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Freshwater Submissions
Ministry for the Environment
PO Box 10362
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Submission on Action for Healthy Waterways

Introduction

1) The Taranaki Regional Council (the Council) thanks the Ministry for the Environment (MfE) for the opportunity to make a submission on the *National Policy Statement for Freshwater Management* (NPS-FM) and *National Environmental Standards for Freshwater Management* (NES) and the *Stock Exclusion Regulations* (SER) as outlined in the Ministry's discussion document *Action for healthy waterways*.

2) The Council makes this submission in recognition of its:

- functions and responsibilities under the *Local Government Act 2002* and the *Resource Management Act 1991* (RMA);
- the environmental regulator functions, responsibilities and costs to be incurred by the Council to implement the NPS-FM, NES and SER proposals;
- regional advocacy responsibilities whereby the Council represents the Taranaki region on matters of regional significance or concern; and
- experience having successfully implemented water quality improvements within Taranaki.

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 notes its concerns about the short time available for submissions with respect to such a substantial reform package, a concern exacerbated by the timing coinciding with local authority elections and the often inadequate information provided in the support package to enable considered choices consistent with Part 2 disciplines of the RMA.

5) The **Council requests a hearing** from the review panel.

Structure of submission

6) In making this submission the Council has provided feedback on the Taranaki context, the Essential Freshwater package generally, as well as feedback on the specific clauses in the NPS-FM and NES, which are in the attached table.

7) In particular, this submission comments on a number of matters and challenges that the Council foresees in implementing the Essential Freshwater package. They are grouped under the following headings/themes.

8) First, is the Taranaki context that sets the scene as to what are the freshwater challenges, trends and interventions already successfully occurring in the region.

9) Second, are the concerns that nutrient and sediment limits lack a credible basis, are out of line with overseas criteria, and would force a very substantial contraction of farming productivity, with consequential impacts on community wellbeing, for no clear benefit.

10) Third, is the socio-economic cost of adopting the Essential Freshwater proposals relating to the Waingongoro catchment, adopting nitrogen caps and the use of OVERSEER in a regulatory framework, and the compulsory preparation and auditing of freshwater modules in farm environment plans.

11) Fourth, is the perverse outcomes from universally restricting 'intensification' in regions experiencing low levels of intensification.

12) Fifth, is the technical challenges and questionable added costs associated with some of the monitoring requirements for freshwater attributes and wetlands set out in the NPS-FM and NES.

13) Sixth, is the concern of that stock-exclusion regulations would conflict with Taranaki's successful Riparian Management Programme, causing unnecessary costs and poorer freshwater outcomes.

14) Seventh, are general comments relating to Te mana o te Wai and the proposed new planning process for freshwater.

15) Eighth, are examples of a large number of drafting issues that need to be addressed so that councils can effectively implement the NES and NPS-FM and/or avoid perverse outcomes.

Executive summary

16) In general, the Council supports the Government's objective to improve the health of water bodies across New Zealand. However, the Council has significant concerns around specific aspects of the proposed new policies and regulations, and requests that the Minister for the Environment consider suggestions for amendments or alternative approaches to some of the proposed measures as a means to achieve better freshwater outcomes.

17) The Council's key messages from this submission are:

- One size does not fit all. Taranaki is unique in its geography and advancement in water maintenance and improvement programmes. Implementing much of the proposal would have

unpredictable and likely only marginal environmental benefits but significant perverse outcomes for community wellbeing.

- The proposal should focus on improving trends rather than setting limits. This would recognise and provide for natural differences throughout regions, and nationally, while halting the decline of water degradation. Regulation should only be used where there is a proven cause and effect and demonstrable benefit.

- For Taranaki there is no cost-benefit justification for the policies and regulation in the NES and NPS-FM, indeed the opposite applies.

18) The Taranaki region has, over time, collectively demonstrated strong commitment to improving freshwater health, taking carefully considered long-term action and spending millions of dollars on interventions of proven effectiveness. Good environmental results are becoming increasingly evident, including through independent assessment, and the efforts and good waterway health trends will be continued through measures already signalled to and agreed by the community's stakeholders in preparations for the next Regional Land and Water Plan.

19) The Essential Freshwater package includes comprehensive and complex proposals that on initial assessment raise many issues, notably:

- Nutrient and sediment limits lack a credible basis, are out of line with comparable overseas criteria, and would force a very substantial contraction of farming productivity for no clear benefit[1]

  Compulsory new bottom-line catchment limits are proposed for Dissolved Reactive Phosphorus (DRP), Dissolved Inorganic Nitrogen (DIN), and sediment. Our analyses to date suggest these limits take inadequate account of regional geology, do not recognise the multiple drivers of stream health across diverse geologies, hydrologies and landscapes. They also have not been shown to be either effective or efficient, are unnecessarily stringent even where their use as an intervention might in principle be justified. The limits would not be achievable across much of Taranaki's ring plain without damaging restrictions on many individual dairy farmers and municipal and industrial activities (with consequences for dependent industrial and commercial activities) and wider community wellbeing, for uncertain and at best marginal environmental gains. Exemptions outlined in the package are too narrow and would place a cost burden on communities to justify their application- a 'guilty until proven innocent' presumption.

