apply to flat to rolling land.

89. The Council supports subparagraph (c) relating to stock exclusion requirements for natural wetlands, including the definition provided.

Alternative option

90. Where landowners are unable to meet the requirements of the regulations, they must apply to the regional council for permission to instead develop a stock exclusion plan. This plan must set out where and when stock will be excluded from waterbodies on their land, and where complete stock exclusion is not feasible, what alternative measures will be undertaken to manage the environmental impacts of stock access to water. Regional councils are expected to assist landowners in developing stock exclusion plans.

91. There will be significant resourcing implications for the Council in implementing this aspect of the regulations unless appropriate cost recovery measures are in place.

Enforcement

92. The Council questions the ability of regional councils to be able to effectively enforce the regulations, especially in the eastern hill country area of the region. There will be additional resourcing requirements for the Council in extending compulsory stock exclusion regulations into the hill country and significant additional compliance costs will be imposed on landowners, without significant net environmental benefit.

93. The consultation document states that if a land owner does not meet the requirements they may be required by the regional council to pay an infringement fee of up to $2,000. The Council questions whether the $2,000 fine is sufficient for serious and/or continuing incidences of non-compliance. The Council believes that the $2,000 fine should be a minimum level with a sliding scale relative to the severity of the non-compliance.

Freshwater improvement fund

94. The Council supports the Government's addition to the Freshwater Improvement Fund.

95. The Council believes it has projects that meet the criteria and has already made an application under the 2017 funding round. The Council proposes to make further applications in due course.

Conclusion

96. The Council again thanks the Ministry for the Environment for the opportunity to comment on proposals in the '*Clean Water*' consultation document.

97. The Council questions the adequacy of the scientific evidence base for the Government's goal that 90% of rivers and lakes will meet swimmable standards by 2040 particularly in light of the significant economic cost to the country of achieving the standards for wet periods when there is unlikely to be any swimming occurring.

98. The Council also has issues around the sources of data for assessing the swimmability of Taranaki's rivers and lakes that underpin the swimmability target.

99. When it comes to the NPS-FM it is left to regional councils to identify in regional plans where the quality of rivers will be improved so that they are suitable for swimming more often, with specified timeframes for that improvement. More work will be required and discussions held with the Ministry to determine a suitable and sensible response to the proposed changes to the NPS in Taranaki.

100. The other major area of concern to the Council is in proposals to exclude stock from waterways via national regulation. The Council has made extensive submissions on this issue in the past opposing the introduction of national stock

exclusion regulations and continues to raise issues of concern. The Council maintains that whatever the shape of the regulations they must not undermine current regional programmes such as this Council's highly successful Riparian Management Programme.

101. The Council looks forward to further discussions on a number of important matters raised in the consultation document.

Yours faithfully

B G Chamberlain
Chief Executive

Appendix A: influence of wet weather on microbiological quality of fresh water in Taranaki.

1. The 'Message from the Ministers' within the Ministry for the Environment discussion document 'Clean water' states '*Water quality varies dramatically with the weather and even our cleanest waterways exceed safe levels of contaminants during flood events*'.
2. This calls into fundamental question the point of the emphasis set out in Appendix 5 of the discussion document, that the frequency of sampling must be increased to daily in wet weather (or strictly, whenever a single sample exceeds 260 *E coli*/100 mls), until *E coli* concentrations return to below this criterion.
3. The evidence of the Taranaki Regional Council's database of water quality analyses is that there is a very significant impact upon water quality when flows are elevated.
4. The Council therefore has a standing advisory to the public, that water quality may be compromised in respect of bathing quality for up to 3 days after wet weather.
5. By observation, the local communities simply do not engage in recreational bathing when the weather is poor and river conditions are unappealing (turbid, high flows, swirling currents, debris being swept downstream).
6. Sampling during such conditions serves no purpose for informing the public- they are already well-advised. Further, daily sampling instead of weekly sampling (as is currently the practice) would incur much higher expenses for the region- in the order of $200,000 or more per year in additional staff resourcing because of the need to cover weekends and all holiday periods.
7. An analysis of flows and microbiological quality underlying and validating this approach is set out below.
8. Data is taken from the SEM general regional water quality monitoring programme 2012-2015. Sampling is conducted year-round at these sites on a monthly, fixed schedule regardless of weather or flow conditions at the time. The data has not been adjusted by season or temperature.
9. 'Below median flows' represent times when the community might find conditions more favorable for swimming.
10. 'Above median flows' are times when rivers will be turbulent, with eddies and strong currents; water quality will be turbid, with poor visibility through the water column to ascertain depth and submerged risks; there will likely be high debris loads in the river; and generally the concurrent weather will be comparatively cooler and wetter; and hence there would be low demand for swimming activities.
11. Note: a separate analysis considers river flow patterns within a nominal bathing season- see Appendix B.

Site code (regional general water quality monitoring programme)	All flows below median flow			All flows above median flow			
	Median *E coli* count	95thile *E coli* count	*Ratio of median:95%*	Median *E coli* count	95thile *E coli* count	*Ratio of median:95%*	Ratio of median coli between the 2 flow regimes
MRK000420	985	6100	*3.2*	1350	7700	*5.7*	1.4
MKW000300	235	2950	*12.6*	520	4150	*8.0*	2.2
MGH000950	85	340	*6.2*	555	2850	*5.1*	6.5
PAT000200	27	240	*8.9*	20.5	350	*17.0*	0.75
PAT000360	150	1650	*11*	405	2300	*5.7*	2.7
PNH000200	108	730	*6.8*	70	965	*13.8*	0.6
PNH000900	475	1200	*2.5*	690	3900	*5.7*	1.5
STY000300	5	26	*5.2*	14.5	485	*33.4*	2.9
WGG000500	185	1060	*5.7*	200	2800	*14*	1.1
WGG000900	175	1800	*10.3*	320	4350	*13.6*	1.8
WKH000500	175	590	*3.4*	545	6200	*11.4*	3.1
	Mean; SD		*6.9 +/- 3.4*	Mean; SD		*12.1 +/- 8.2*	