- OVERSEER given a role it's not suitable for

  The proposed water quality limits and requirements to prepare farm plans would rely on the use of the OVERSEER farm-management tool. The Council supports farmers' use of OVERSEER as a farm-management tool offering guidance to help them identify best practices and reduce

[1] '[New Zealand's] *diversity in physical setting also results in a great diversity in catchments, and the waterbodies that they feed….the baseline or 'reference' conditions for measuring aspects of water quality vary between systems [rivers, lake, aquifers, wetlands] and between regions, depending on factors such as climate, hydrogeology, vegetation, soil composition and land use..*' from *New Zealand's fresh waters: values, state, trends and human impacts,* Q and A pg x, and Technical report pp 10-11, Office of the Prime Minister's Chief Science advisor, April 2017

inappropriate nutrient leaching. But the Council shares the view of many experts and authorities that OVERSEER is unfit for use as a regulatory tool, is highly inaccurate, remains unproven in many landscapes, and does not correlate with the state of the receiving environment. This view has been stressed by the Parliamentary Commissioner for the Environment, while the Environment Court has found that OVERSEER has 'notable limitations in a regulatory context'.

- Stock-exclusion rules override Taranaki's successes

  The proposals include new 'one size fits all' stock-exclusion regulations that would override the proven, successful, and much more comprehensive Taranaki Riparian Management Programme, for added cost, dubious gain, failure to address critical source zones in waterways (the headwaters and springs), and the generation of loss of credibility and confidence.

- Questions over farm and community viability and wellbeing

  The Government has not provided appropriate cost-benefit analyses so the precise extent of the impacts remain unclear. The Council has found the likelihood of a very adverse impact on the viability of many farms because of imposed reductions in fertiliser use and soil fertility (per constraints on both nitrogen and superphosphate usage), regardless of any suggestions of a compliance timeframe of 'a generation'. This would impact on the economic and social well-being of the wider community, urban as well as rural. The financial burden will not be spread equitably but would fall predominantly on those farming activities in wetter areas, regardless of the extent of adoption of good practice.

- Major costs for questionable gain – we're already making good progress with considered and sound substantial investments

  If adopted, the Government's proposals will impose major costs on the Taranaki region for unpredictable and probably only marginal freshwater-quality gains. The Council commissioned report *Assessment of the agricultural economic impacts of DIN limit proposal in Essential Freshwater package in Taranaki* (Appendix 3) indicated that the cost to reach the DIN bottom line proposed in the NPS-FM would exceed $100,000 per annum for 33% of farms and $50,000 per annum for 70% of farms. Taranaki's mountain-fed rivers are in the 'A' and 'B' bands for ecological health according to the Government's own measures. Their ecological health has, with only rare exception, been stable or improving over the past decade or more. In terms of swimmability, our rivers are mostly in good or excellent health at the places and times most people swim. The Council has a clear view based on evidence that the proposed national interventions are neither credible nor necessary with respect to Taranaki. Indeed, the Council notes the view expressed by the Prime Minister's former Chief Science Advisor, Sir Peter Gluckman*: 'Irrespective of any global goal that is set, most people want to know whether at any monitored site the water quality meets requirements for human and ecosystem health, and if it does not, that there is evidence of improvement over time.'*[2]

- Uncertainty over interpretation and application of the concept of Te Mana o te Wai

[2] *New Zealand's fresh waters: values, state, trends and human impacts,* Summary report, Office of the Prime Minister's Chief Science advisor, April 2017, pg xxvii

The proposed NPS-FM gives a fundamental pre-eminence to the concept of Te Mana o te Wai. The interpretation, policy incorporation, and implementation of this metaphysical concept sit uneasily within the established RMA framework and will inevitably cause confusion, uncertainty and frustration if given effect to in its existing vague form and framework. Extensive, careful and well-considered examination and explanation are needed in order to give proper recognition to this concept within an RMA regulatory tool.

Taranaki context

20) The Council seeks greater recognition of the local context when imposing national regulations. The Council is committed to maintaining and enhancing Taranaki's freshwater quality. Maintaining and improving water quality has been a successful focus of the Taranaki community for decades. Taranaki's communities require good quality water for their cultural, social, economic and environmental well-being. Hence, for many years, the Taranaki community has invested heavily in fit-for-purpose policies and work programmes to maintain and enhance our freshwater quality. Unlike other parts of New Zealand, the health of Taranaki's freshwater is indeed being maintained and improved through regulatory and non-regulatory programmes – as confirmed by extensive and long standing state of the environment monitoring (with independent review).

21) Taranaki is unusual in a recent New Zealand land use and freshwater context. Dairy farming is well established in Taranaki and it has not experienced the intensification seen in some other regions. For example, the total number of milking dairy cattle in 1998/1999 was 481,034 (nearly 15% of the nation's milking herd) and by 2013/2014 it was still only 493,361 (10% of the national herd). Likewise, stocking rates have hardly changed, from an average of 2.8 cows per hectare in 1998/1999 to 2.85 cows per hectare in 2013/2014. These are lower stocking rates than the national average. The pressures on land use are not increasing, and measures of water quality are trending in the right direction. The region is not facing an unmanaged crisis in water quality, quite the opposite situation is evident.

22) Over 300 rivers and streams radiate from Mount Taranaki across the ring plain. These are generally short, narrow, incised, cool, and fast flowing, and water leaving the Egmont National Park has usually reached the sea within 24 hours. High rainfall on the mountain generally means that most ring plain rivers and streams receive a steady flow of water with frequent intensive flushing. These natural features along with the recognised benefits of vegetated riparian boundaries mean that the ring plain rivers should not be judged by the ecological consequences of nutrient loads evident in other areas.

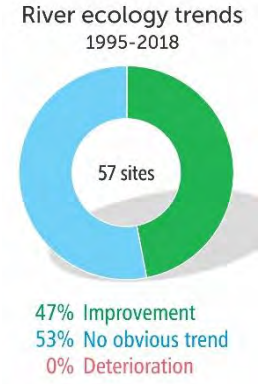
23) The Taranaki hill country is steep and prone to soil erosion and slipping, but managed properly can support both pastoral farming and commercial forestry alongside reversion to and regeneration of native bush. Hill country rivers have short tributaries contained by narrow valleys and invariably carry high sediment loads because of the soft sandstone and siltstone geology and intensive rainfall. The water quality issues in the hill country are different from the ring plain in that sediment is the main attribute requiring management.