12. The data in the table show that with the exception of sites PAT 000200 and PNH000200 (high altitude sites immediately below the border to the Egmont National Park), all sites have much higher (1.1 to 6.5 times higher) median E coli counts when flows are above median annual flow than when lower. That is, the *E coli* elevation effect is not limited solely to a few extreme flood events, but is found throughout the year whenever flows are above median.
13. Further, the data shows that there is no consistent relationship between median E coli counts and 95th%ile counts within either flow regime, with very large variations in the ratio of median to 95th%ile counts on a site by site basis. For example, under below-median flows, the 95th%ile value may be as low as 2.5 times or as high as 12.6 times higher than the median *E coli* count for the same site under the same conditions. In higher flows, the 95th%ile value may be as low as 5.1 times or as high as 33.4 times higher than the median *E coli* count for the same site.
14. This goes to the heart of the questions over the Ministry's proposed multi-criteria approach to categorising bathing water suitability.
15. In terms of year-round river flow conditions that are suitable for swimming, median counts at ten of Taranaki's eleven sites meet the criterion of 540 *E coli*/100 mls. However, when flows are higher, only seven of eleven sites have medians below this criterion.
16. Three of the sites have 100% of their samples below the same criterion. Under higher flows, this drops to two sites.
17. Using the supplementary MfE criterion that the 95th%ile of *E coli* results at a site should be below 1200 for a site to be deemed at all swimmable (deemed through their modelling to be equivalent to having 80% of samples below 540 *E coli*/100 ml), seven of the eleven SEM sites would meet the 'swimmability' criterion if judged on year-round below-

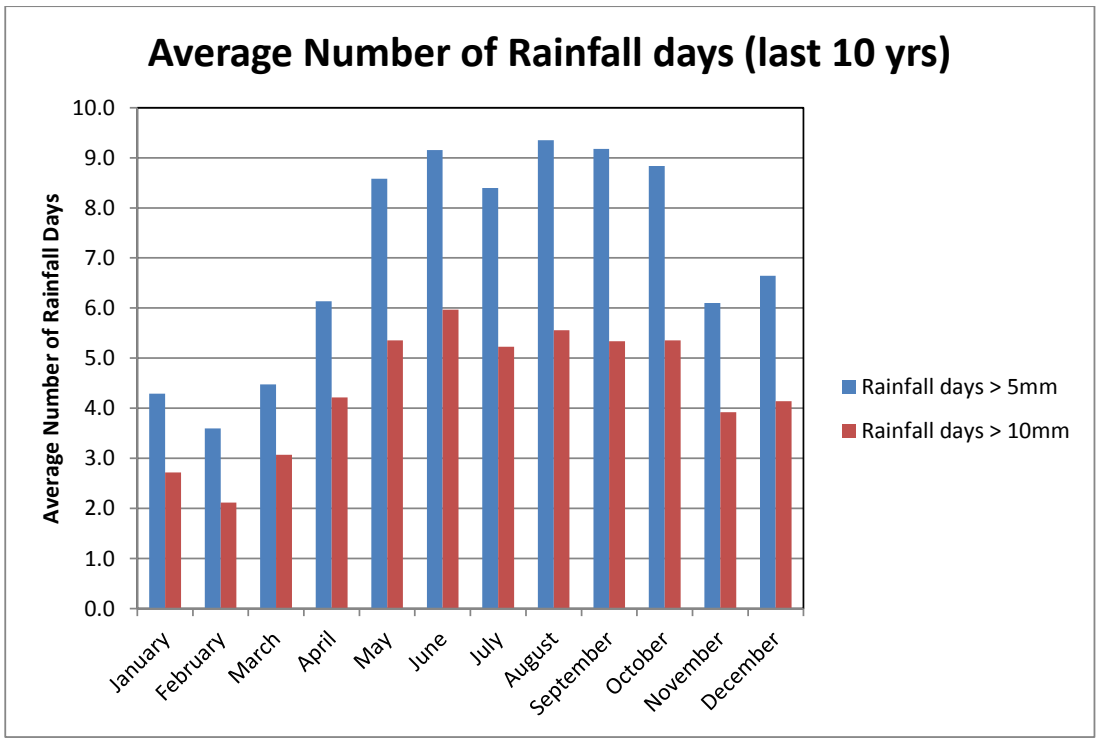
median flow data, but only 3 of these sites would meet this criterion if judged on all monitoring data (data not shown).

18. In the case of the EU bathing directive, there is a strong implication that collection can or should be in conditions conducive to bathing rather than under all weather and flow conditions. Explicitly, the Directive states that [Article 3(6)] '*Samples taken during short-term pollution may be disregarded. They shall be replaced by samples taken in accordance with Annex IV.'* The Directive defines '*Short-term pollution' microbiological contamination as referred in to Annex I, column A, that has clearly identifiable causes, is not normally expected to affect bathing water quality for more than approximately 72 hours after the bathing water quality is first affected and for which the competent authority has established procedures to predict and deal with as set out in Annex II'.*
19. It is the view of the Council's scientific staff that continuation of the protocols set out in the 2003 recreational guidelines, that sampling should be undertaken within those times when the communities are most likely to be bathing, together with the use of public advisories as to when natural conditions do not favour immersion, is the meaningful, preferred, and defensible approach.

Appendix B: Duration and extent of wet weather and elevated flows during the nominal fresh water bathing season in Taranaki.

(a) Rainfall effects

1. Hydrology staff have provided an analysis of the average number of days per month that rainfall is above 10mm on the ring plain of Taranaki (i.e at sites other than on the mountain). The graph is presented below (red bars on the graph). This level of rainfall has been chosen as a level of rainfall that makes it likely that there will be runoff from land (pasture, streets etc) to waterways, thus causing both elevated flows and elevated bacterial contamination.
2. The analysis is set out below. It shows that in a typical January, there will be 2.7 days of significant rainfall; in February, 2.1 days; and in March, 3.1 days. Other months of the year have between 4 and 6 days of significant rainfall.
3. The Council's public notification of rainfall effects upon bathing water quality specifies that '*As a precautionary approach, people should generally avoid swimming in rivers and lakes for three days after heavy rainfall*'. That is, from the Council's experience and monitoring records, rainfall can affect bathing quality for up to three days following a significant rainfall event.
4. In other words, the number of rainfall-affected days each month in a typical year is: January 10.8 days (equivalent to 35% of the month); February 8.4 days (30% of the month); and March 12.4 days (40% of the month).



5. It is recognised that the Council's advice is precautionary; that is, there is no suggestion that exceedances of the bathing guideline would be through to the very last moment of the three days the Council designates as 'rain-affected' following heavy rain. But even if applying the EU guidelines, that only events of less than 72 hours' duration should be excluded from consideration of bathing quality (equivalent to taking into account the day of rain and the two days following), then the number of 'rain-affected' days in a typical Taranaki summer is: January 8.1 days (26% of the month); February 6.3 days (23% of the month); and March 9.3 days (30% of the month).
6. Given that the MfE tolerance for non-compliance (such as might be due to rain-affected days) is only 20%, and even in the driest month (February) there will typically be 23% days that are rain-affected in Taranaki, it is immediately apparent that because of the pattern of rainfall in Taranaki during summer, there is a markedly reduced possibility of attaining even the minimum compliance target, solely because of natural wet weather influences in Taranaki rivers.
7. Cawthron report[2] that on a national scale, they found only a weak association between flows and *E coli*. However, their discussion notes that there are likely to be: differences in the dominant processes driving *E coli* concentrations at different sites-eg dilution with increasing flows at some sites vs spikes of *E coli* wash off into streams at others; inconsistent relationships between flows and concentrations depending on whether flows are rising (wash-off) or falling (residual in-stream or in-sediment *E coli* only); and disproportionately poor representation of high flows in the national dataset. The report notes that relationships of flow and microbiological concentrations are complex. The report notes that '*Site data rather than model predictions are therefore the best basis for identifying specific locations with E coli issues, and for assessing the effectiveness of response actions*'.[3]
8. On this rationale it is held that the NPS should provide for selective and well-founded sampling regimes rather than impose a universal, one-size-and at-all-times requirement as does the draft at present.

(b) Flow effects

9. In terms of the flow regimes in the main rivers of Taranaki, hydrology staff have provided flow data from the last ten years for flows over the three summer months of January-March for the main rivers in Taranaki, examining the percentage of the time that flows were above annual median flow levels. This approach is founded upon the recognition that higher flows often carry higher bacterial contamination loads (see Appendix A).
10. For each river, February was the month with the shortest cumulative duration of flows that were above the level of the annual median flow.
11. For the Waiwhakaiho River, flows are elevated above annual median flows at Egmont Village for 21% of the time over summer, and for 24% of the time at Rimu

[2] Ibid, pg 43
[3] Ibid, pg 44

Street (central New Plymouth). In the particular month of February, flows were above median annual flow for 16% and 17% of the time, respectively.

12. For the Waitara River, flows are elevated above annual median flows for 15% of the time over summer. In February, flows were above median annual flow for 10% of the time.
13. For the Patea River, flows are elevated above annual median flows for 15% of the time over summer. In February, flows were above median annual flow for 8% of the time.
14. For the Waingongoro River, flows are elevated above annual median flows for 13% of the time over summer. In February, flows were above median annual flow for 6% of the time.
15. For the Kaupokonui River, flows are elevated above annual median flows for 13% of the time over summer. In February, flows were above median annual flow for 5% of the time.
16. At all sites, flows were elevated above median annual flows for about or more than 20% of the time in the month of January. Results for March were more variable.
17. Given that the MfE tolerance for non-compliance (such as is due to high-flow days) allows for a maximum of 20%, it becomes immediately apparent that because of the pattern of high flows in Taranaki even during summer, there is a markedly reduced possibility of attaining the minimum compliance criterion even during the driest month alone, let alone for the whole of the notional bathing season.

Appendix C: Calculated reductions in *E coli* loadings to rivers and streams in Taranaki, without and with riparian fencing.

1. Reference is made to modelling undertaken by Richard W McDowell of Lincoln University. The modelling was developed to estimate the load of contaminants [suspended sediment (SS), nitrate+nitrite nitrogen (NO_3-N), ammoniacal-N (NH_4N), total N (TN), filterable reactive phosphorus (FRP), and total P (TP)] in all catchments classified by the River Environment Classification. The model is described elsewhere (McDowell, R.W., Snelder, T.H., Cox, N., Booker, D.J., Wilcock, R.J., 2013a. *Establishment of reference or baseline conditions of chemical indicators in New Zealand streams and rivers relative to present conditions.* MAR. FRESHWATER RES. 64, 387; and McDowell, R.W., Wilcock, R.J., Hamilton, D., 2013b. *Assessment of Strategies to Mitigate the Impact or Loss of Contaminants from Agricultural Land to Fresh Waters*. Ministry for the Environment, Wellington, New Zealand).
2. The model looks at reductions in contaminant loading to streams if riparian fencing is applied in accordance with the LAWF recommendations.
3. It is noted that the modelling finds that should the LAWF recommendations for fencing be implemented on land used for pasture (REC class P), the reduction in national *E coli* loading would be about 13% within pasture-dominated catchments, with about a 12% reduction if taken across the entire landscape. That is, riparian fencing on pastoral land will have only a small effect at best upon microbiological concentrations in our waterways.
4. Because the Taranaki riparian approach is to fence all streams and waterways (permanent or ephemeral), and not just those that fall within the LAWF criteria, fencing across the Taranaki pastoral landscape is modelled to lead to a much higher (relative) reduction in E coli loading, of 38%.
5. McDowell did not model the additional benefit of riparian planting, which is widely recognised as providing a further degree of filtration of runoff and thus reduction of *E coli* loadings.
6. It is critical to note that Taranaki already has over 84% of its ringplain stream banks fenced, and 69% or more planted. Therefore even 100% completion of comprehensive riparian fencing and planting will see only the most modest of reductions in E coli loadings to inland waterways.
7. Over the last twenty years, the percentage of ringplain streambank fenced has risen from roughly 55% to more than 84%. The proportion of ringplain streambanks planted has risen from roughly 48% to over 69%.
8. Over the same period, there has been no discernible significant change in the overall microbiological quality of the rivers and streams on the ringplain.
9. It is noted that in the same period, the number of dairy cows rose by 13%, on the same land area. One could therefore argue that in effect the change in riparian management to date has offset this increased source loading, and has thus brought about a 13% reduction in the loadings that would otherwise have occurred.
10. However, it is clearly completely unrealistic to assume that there would be more than a negligible shift in microbiological water quality in the Taranaki region due

to completion of future riparian fencing and planting initiatives. De-stocking of land, together with diversion of remaining discharges of milking platform effluent from water to land, emerges as the only alternative that can sufficiently reduce microbiological contamination of recreational waters in order to meet the criteria set out in the proposed NPS amendments.

Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy and Planning Committee

Subject: Public perceptions of New Zealand's environment: 2016

Approved by: A D McLay, Director – Resource Management

B G Chamberlain, Chief Executive

Document: 1844325

Purpose

The purpose of this memorandum is to introduce the 2016 report prepared by Lincoln University on public perceptions of New Zealand's environment.

The 90-page report can be viewed at
http://www.lincoln.ac.nz/Documents/LEaP/perceptions2016_feb17_LowRes.pdf_.

Executive summary

The latest (2016) Lincoln University report on public perceptions of New Zealand's environment has been released.

The main aims of the survey were to measure, analyse and monitor changes in New Zealanders' perceptions, attitudes and preferences towards a range of environmental issues ultimately contributing to improved state of the environment reporting.

Among the main findings are that New Zealanders' continue to consider both the state and management of the New Zealand environment to be good, and better than in other developed countries.

The states of air, and native bush and forests were rated highest, while rivers and lakes, and marine fisheries were rated as being in the worst state. Management of farm effluent and runoff continued to be perceived very negatively. Water related issues were rated as the most important environmental issue facing New Zealand, while greenhouse gas emissions and climate change was the most commonly identified global issue.

The survey provides a useful addition the Council's state of the environment monitoring information.

Recommendation

That the Taranaki Regional Council:

1. receives the memorandum *Public perceptions of New Zealand's environment: 2016.*

Background

This is the eighth survey (the first having been completed in 2000) of people's perceptions of the state of the New Zealand environment. The report was prepared by Ken Hughey, Geoffrey Kerr and Ross Cullen of Lincoln University.

The 2000 postal survey was designed to be undertaken once every 2 years. In 2010 after having completed five postal surveys, the researchers decided to change to an electronic survey format and to complete the survey every 3 years.

The survey is based on the Pressure-State-Response model, which is used internationally as the basis for environmental reporting and is used by this Council in its own state of the environment reporting.

The main aims of the survey were to measure, analyse and monitor changes in New Zealanders' perceptions, attitudes and preferences towards a range of environmental issues ultimately contributing to improved state of the environment reporting. Among the specific objectives for the research were to provide independent commentary on environmental issues of public concern as a contribution to public debate and as a means of alerting government and others to these issues. It remains the only long-running survey of its type in the world.

The Taranaki Regional Council contributed to the funding of the survey.

Discussion

The report undertakes a pressure-state-response analysis by summarising the perceptions of respondents on the state of the environment, its management and participation in environmental activities. It then goes on to present its findings on New Zealander's perceptions of the main resource areas (for example air, freshwater, biodiversity) before drawing some conclusions and outlining implications for policy makers.

Some of the report's more notable findings include:

- New Zealanders' continue to consider both the state and management of the New Zealand environment to be good, and better than in other developed countries
- The states of air, and native bush and forests were rated highest, while rivers and lakes, and marine fisheries were rated as being in the worst state
- Management of all components of the environment was considered to be adequate to good, with management of national parks rated the highest. Rivers and lakes, and groundwater were judges to be the worst managed parts of the environment
- Management of farm effluent and runoff continued to be perceived very negatively
- Farming is perceived to be one of the three main causes of damage to freshwater by over half of respondents and was also considered an important cause of damage to several other resources

- Water related issues were rated as the most important environmental issue facing New Zealand, while greenhouse gas emissions and climate change was the most commonly identified global issue.

Of significance, New Zealanders continued to rate both the state and management of New Zealand's environment to be good, and better than in other developed countries.

The authors note that the perceptions of the quality of rivers and lakes have changed over time – particularly over the six-year period from 2010 to 2016. Earlier surveys showed the people thought the condition of rivers and lakes was 'adequate or good' but by 2016, 45.4% thought it was 'bad' or 'very bad'. The main causes of damage to fresh waters and the range of variations from 2000 to 2016 are considered to be 'farming' (25 to 59% from 2000 to 2016) and 'sewage and stormwater' (40-47%) and 'industrial activities' (27-36%).

Farming in particular 'has increased hugely' in perceived importance over the survey period. In terms of freshwater management, the authors note that 47.2% of respondents in 2016 thought management of rivers and lakes was poor or very poor. Of course, this means that the remainder (52.8%) thought freshwater was adequately managed, well managed or very well managed and this probably reflects the differing pressures on freshwater resources and the responses to those pressures in different parts of the country.

The authors note that water quality and quantity issues have been of high public interest in New Zealand over about the last decade. In more recent times the authors note, that the Government's Land and Water Forum has made many recommendations on future directions for freshwater management and the Government has introduced a National Policy Statement for Freshwater Management. There has also been sustained media interest in water quality issues in response to the high profile 'dirty dairying' campaign implemented by Fish and Game New Zealand (particularly in Canterbury), and the more recent community-wide water quality contamination at Havelock North.

There are a number of issues highlighted by the authors where the perceptions by the New Zealand public don't match the reality of the state of the environment. One area is in the condition of our native plants and animals where respondents rated this as 'adequate' or 'good' 'when clearly it is not the case' (page 28). The authors hypothesise that the large amount of apparently 'good' news stories about endangered species management 'masks the gravity of the biodiversity situation in New Zealand for many'.

The survey is a useful addition to the Council's state of the environment monitoring information even though it is conducted at the national level with no regional breakdown. The survey also relies on the opinions of respondents and this is influenced by a wide range of factors such as their knowledge of the environment and the level of media attention given to issues. Nevertheless, it does provide a regular update on changing public perceptions of environmental issues and responses and to this extent is of value to the Council.

Decision-making considerations

Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Agenda Memorandum

Date 2 May 2017

Memorandum to
Chairperson and Members
Policy and Planning Committee

Subject: **Review of Pest Management in Taranaki: *Proposed Regional Pest Management Plan for Taranaki; Section 71 Report; and Biosecurity Strategy 2017–2037***

Approved by: S R Hall, Director - Operations

B G Chamberlain, Chief Executive

Document: 1806917

Purpose

The purpose of this memorandum is to present for Members' consideration the *Proposed Regional Pest Management Plan for Taranaki* (the Proposed RPMP), the report *Pest Management Plan for Taranaki - Impact Assessment and Cost Benefit Analyses* (Section 71 Report), and the *Taranaki Regional Council Biosecurity Strategy 2017–2037*.