24) The maintenance and enhancement of our freshwater quality has not occurred by accident. For decades the Council has used its internationally recognised voluntary programmes, proactive compliance monitoring programmes, and strict regulatory enforcement to ensure that freshwater quality, which was degraded up to the 1980's, is now generally a source of pride for the Council and Taranaki communities. The Council's programmes have been developed in close consultation with

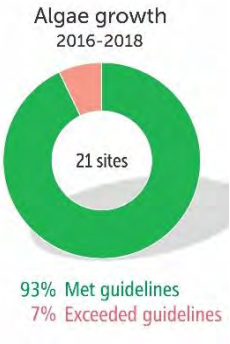
the community over many years and reflect widespread community support and aspirations. As expressed in its preparatory work for its draft next generation Regional Land and Water Plan, the Council and stakeholder groups are pursuing further gains in stream health.

25) The Council and indeed the Taranaki community is therefore demonstrably supportive of the intent of the proposed NPS-FM, NES and SER.

26) Taranaki has two long running large scale non-regulatory water protection and enhancement programmes – its riparian management programme and hill country sustainable land management programme. These programmes focus on tailored interventions that contribute to making the greatest cost beneficial improvements in water quality for the location and relevant water quality pressures. Both programmes have been running for over 25 years and focus strongly on farm management plans as the basis of driving actions to improve water quality. They have both been very successful in this regard.



27) The Taranaki Riparian Management Programme focuses on fencing and planting every waterway and wetland on the intensively farmed ring plain and coastal terraces. This is an area of approximately 230,000ha, of which approximately 80% is in pasture with the remainder being mainly indigenous vegetation. Since the 1990s, landowners and farmers on the Taranaki ring plain and coastal terraces have voluntarily protected rivers, streams and wetlands with strong individual encouragement from the Council. The riparian management programme has resulted in 99.9% (2,889) of Taranaki dairy farms having riparian management plans. The plans cover 15,916 km of streambanks. Of this, 13,863km (87.1%) is currently protected by fencing and 9,156km (75.2%) is currently protected by vegetation. Annual progress under the programme is accelerating towards substantial completion within 5 years. The Council has publicly stated its intention to regulate its riparian management programme through its resource management plan provisions and this will capture those few farms yet to implement plans and ensure ongoing compliance for those who have completed their programmes.



28) The Taranaki hill country sustainable land management programme focuses on achieving sustainable land management practices in the steep eastern hill country of the region. This is an area of approximately 400,000ha, of which more than 70% is indigenous vegetation, 10% exotic forestry, and the remainder pastoral farm land. The Council has worked with landowners to prepare over 450 farm plans covering over 200,000ha. Farm plan recommendations, which are principally based on detailed land use capability assessments, include actions focused on reducing erosion, including – exotic and indigenous forestry planting, permanent land retirement, fencing and poplar pole planting. Much progress has been made with 90% of farm plan

recommendations having been implemented in whole or in part. Long term monitoring of sustainable land use shows that 87% of the hill country is currently being sustainably managed as identified by Landcare Research.

29) The riparian and hill country programmes proves the value of a bottom-up approach that emphasizes winning support from the community in question, as the first stage towards effective intervention.

30) Through the Council's own peer reviewed data, independent scientific analysis and expert accounts we know that Taranaki's approach to freshwater management is producing the desired environmental outcomes. Professor Bruce Clarkson (Deputy Vice-Chancellor Research, University of Waikato) has stated that *"… Taranaki is on a trajectory, which puts it at the forefront of a more sympathetic and intergenerational approach to land and water management. This comes in the form of regenerative and sustainable agricultural practices and landscape scale ecological restoration"* (Transforming Taranaki, 2019 – Appendix 1). NIWA's and the Council's own monitoring data show that Taranaki's rivers and streams are at, or near, the best ecological health ever recorded. Taranaki's river ecology trends (1995-2018) at 57 sites show that 47% of sites are improving, 53% have no obvious trend and none are deteriorating. NIWA have independently concluded that the *"landscape scale restoration …of the Taranaki Riparian Management Programme has had beneficial effects on stream health and water quality for human health and recreation in the region…"* (Analysis of stream responses to riparian management on the Taranaki ring plain, NIWA, 2008 www.bit.ly/RiparianReport2018)

31) The Council therefore cannot find justification for further nationally imposed regulation-based interventions that enshrine a one-dimensional approach to improving stream health (i.e. by manipulation of nutrient concentrations), when a demonstrably effective alternative (based on bespoke management, hands-on delivery, mitigation of multiple drivers of stream health, and most of all community buy-in) is already in place achieving the results desired. This more bespoke, targeted approach to having effective interventions, right down to the farm scale, is consistent with current international trends in land and water resource management.

32) The Council also has a long and effective history of intentional and proactive compliance, monitoring and enforcement (CME). A December 2018 report by The Catalyst Group *Independent analysis of the 2017/2018 compliance monitoring and enforcement metrics for the regional sector* showed that the Council had the most full time equivalents of CME staff of any regional council in New Zealand. CME staff undertake proactive monitoring of a range of resource consents including all discharge consents. When the high standards set by the Council and the community are not met, the Council takes enforcement action. In the five years to 30 June 2019, the Council issued 996 abatement notices (920 for water related infringements), 411 infringement notices (313 for water related infringements) and initiated seven successful prosecutions (five for water related infringements). Because of this, the Council has a very high full compliance rate of 94.2% compared with a national average of 71.1% (the Catalyst Group, 2018).

33) The 2019 audit of Taranaki Regional Council by the Controller and Auditor-General (OAG)[3] also found that the Council had strong regulatory approach noting that "*Taranaki Regional Council was particularly active…in providing good support and useful information to help users understand their obligations under the Resource Management Act, plan rules and resource consents…* "(pg 61).

[3] *Managing freshwater quality: challenges and opportunities, Controller and Auditor-General September 2019*

"…Taranaki Regional Council …. have comprehensive dairy compliance monitoring programmes and monitor all dairy farm consents annually…Taranaki Regional Council includes how much contact staff have with consent holders in staff performance measures. This helps ensure regular contact" (pg 64). *"We were satisfied with Taranaki Regional Council's approach. Its rigorous approach helps maintain the integrity of its overall environmental management model. It also shows that being strong and effective environmental regulator does not preclude having healthy and co-operative relationships with land owners"* (pg 65*). "Taranaki Regional Council's healthy relationships with farmers enables it to maintain a strong approach to compliance while working alongside them to implement its voluntary riparian management programme"* (pg 65). *Taranaki Regional Council has a strong approach to regulatory enforcement that includes warranting its compliance team and empowering it to issue abatement notices on-site.*

34) Given that stream health across the region is already good by national measures, the imposition of a national-level framework involving further consenting and compliance-based performance would offer marginal added value at high administrative cost and diversion of resources from practical stream health enhancement.

35) The Council is very concerned that aspects of the Government's proposal (such as the requirement to reach stringent dissolved inorganic nitrogen (DIN),dissolved reactive phosphorus (DRP), and sediment attribute limits) will divert the Council's and community's resources away from scientifically proven successful initiatives to those that, while well intentioned, are very expensive and not likely to achieve significant environmental gain.

36) In September 2019, the Office of the Auditor-General report *Managing freshwater quality: Challenges and opportunities* was released. Importantly, the Controller and Auditor-General noted that he was "*…concerned that there is not enough information about freshwater at a national level to prioritise efforts on a national basis. Decision-makers do not have the information they need to prepare a national approach or long-term strategy to this significant environmental issue*." Given this strongly worded statement, the Council is concerned that the Government is rushing through a national proposal which could undermine both the effective work achieved in Taranaki at a regional level and the goodwill of a community dedicated to achieving enhanced water quality.

37) The Council has continually tested the effectiveness of its interventions against recognised science, ongoing monitoring of both uptake and outcomes, and independent audit. On the other hand, the Council notes with concern the above comments of the OAG, concerns which are reinforced when the STAG's own recommendations are noted-'*Recommendation 15: undertake urgent work to fill the identified knowledge gaps which currently constrain our ability to effectively manage freshwater and the health of freshwater ecosystems….we are particularly concerned that the current framework for freshwater management has important gaps relating to…applied science to describe what is required to lift ecosystem health to meet community objectives and support adaptive management'*[4].

General comments

38) The Council supports the Government's goal of maintaining and enhancing freshwater quality across New Zealand, and indeed Taranaki has been following that pathway for more than three decades already.

[4] *Freshwater Science and Technical Advisory Group: Report to the Minister for the Environment June 2019* Pp47-48

39) Notwithstanding that support, the Council is concerned that the Government has had insufficient regard to social and economic costs of their proposals, that the underpinning scientific rationale for key aspects of the proposal is poorly defined if not highly selective, and that the Government has had insufficient regard to the capacity of the sector (and others) to deliver.

40) The Council also acknowledges the submission from Local Government New Zealand and broadly supports their 'Solutions' where they align with the relief sought in this submission.

Dissolved Inorganic Nitrogen Limits (NPS-FM – Appendix 2a)

41) The Council strongly opposes the use of dissolved inorganic nitrogen (DIN) as an attribute requiring nationally applicable compulsory limits. There is a demonstrably poor correlation in Taranaki between nutrient concentrations and instream ecosystem health (and anticipated instream effects). Indeed, this has also been emphasized by the Prime Minister's former Chief Science Advisor, Sir Peter Gluckman: '[*D]etermining acceptable level of nitrogen and phosphorus is complex because different situation (eg light/shading, river flow regimes, river bed type, lake type) influence the response of algae and lead to one or the other nutrient being the limiting factor for the growth of plants and determining the trophic state'*[5]. Sir Peter went on to point out the need to establish *'**locally-relevant objectives** for water quality and ecosystem health. The differences in waterbody character greatly influence management actions and their outcomes'*[6] (emphasis added).

42) He further pointed out '*These dynamics, and between-river variations in other influences including flow regimes, shade (and water temperature), bed stability, and grazing by benthic herbivores, lead to high variation in nutrient/periphyton relationship (Larned, 2010) and high uncertainty in statistical models used to predict periphyton biomass from these combined influences (Snelder et al, 2014). As a consequence, location-specific studies and location-specific nutrient targets are needed to effectively manage periphyton. This is very complex and difficult from a management perspective*[7]. In discussing whether nutrient limits can control eutrophication, Sir Peter noted that *'given that trophic status can vary spatially and temporally due to a number of dynamic factors including climate, flow, geology, soil composition, and biological processes, this is now considered to be overly simplistic*[8]*'*.

43) The Council's analysis of freshwater monitoring data indicates that around two-thirds of all the waterways on the southern ring plain around Mt Taranaki fail the proposed DIN national bottom line, yet with little to no eutrophication effects in our waterways and generally good to excellent instream ecosystem health. For example, only two of the 11 sites in the Taranaki region for which both chl-a and nutrient data are available, meet both of the proposed DIN and DRP bottom lines. Yet every site lies in the 'A' band for the effect being controlled, that of chl-a in periphyton as a measure of trophic state. Our experience from our own data sets is that there is a poor correlation between nutrient concentrations and macroinvertebrate scores This reflects the complex nature of ecosystem health

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[5] *New Zealand's fresh waters: Values, state, trends and human impacts*, Summary report, Office of the Prime Minister's Chief Science Advisor, April 2017 pg xxvi

[6] *New Zealand's fresh waters: Values, state, trends and human impacts*, Technical report, Office of the Prime Minister's *Chief Science Advisor, April 2017, pg 11*

[7] *Ibid,* pg 50

[8] *Ibid,* pg 49

with multiple drivers all working in differing ways in different locations. The Council's analysis and observation has been independently verified by NIWA[9].