Attached separate to this agenda are the Proposed RPMP, Section 71 Report and Biosecurity Strategy.

Executive summary

- In 2007, the Taranaki Regional Council (the Council) adopted the *Pest Management Strategy for Taranaki – Animals* and the *Pest Management Strategy for Taranaki – Plants*. These strategies set out the regulatory framework for the Council's pest management work under the Biosecurity Act 1993 (BSA).
- Ten years on, the Council has reviewed the current pest management strategies and presents a new combined plan – the Proposed RPMP – plus a new **non-statutory** Biosecurity Strategy.
- The Proposed RPMP combines the current strategies and sets out rules and/or accesses Part 6 [regulatory] powers to control 18 plant and animal pests targeted for eradication or sustained control.
- The Proposed RPMP would be a fourth generation plan. As such, it largely builds on the existing strategies but incorporates significant changes in the law, national regulation, and sector guidance relating to pest management plans. Key changes include:
  - the inclusion of new 'good neighbour rules' which bind both Crown and private land occupiers
  - new rules relating to the control of Old man's beard that target infestations along the Kaupokonui Stream and Waingongoro River

  - a change of focus for certain species for which rules currently apply, whereby species better addressed through 'pathway', advocacy and site-led activities will be managed alongside other harmful organisms under the *Taranaki Regional Council Biosecurity Strategy*.
- As required by law all legislative requirements set out in sections 70 to 72 of the BSA relating to the preparation and making of the Proposed RPMP have been satisfied.
- In addition to the Proposed RPMP, and as part of the review, the Council has prepared the draft *Taranaki Regional Council Biosecurity Strategy 2017–2037* (the Biosecurity Strategy). The Strategy is a new **non-statutory** document that covers all of the Council's biosecurity activities and programmes, whether statutory or non-statutory. Of note, most activities undertaken by the Council are discretionary.
- The Biosecurity Strategy represents a significant change in business for the Council with a shift from focusing on 'legacy' pests to proposals that also seek to prevent new 'pests' from entering or spreading across the region. It recognises that regulation is not always the best option for addressing some problems.
- The Biosecurity Strategy aligns with national initiatives (where it is appropriate to do so), plus the Eradication and Sustained Control programmes set out in the Proposed RPMP. However, the Strategy also includes Council programmes and activities specific to the Strategy including:
  - increased focus on contingency planning and surveillance to, as far as is practicable, prevent new harmful species from entering the region
  - a proposal to investigate expanding the Self-help Possum Control Programme to deliver and contribute to predator control for possums, rats and mustelids across 275,000 hectares
  - urban pest control programmes to promote biodiversity outcomes
  - support for community pest initiatives and site-led programmes, including the Key Native Ecosystems programme and Wild for Taranaki's *Restoring Taranaki*.
- This item recommends that the Proposed RPMP and Biosecurity Strategy are publicly notified for public consultation on or before 20 May 2017.

Recommendations

That the Taranaki Regional Council:

1. receives this memorandum and the Proposed RPMP, Section 71 Report, and Biosecurity Strategy
2. notes that the Proposed RPMP has been the subject of a successful inter-regional consistency check and is consistent with a regional collective template for proposed plans
3. agrees that the Proposed RPMP meets the section 71 content requirements for a proposed regional pest management plan as required by the BSA
4. agrees that the Proposed RPMP is not inconsistent with the *National Policy Direction for Pest Management 2015*, other pest management plans on the same organisms, any pathway plan, regional policy statements or plans under the Resource Management Act 1991, or any regulation
5. agrees that that each organism included in the Proposed RPMP is capable of causing at some time a serious adverse and unintended effect in relation to the region

6. agrees that the benefits of the Proposed RPMP in relation to each organism to which the proposal applies outweigh the costs after taking account of the likely consequences of inaction or other courses of action
7. agrees that, for each subject, persons who are required to meet directly any or all of the costs of implementing the Proposed RPMP –
   (i) would accrue, as a group, benefits outweighing the costs or
   (ii) contribute, as a group, to the creation, continuance, or exacerbation of the problems proposed to be resolved by the plan
8. agrees that for each subject, there is likely to be adequate funding for the implementation of the Proposed RPMP for five years
9. agrees that each proposed rule would assist in achieving the Proposed RPMP's objective and would not trespass unduly on the rights of individuals
10. agrees that the Proposed RPMP is not frivolous or vexatious, that it is clear enough to be readily understood, and that Council has not rejected a similar proposal within the last three years
11. notes that the Section 71 Report will be made publicly available
12. agrees to publicly notify the Proposed RPMP and Biosecurity Strategy for public submissions on or before 20 May 2017.

Background

Biosecurity is the prevention or management of risks from the thousands of pests and other harmful organisms that affect our economy, environment and wellbeing. Biosecurity and pest management is vital to New Zealand's environmental and economic well-being, with weeds, wasps, rats, possums and feral cats among thousands of harmful species that cost the country billions in control and lost revenue.

Regional councils' mandate for undertaking pest management on behalf of the region comes largely from the Biosecurity Act 1993 (the BSA), which provides for "*…the exclusion, eradication and effective management of pests and unwanted organisms*". The Act provides regional councils with a leadership role and powers to manage harmful species classified as pests or unwanted organisms. It also enables councils (and others) to prepare rules or access its regulatory powers via pest plans.

Under the BSA, the Taranaki Regional Council (the Council) is required to have in place a pest management plan for its region if it wishes to undertake pest management. A pest management plan specifies what organisms are declared to be 'pests' and sets out the rules in relation to those 'pests'. Once operative, the RPMP empowers the Council to exercise the relevant enforcement and funding provisions available under the BSA.

Because rules impose costs and obligations on people, pest management plans and rules are rigorously tested through processes set out in the BSA. Under the Act, 'pests' mean organisms specified as such in a pest management plan, and their nomination must comply with the Act and clause 7(1) of the *National Policy Direction for Pest Management 2015* (the NPD).