44) On the other hand, the cautionary note expressed by MfE's consultants should be given full recognition:

"*…It is generally recognised that nutrient concentration criteria are highly site specific* (Biggs, 2000; Snelder, 2018). *A recent analysis suggests that total nitrogen concentrations that are consistent with the periphyton bottom line vary spatially between approximately1 0.2 to 3.5 mg* L^{-1} (Snelder, 2018).

A key assumption in this analysis was that periphyton bottom lines would be achieved purely by managing instream nutrient concentrations. This is a conservative assumption (i.e. it maximises the impact of the current NPS-FM requirements) because measures other than nutrient concentration management can contribute to achieving periphyton objectives. Stream shading may be a more effective measure for achieving the periphyton bottom lines in many, particularly small, streams and rivers. Stream shading may reduce the need partially or wholly to reduce instream nitrogen. In some situations it may be possible to manage periphyton biomass by managing river flows, for example where additional flushing flows can be provided from hydro power facilities. However, it is expected that nitrogen load reductions are the most generally applicable method of managing periphyton biomass."[10]

45) The Council notes that at numerous public meetings and through the media the Ministry for the Environment (MfE) staff and the Minister for Agriculture have stated that tighter controls over nitrogen leaching were to the betterment of agriculture as it serves our international reputation. However, internationally, the use of DIN or nitrate criterion for management of freshwater ecology has been considered and found wanting due to lack of scientific validity. This includes the United Kingdom Technical Advisory Group (UKTAG) who provides instruction to the Government on the Water Framework Directive (which requires the setting of biological and physico-chemical standards necessary to protect and enhance the country's waterways). All standards set by the UKTAG are intended to support at least good ecological status (ecological status can be categorised as high, good, moderate, poor and bad). In respect of DIN/nitrate, the UKTAG found:-

"…Although nitrogen may have a role in the eutrophication in some types of freshwaters, we consider the general understanding of this to be insufficient at present for it to be used as a basis for setting standards or conditions. The possibility is too strong that the statistical associations produced by these methods would represent correlation between nitrogen and phosphorus (and other factors), and not the standards for nitrogen that are truly needed to protect the biology. For these reasons no standards for nitrogen are proposed in this report."[11]

[9] *Analysis of stream responses to riparian management on the Taranaki ring plain*, NIWA March 2018, pp29-30

[10] *Essential Freshwater: Impact of existing periphyton and proposed dissolved inorganic nitrogen bottom lines,* September 2019 Ministry for the Environment

[11] *UK Environmental Standards and Conditions (Phase 1),* April 2008, WFD UK TAG Pg 31. A subsequent revision of nutrient limits in 2014 did not see fit to introduce any DIN/nitrate standard.