The Council made the *Pest Management Strategy for Taranaki – Animals* and the *Pest Management Strategy for Taranaki – Plants* (the strategies) operative on 1 May 2007. Ten years on the Council is required by law to review these strategies.

This review involves publicly notifying a new Proposed RPMP and the development of a new **non-statutory** Strategy to ensure pest management in Taranaki is adaptive, efficient, effective and relevant to the community's expectations for biosecurity.

Of note, the review takes into account significant legislative changes that occurred over the life of the current strategies. Changes of particular importance to regional councils were:

- the inclusion of national and regional leadership responsibilities in the BSA for pest management
- the introduction of proposed new policy instruments including the NPD
- the introduction of good neighbour rules and requirements for the Crown to comply with such rules in regional pest management plans, and
- changes relating to the development and review process for pest management plans, including the re-naming of 'strategies' as 'plans', and the plans being reviewed every 10 years (instead of 5 years).

Plan review process

As noted above, ten years on the Council is required by the BSA to review its current strategies.

Members may recall that in 2013, shortly following the amendments to the BSA, the Council commenced early engagement to inform this plan review. A position paper entitled *Future Directions for Pest Management: Review of the Pest Management Strategy for Taranaki: Animals and the Pest Management Strategy for Taranaki: Plants* was prepared and released for targeted consultation. The paper reviewed the efficiency and effectiveness of the current strategies and made proposals on the broad policy directions for future pest management, including merging the two current strategies into a single regional pest management plan. Feedback from stakeholders at that time confirmed the broad directions proposed in the position paper.

Further work and progress on developing a draft pest management plan was necessarily delayed awaiting promulgation of the NPD, which was approved on 17 August 2015.[1]

Upon confirmation of the content requirements of the NPD, Council officers have been working with other regional councils on a project to promote inter-regional alignment as far as practicable by developing templates for the scope, structure and content of proposed and adopted plans that are consistent with the NPD. The final collective 'template' (including template good neighbour rules) was approved by Regional Council Chief Executives in November 2015 and has been incorporated into the Proposed RPMP. Officers have also been involved in additional sector work undertaken to develop 'template' good neighbour rules for pest plant and animal species that are of common interest.

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[1] *The NPD is a new statutory instrument that the Minister for Primary Industries must enact pursuant to section 56 of the BSA. The NPD contains directions on the setting of good neighbour rules, the analysis of benefits and costs, the allocation of costs, and programme descriptions and objectives. All national and regional pest and pathway plans, and small-scale management programmes, must be consistent with the NPD.*

A draft Proposed RPMP consistent with that sector advice was developed and was considered by Members at a workshop on 14 March 2017. The draft Proposed RPMP and Biosecurity Strategy were further circulated to key and valued stakeholders for comment. Summary factsheets on the Proposed RPMP, the Biosecurity Strategy, good neighbour rules, and the wider pest management context were also provided to assist that consultation. Two responses were received. The New Zealand Transport Agency was supportive of the Biosecurity Strategy and the Proposed RPMP, and highlighted their particular support of the good neighbour rules, stating that they gave the agency "*greater clarity and direction around pest management responsibilities*." The agency noted their support for the approach taken by the Council in respect of Yellow bristle grass and looked forward to working with the Council on research, surveys, monitoring and control actions required to control the plant. Te Kaahui o Rauru welcomed the opportunity to provide early input to the development of a Proposed RPMP and Biosecurity Strategy and provided high-level comments supporting the Council's mandate to undertake pest management work. Te Kaahui o Rauru sought that the Biosecurity Strategy's vision include reference to protecting or enhancing cultural values and to integrate a Maaori world view.

Following the workshop meeting of 14 March, Council officers also forwarded the draft Proposed RPMP to other councils to peer review the Plan wording and rule structure to confirm compliance with the collective template and advice. The inter-regional consistency check found only minor inconsistencies and these have been resolved in the current version.

Pursuant to section 72 of the BSA the Council must be satisfied that, in the making of the Proposed RPMP, it has consulted with Government Ministers, local authorities, tangata whenua and other persons affected by the Plan.

Throughout the review to date, Council has given effect to that requirement. However, it is recommended that further consultation be undertaken in the form of publicly notifying the Proposed Plan and Biosecurity Strategy for public submissions. Although public notification of the Plan is not strictly necessary under the BSA, it is Council practice to widely canvas community views on pest management and provide the community with the opportunity to have input into the plan review process.

Set out below is an overview of three attached documents – the Section 71 Report, the Proposed RPMP, and the Taranaki Regional Council Biosecurity Strategy. Where applicable, legislative matters that require the Council's explicit consideration are highlighted, and discussed.

Section 71 Report

Attached separate to the Agenda is the Section 71 Report. The Council is required under the BSA and NPD to be cognisant of, and evaluate and document the benefits, costs, funding arrangements and adverse effects associated with the management of pests, prior to the notification of a proposed RPMP.

Sections 6 and 7 of the NPD sets out additional requirements in relation to and for determining the allocation of costs.

To inform its deliberations, the Council commissioned Wildlands Consultants Limited, an ecological consultancy company, to evaluate and summarise data on the known impacts of candidate 'pest' species with invasive characteristics of potential regional interest. Council

has also been working with other councils to develop sector guidance on the development of CBA methodologies in relation to common pests for which good neighbour rules are proposed. The findings and methodologies from that work are incorporated into the attached Section 71 Report.

The Section 71 report documents the benefits and costs analyses (CBAs) and cost allocations for the 18 candidate pest species. The report documents, in relation to each species:

- pest attributes and distribution
- qualitative and quantitative impact evaluations
- costs and benefits of two scenarios – no intervention versus the preferred intervention (i.e. eradication or sustained control), including assumptions
- an assessment of the risks of the preferred intervention not being successful in achieving Plan objectives
- an assessment of beneficiaries of the programme and exacerbators of the problem, including who should pay for the proposed management approach.

As far as is practicable, the report has monetarised the benefits and costs of regional intervention over a 50-year planning horizon. It is important to note that the cost-benefit analysis is only one part of the full assessment process, as there are other, non-monetarised benefits arising from the pest management programmes.

In summary, the Section 71 Report:

- confirms the proposed RPMP programmes have merit as a means of eradicating or effectively managing the species identified in the Proposed RPMP (section 71(c) of the BSA)
- identifies that each candidate pest species is capable of causing regionally significant adverse effects on the region's economic well being and/or on natural, social, cultural, recreational, tangata whenua, and animal welfare values as identified in section 71 (d) of the BSA
- confirms that for each pest "…*the benefits of the plan would outweigh the costs, after taking account of the likely consequences of inaction or other courses of action*" (Section 71(e))
- identifies the groups of persons required to meet the costs of implementing the Plan either as a beneficiary or exacerbator (Section 71(f)).

Pursuant to the NPD, the Council (as the proposer of the RPMP) must make its cost benefit report publicly available along with the Proposed RPMP.

Draft Proposed Plan

Attached separate to the Agenda is the Proposed RPMP.

As noted above, the Proposed RPMP sets out, for the next ten years, the regulatory framework for pest management in the region. The proposed RPMP is a fourth generation plan and is the 'rulebook' for 18 plant and animal pest species targeted for eradication or sustained control. It is an offence under the Biosecurity Act not to comply with Plan rules and requirements.

Eradication control programmes

The RPMP objectives for the eradication species are to completely eradicate them from the region. The cost of that control is borne by the Council in recognition that the benefits accrue to the region rather than individual land occupiers.

Through their inclusion as 'pests' in the Plan, Council can access Part 6 regulatory powers under the Biosecurity Act, such as entry onto land to undertake works to control these species. Eradicating any species is technically challenging but proactive action may avoid significantly added costs being accrued later on. The four proposed eradication species are:

- Climbing spindleberry
- Giant reed
- Madeira (Mignonette) vine
- Senegal tea.

Sustained control programmes

For 14 pest animal and plant species, the Proposed RPMP contains rules to maximize the effectiveness of control action by individual land occupiers of these species across the region. Sustained control programmes involve the Council undertaking compliance activities to ensure land occupiers are controlling a pest species to a level where they will not cause problems for their neighbours. Responsibility for, and the cost of, control rests with the land occupier.

Sustained control programmes in the Proposed RPMP contain two types of rules:

1. **good neighbour rules –** a new type of rule brought in by the BSA amendments that applies to both private and Crown land occupiers. These rules apply to all 14 Sustained Control Programme pests and require land occupiers to control the pest within a buffer distance from the boundary to address any 'spill over' effects of the pest on neighbouring values (subject to the adjacent land occupier also actively managing the pest)
2. **general or other rules –** apply to private land occupiers only (i.e. in accordance with the BSA they cannot be applied to the Crown). These rules apply an additional level of control that the community has determined is appropriate. They apply largely to pests having impacts on environmental values, plus Yellow ragwort, which has always had a high level of control in this region.

The fourteen species for which proposed rules apply are:

- Brushtail possums
- Giant buttercup
- Giant gunnera
- Gorse
- Kahili ginger
- Nodding and Plumeless thistle
- Old man's beard
- Common and purple pampas
- Variegated thistle
- Wild broom
- Yellow ginger

- Yellow ragwort.

For the aforementioned species, the Proposed RPMP largely builds on the existing rules, with the exception that the Plan now includes the new Good Neighbour Rules (which bind the Crown) and requirements relating to the control of Old man's beard now extend to infestations along the Kaupokonui Stream and Waingongoro River.

For rabbits, Argentine ants and Pink ragwort – for which rules currently apply – it is proposed that they be managed along with other harmful species through Council 'pathway', advocacy and site-led activities undertaken through the Biosecurity Strategy (refer to discussion below).

Council considerations for preparing and making a RPMP

Outlined below are the legislative requirements that Council must be satisfied are met as part of preparing and making a RPMP.

Content requirements (section 70 of the BSA)

The first step in the making of a regional pest management plan is the preparation of a proposal (i.e. the Proposed RPMP). Pursuant to section 70(2) of the BSA, Council must be satisfied that the Proposed RPMP sets out the following content matters:

- the name of the person making the proposal (refer section 1.1 of the Plan)
- the subjects of the proposal– meaning the 18 organisms specified as pests under the Plan
- the period for which the Plan will be in force (refer section 1.4 of the Plan)
- for each subject (or pest):
  - a description of its adverse effects, and the reasons for proposing a plan
  - the plan's objectives and the principal measures for achieving the objectives
  - the reasons why the plan is more appropriate than relying on voluntary actions
  - an analysis of the benefits and costs of the plan
  - the extent to which any persons, or class of persons, are likely to benefit from the plan or contribute to the creation, continuance, or exacerbation of the problems proposed to be resolved by the plan
  - the rationale for the proposed allocation of costs, any proposed levies, and whether any unusual administrative problems or costs are expected in recovering the costs allocated; (section 70(2)(a)-(c) of the BSA) (refer sections 6; 7 and 11, & appendices 1 and 3 of the Plan)
- other matters that must be included concern the effects of the Plan and the powers and rules it sets out; monitoring, compensation, funding, consultation, and how the Plan has documented compliance with the NPD (section 70(2)(d)-(v)) (refer sections 2.4; 2.6; 3.2; 8; 9 and 10 of the Plan).

A recommendation is presented at the front of this item that Members agree that they are satisfied that the section 70 content requirements for a proposal have been met.

Section 71 requirements

Under section 71 of the BSA, the second step in the making of a regional pest management plan is for the Council to be satisfied that:

- the proposal is not inconsistent with the NPD, other pest management plans on the same organisms, any pathway plan, regional policy statements or plans under the Resource Management Act 1991, or any regulation (refer discussion below)
- during the development of the proposal, all process requirements in the NPD were complied with (refer discussion below)
- the Proposed Plan has merit as a means of eradicating or effectively managing the organisms specified as 'pests' and that each 'pest' is capable of causing adverse effects on the region's economic well being and/or on natural, social, cultural, recreational, and animal welfare values as identified in section 71 (d) of the BSA (refer Section 71 Report)
- for each pest, "*the benefits of the plan would outweigh the costs, after taking account of the likely consequences of inaction or other courses of action*" (refer Section 71 Report)
- the groups of persons required to meet the costs of implementing the Plan (including the Council) – would either accrue, as a group, benefits outweighing the costs (the 'beneficiaries'), or that they are, as a group, contributing to the creation, continuance, or exacerbation of the problems proposed to be resolved by the Plan (the 'exacerbators') as required by section 71(f)) of the BSA (refer Section 71 Report)
- a requirement for adequate funding for the duration of the Plan and that each proposed rule both assists the achievement of the Plan's objectives and does not unduly trespass on individual rights (71(g)-(h)) (refer to proposal and discussion below)
- the proposed Plan is not frivolous or vexatious, and is clear enough to be readily understood (71(i)-(j) (refer to proposal and discussion below).