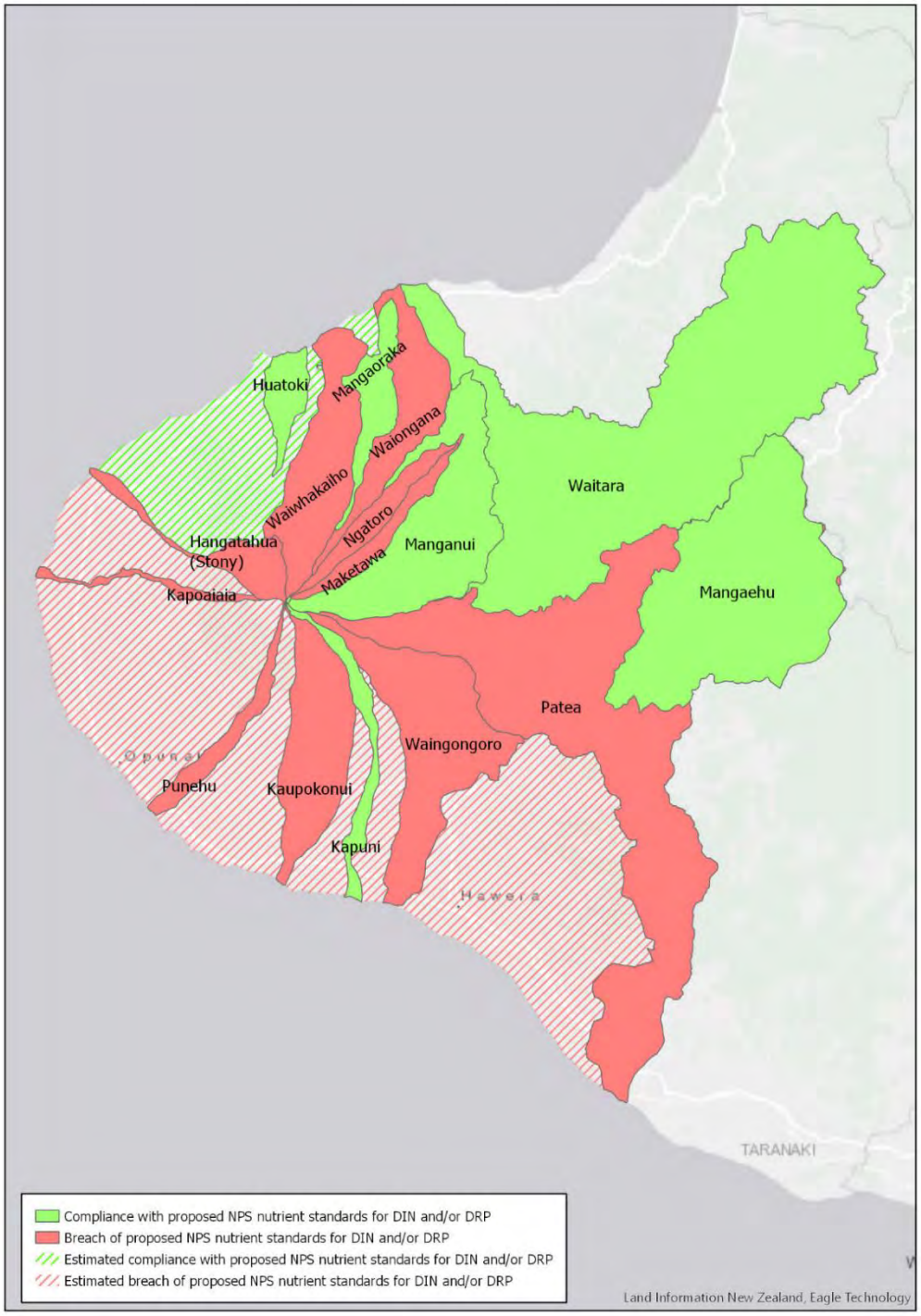

Figure 1 Catchments in Taranaki monitored for nutrients, showing compliance or non-compliance with proposed nutrient standards

46) Considering that DIN is not widely recognised internationally as a valid indicator of freshwater ecological condition, the Council is questioning why the Government is setting compulsory limits which are not well-supported outside New Zealand and will not necessarily have ecological benefits. This only serves to engender criticism of ourselves and from others for not meeting a standard – albeit one the Government has invented.

47) Appendix 2 of this submission provides further details supporting the Council's discussion in relation to DIN.

Economic Impacts of Dissolved Inorganic Nitrogen Limits

48) The Council notes that should the Government persist with their proposals to apply the proposed DIN limits, the social and economic consequences in Taranaki are likely to be severe as farmers will need to change their land use, amend their land use practices, reduce stocking rates, and absorb substantially increased compliance costs. Surprisingly, given the questions around the scientific validity of using DIN limits to drive freshwater quality improvements, the Government has undertaken no meaningful analysis of the social and economic costs of their proposals, particularly with reference to regional and local scales.

49) Unfortunately, the 6-8 week consultation period on the Essential Freshwater proposals limits the Council's opportunity to undertake its own social and economic analysis of the consequences of the entire *Action for healthy waterways* package. However, the Council has commissioned Simon Harris of Land Water People to prepare an *Assessment of the agricultural economic impacts of DIN limit proposal in Essential Freshwater package in Taranaki*. This work is built on previous analyses conducted by Mr Harris on the Taranaki situation commissioned by the Council in the earlier development of Taranaki's freshwater plan proposals.

50) Harris modelled three alternatives for reducing DIN concentrations in receiving waters to deliver the proposed DIN bottom line;- (i) an equal proportional reduction for every farm on the southern ring plain of Taranaki; (ii) a single and universal N cap; and (iii) conversion of dairy farms to forestry. This report is provided in-full as Appendix 3 and the key points are listed below:

- To achieve the N loss reductions in south Taranaki, manageable land uses (land use that can alter its N loss, such as farming, as opposed to land uses that cannot such as forestry and conservation forestry) must reduce N loss by 46%.
- If using the N cap approach, the N cap for south Taranaki would be 27.2 kilograms of N per hectare.
- The costs to achieve these reductions would exceed $100,000 per annum for 33% of farms and $50,000 per annum for 70 percent of farms.
- This is likely to involve large scale changes to affected catchments, and substantial disruption to the existing structure of farming and the community.
- To achieve reductions in N losses of approximately 50%, dairy farms are likely to have to make major changes to the farm system, such as moving all stock off pasture to herd homes and the capture of all effluent.
- The average debt to equity ratio for Taranaki farms in 2017/18 was 53%. In this year the average farm also made a loss and a return on equity of -8.4%.
- Approximately one quarter of farms are vulnerable to a sustained decrease in operating profit. A 46% N loss reduction could result in a 33% reduction in operating profit with land values likely to decrease by a similar amount. Such a decrease would result in a significant proportion of Taranaki farms becoming insolvent.
- The overall mitigation cost of the DIN limit for south Taranaki farms is estimated to be in the order of $46-$60 million per annum.

- To achieve the DIN limit through conversion of land uses, large parts of the southern Taranaki ring plain (up to 30,000 hectares or 32%of the area) will need to be converted to forestry and lost to dairying.
- Conversion to forestry represents the lowest N mitigation cost when returns from greenhouse gas emission absorption are included. However, it relies on a continued robust market for forest products and NZ Units, which is not guaranteed if large scale conversion to single species (radiata) forestry occurs.
- In the N cap approach, there are properties in high rainfall areas which will need to reduce losses by over 80%. This could only be achieved by conversion to forestry or retirement of the land.
- The socio-economic impact to Taranaki region is expected to be substantial, particularly in the rural areas affected and for local businesses and communities that provide support services to dairy farms. Taranaki will typically expect to see falling populations in affected areas, loss of scale for services providers, and flow on impacts into the regional towns of Stratford, Hawera and New Plymouth. Household incomes of business owners and their employees will be affected, the impacts will extend into businesses that are not directly related to the agriculture sector. Conversion to forestry would result in reduced local population and associated impacts on local businesses, schools, clubs and community organisations, and a resulting reduction in health and other community services.
- For specific areas and farmers, the effects of the Essential Freshwater package will be in the same order of magnitude as the last rural downturn in the 1980s – 1990s.