In the development of the Proposed RPMP, officers have implemented sector advice on the scope and content of a proposal to ensure alignment with the NPD and other pest plans. In particular, the Plan is consistent with NPD directions relating to the setting of objectives, programme descriptions and good neighbour rules. Officers have further reviewed proposed Plan provisions against other pest plans, regional policy statements, and plans and are satisfied that the proposal is not inconsistent with those policy instruments.

Members must be further satisfied that the proposal has merit in terms of pest impacts, the benefits and costs of intervention, and funding allocation.

As previously noted, the Section 71 Report confirms that the 18 pest programmes identified in the Proposed Plan are net beneficial. The Section 71 Report further identifies the beneficiaries and exacerbators and the rationale for the apportionment of costs. The Section 71 Report's findings are reflected in the Proposed RPMP. In brief, where there are eradication objectives the benefits are identified as a public good for which the Council will do the work on behalf of the regional community. For sustained control objectives, the costs of control largely lie with the land occupier with infestations. This reflects the land occupier being the principal beneficiary of the control and/or exacerbators of the problem. Council costs are associated with the implementation of an advisory, inspectorial, and compliance regime to maximise the effectiveness of individual control across the region.

A recommendation is presented at the front of this item that Members agree that they are satisfied that the section 71 requirements have been met.

Satisfaction with consultation or requirement of more consultation (Section 72 of the BSA)
Finally, if the Council is satisfied that the requirements of sections 70 and 71 of the BSA have been met, the third step in the making of a plan is for the Council to consider the consultation requirements of Section 72. They include:

- being satisfied as to whether, if their responsibilities or area are affected, that Ministers, local authorities, and tangata whenua have been consulted; or whether consultation with other persons is appropriate and has occurred (section 72(1))
- in considering whether other persons may need to be consulted with, the council must have regard to the scale of impacts on those persons, the degree and nature of consultation that may have occurred, and the likely level of their support or opposition (section 72(2))

As previously discussed, this Council has given effect to the requirements above, and is satisfied that sufficient and appropriate consultation has taken place. However, it is recommended that further consultation be undertaken in the form of publicly notifying the Proposed RPMP and Biosecurity Strategy for public submissions.

A recommendation is presented at the front of this item that Members agree to publicly notify the Proposed RPMP (and Biosecurity Strategy) for public submissions.

The Taranaki Regional Council Biosecurity Strategy

Attached separate to this Agenda is the Biosecurity Strategy. As previously noted the Biosecurity Strategy is a new **non-statutory** document.

As Members are aware, regulation is but a small part of the Council's overall pest management response. Most activities undertaken by the Council are discretionary. The Biosecurity Strategy therefore covers all of the Council's biosecurity activities and programmes relating to threats posed by harmful organisms, regardless of their 'pest' status. In so doing, it covers the Council's full suite of non-regulatory and regulatory pest management programmes and activities.

The Biosecurity Strategy relates to that part of the biosecurity system for which the Council has a mandate to be involved. Other players such as the Ministry for Primary Industries and the Department of Conservation have separate roles and responsibilities.

The Biosecurity Strategy seeks to address not only the 18 species for which rules and regulation are deemed appropriate (refer to previous discussion on the Proposed RPMP) but also the thousands of other harmful species that warrant different forms of intervention (ranging from advice, biological control, regulation, to the Council itself undertaking direct control).

Key features unique to the Biosecurity Strategy include:

- a vision for biosecurity in the Taranaki region, including principles and priorities that underpin the Council's biosecurity programmes and activities, including the *Proposed Pest Management Plan for Taranaki*
- increased focus on contingency planning and surveillance programmes to prevent new 'pests' that have significant impacts from entering the region

- a proposal to investigate expanding the Self-help Possum Control Programme to deliver and contribute to predator control for possums, rats and mustelids across 275,000 hectares
- increased focus on eradicating species not yet established in the region and for which eradication is technically feasible
- new programmes targeting pest control in urban areas to promote biodiversity outcomes
- continuing to work with others to support community pest initiatives and site-led programmes, including the Key Native Ecosystems programme and Wild for Taranaki's *Restoring Taranaki*,
- biological control for suitable harmful organisms already widespread in the region.

The Biosecurity Strategy represents a significant change in business for the Council. Over time, the Council has committed significant resources to the management of legacy (widespread and established) pests impacting on production and biodiversity values. However, through the Biosecurity Strategy, the Council is also seeking to develop initiatives and actions that target harmful organisms before they become a problem (recognising that other agencies also have responsibilities) and to better target Council responses to sites and places where they threaten particular values.

The overall aim of the Strategy is to identify Council actions that should help the region to become more resilient to pest impacts.

Next steps

Although public notification of the Plan is not strictly necessary under the BSA, it is suggested that the Proposed Plan and Biosecurity Strategy be released for public comment following the Ordinary meeting of 16 May 2017.

The deadline for submissions is proposed to be six weeks at which time officers can begin to analyse submissions and report back to Council.

It is noted that throughout the review process the rules of the current strategies continue to have effect.

Decision-making considerations

Part 6 of the *Local Government Act 2002* (planning, decision-making and accountability), has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks

including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Appendices/Attachments – separate reports

Document 1679033: *Proposed Regional Pest Management Plan for Taranaki*
Document 1698161: *Draft Taranaki Regional Council Biosecurity Strategy*
Document 1809440: *Impact Assessments and Cost-benefit Analyses for the proposed Regional Pest Management Plan for Taranaki*.

Agenda reports

Policy and Planning Committee, May 2017

Item 7

Proposed Regional Pest Management Plan (PDF, 1.1 MB)

Draft Biosecurity Strategy (PDF, 2.1 MB)

Pest Management Plan Impact Assessment & Cost-Benefit Analyses (PDF, 1.2 MB)