51) The Council notes that the finding from the Land Water People report are broadly consistent with the three economic impact reports on the *Action for healthy waterways* package commissioned by DairyNZ[12] [13] [14]. Further, the Council notes that all these economic reports relate only to dairy farming. The impacts on hill country farming are likely to be equally significant.

52) The Council requests the Government to reconsider imposing DIN and DRP limits. Again we highlight that the major impacts on Taranaki's dairy farming industry with spill-over consequences to the regional economy are unlikely to yield any more than marginal gains in ecological benefits as for most measures of ecosystem health the affected catchments already have A or B ratings.

<u>Relief sought:</u>

a) That DIN limits be removed from the NPS-FM;
OR
b) That Taranaki be excluded from any requirement to meet DIN national bottom lines;
OR
c) That the DIN national bottom line only apply to those regions where there are proven ecological health problems and these have been proven to be caused by DIN.

[12] *Economic impacts of the Essential Freshwater proposals on New Zealand dairy farms,* Dr G Doole, October 2019

[13] *The economywide effects of proposed environmental policies,* Sense Partners, October 2019

[14] *Regional and National Impacts of Proposed Environmental Policies on the New Zealand Dairy Sector*, Infometrics, October 2019

Dissolved Reactive Phosphorus Limits (NPS-FM – Appendix 2a)

53) The Council opposes the use of dissolved reactive phosphorus (DRP) as an attribute requiring limits.

54) The Council's analysis of freshwater monitoring data indicates that around three-quarters of all the waterways on the entire ring plain around Mt Taranaki would fail the proposed DRP national bottom line, by up to 280%; this is despite DRP levels in Taranaki being lower than in most intensive dairying regions.[15]

55) The Council notes that the proposed NPS-FM bottom line for DRP is much more stringent than that applied within Europe. For example, **the UK threshold for 'good' ecological condition is 2-3 times higher than that proposed in New Zealand for its new 'bottom line'.**[16] Many sites in the UK which achieve the UK's highest ecological condition rating would fail to meet the proposed New Zealand bottom line. Given that the Government is stating that they wish to achieve similar ecological objectives as for the UK, a fair assumption would be that the desired attributes and limits would be comparable. However, by comparison, New Zealand's proposals are extreme, without rigorous scientific justification. They would unfairly condemn a large portion of rural New Zealand to failure or substantial cost – without achieving any predictably significant net environmental gain.

56) Statements by the Prime Minister's former Chief Science Advisor, Sir Peter Gluckman, provide an important context in considering whether limits are justified, and if so, at what level they should be pitched: '*All consumptive uses of water have some impact on the freshwater environment, even where water recycling is involved*[17] *… Even where restoration has occurred, this is generally not to the original state, nor can it be, given the fact that humans and terrestrial mammals are only recent arrivals*[18] *…it is inevitable that fresh water quality has changed since humans arrived in New Zealand…This knowledge should help support realistic expectations about what can be done, given the context of a country that has a very different human, animal, and land-use profile to what existed 200 years ago*[19].

57) The cautionary note expressed by the UKTAG in 2014 should be given full effect:

"*…This approach is designed to take account of the natural variation of nutrient concentrations along rivers and site-to-site differences in the ecological response to elevated concentrations….the proposed standards represent a major step forward in matching nutrient concentrations to ecological change. However, it is also clear that factors other than those taken into account in the method for setting the standards can affect the extent to which water plants at any individual sites respond to a given nutrient*

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[15] *Nitrogen and phosphorus in New Zealand streams and rivers: control and impact of eutrophication and the influence of land management,* New Zealand Journal of Marine and Freshwater research 2009 Vol 43 pp 985-995, RW McDowell, S Larned, and DJ Houlbrooke. Available at https://www.tandfonline.com/doi/pdf/10.1080/00288330909510055

[16] *Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment* May 2014, DEFRA pp18-19

[17] *New Zealand's fresh waters: Values, state, trends and human impacts*, Summary report, Office of the Prime Minister's Chief Science Advisor, April 2017, pg xix

[18] *Ibid*, pg xxxv

[19] *New Zealand's fresh waters: Values, state, trends and human impacts*, Technical report, Office of the Prime Minister's Chief Science Advisor, April 2017, pp 2-3

concentration…the proposal is not to seek costly action to reduce phosphorus concentrations at individual sites without appropriate ecological evidence of nutrient-related impacts."[20]

58) It is understood that the Government's intention is to improve ecosystem health. However, as is proven by Taranaki's example, lower DRP limits do not correlate with better ecosystem health measures - for most measures of ecosystem health the affected catchments already have A or B ratings.

59) The Council notes and supports Section 3.23 of Subpart 4 of the proposed NPS-FM allowing for exemptions from having to meet national bottom lines when a council is setting target attribute states for a water body or part thereof, and the effect of naturally occurring processes is to make even the national bottom line unattainable. Exemptions may be appropriate for Taranaki, noting that the volcanic rock and soils of Mount Taranaki and the surrounding ring plain have naturally high concentrations of phosphate, which by virtue of natural cycling of forms of phosphate will continually release DRP into interstitial (pore) water within the soil structure, and by subsequent transport into waterways. Even in very close proximity to the boundary of the Egmont National Park, DRP concentrations are close to or above the proposed national bottom line for DRP. Therefore it is eminently sensible to apply an exemption.

60) The Council supports having exemptions, in principle, but would first seek that DRP limits be removed from the NPS-FM. As a matter of principle, the onus should be on the Government to prove the necessity and justification of a universally imposed intervention, rather than on the Council and community to prove (and be burdened with the cost of proving) that an imposed regulation is in fact unwarranted and superfluous.

61) For the record, the Council notes that it continues to pursue measures of proven effectiveness that will reduce loss of DRP to waterways from pastoral areas. Completion of the region's stock exclusion and planting programmes along all waterways, together with the diversion of substantially all discharges from dairy shed effluent from waterways to land irrigation, is estimated to achieve a 35% reduction in DRP over current loadings. The gross investment cost to the farming community of the entire effluent diversion and riparian management programmes from their commencement more than 25 years ago to completion within a few years, will be in the order of $287 million (current value), with multiple water quality, stream health, biodiversity, and aesthetic benefits.

62) In terms of the simple practicalities of options for reducing DRP further in order to meet the proposed limit, the only obvious choice is to deliberately mine the existing concentrations of DRP within the soil - that is, strip the soil of its fertility and productivity, in order to move a small way towards a limit that requires reductions to one-third of existing levels

63) Further, the Council has already become aware of a perverse outcome from the NPS-FM proposal for stringent DRP limits: the Council is fielding enquiries from industries that rely on phosphate-based chemicals for anti-corrosion water treatment in cooling tower and boiler systems, such as the region's power stations. Such chemicals inevitably end up in frequent or continuous discharge to waterways via blow-down discharges. Given the priority given in the NPS-FM on reducing DRP in receiving waters, the companies are considering switching to zinc-based dosing regimes to demonstrate good environmental stewardship and awareness. Given the known acute and chronic toxicity of zinc (or alternatives such as copper-based anti-corrosion matrices) to aquatic life at

[20] *WFD*, Pp18-19

extremely low levels, and widespread existing low-level zinc contamination of waterways through urban and rural runoff, the NPS-FM driven incentive for industries to switch away from sources contributing phosphate is blinkered and poorly considered.

64) Appendix 2 of this submission provides further details supporting the Council's discussion and relief sought in relation to DRP.

Relief sought:

d) That DRP limits be removed from the NPS-FM;
OR
e) That Taranaki be excluded from any requirement to meet DRP national bottom lines;
OR
f) That the DRP national bottom line only apply to those regions where there are proven ecological health problems and these have been proven to be caused by DRP.

Waingongoro River (NES – Schedule 1)

65) For the reasons already discussed above the Council questions the Government's approach of fixating on high N levels when identifying Schedule 1 'at risk catchments' in the NES-FM. There are 23 attributes for freshwater quality and, as previously discussed, DIN is found to be a poor attribute for use as an indicator of ecosystem health within the Taranaki region

66) The Waingongoro catchment is one of those identified as a 'schedule 1' river in the proposed NES and therefore one of 13 catchments flagged for more rapid management changes than the rest of the country. The discussion paper alludes to MfE and DOC's combined expertise about freshwater biodiversity, ecosystem health, and land use intensification that has resulted in the co-development of a model (page 82) that presumably has resulted in 'at risk' catchments being identified. However, this expertise/modelling disregards 'real' instream conditions of the actual stream health.

67) It is the Council's understanding that the "impacts" that the NES and NPS-FM are trying to address are poor macroinvertebrate community index scores, poor periphyton states, poor ammonia and nitrate toxicity states and poor oxygen levels. However, state of the environment monitoring results for the Waingongoro River clearly shows generally good to excellent instream health as measured by macroinvertebrates, periphyton, and chlorophyll-a. Macroinvertebrate community index scores are showing significant improving trends. In fact, the Waingongoro River is one of Taranaki's fastest improving rivers and this has been achieved through riparian management and a reduction in point source discharges.

68) As an aside, it is observed that in terms of suitability for recreational use during the 2018/2019 bathing season, the Council's mid-catchment site recorded 100% compliance with the 2003 MfE/MoH guidelines, while the lower site (just above the marine influence) recorded over 90% compliance across all samples. Further, cyanobacteria levels remained below guidelines at all times at both sites.

69) LAWA's 'River of the Month' video below explains the success the Council and the Waingongoro community have had in improving the river.

70) The Council commissioned Simon Harris from Land Water People to assess the economic impacts of the Government's DIN proposals. In his report, *Assessment of the agricultural economic impacts of DIN limit proposal in Essential Freshwater package in Taranaki*, attached as Appendix 3, he noted the following impacts regarding the use of the Option 1 interim N Cap for the Waingongoro catchment:

- The requirement for all farmers to reduce N losses to the 75th percentile of all losses in the Waingongoro catchment will mean that all farms will have to be at or below 58 kilograms of N per hectare.
- The Waingongoro catchment's land use is largely in dairy farms with most of the land in higher rainfall areas (>1500mm).
- 25 percent of properties in the Waingongoro catchment will be affected and this would result in approximately a 10 percent reduction in N losses for the catchment.
- The total estimated cost of meeting the interim N cap for the catchment is $1.16 million per annum. This is an average of $30,000 per affected property. Some properties will experience costs exceeding $100,000 per annum.
- There will be practical difficulties in implementing the required changes in such a short period.
- The reduction in profitability and associated reduction in land values would appear to have the possibility of rendering numerous farms insolvent.

71) As an aside, it is widely recognised that the Waingongoro catchment contains some of New Zealand's (and internationally) best 'dairying' country. It is the home of New Zealand's export dairy industry.

72) It is illogical to deem this catchment as a 'degraded' catchment in need of immediate national-level intervention and to require that farmers endure immediate, added significant and unwarranted costs, to achieve an ecosystem health level that has already been achieved and will be further enhanced through the programmes and measures already underway and of proven effectiveness.

Relief sought

g) That the Waingongoro River be removed from the Schedule 1 of the NES;
AND
h) That the Government re-visit its approach of identifying 'at risk' catchments to focus on evidence-based water quality issues and outcomes.

Nitrogen Cap and use of OVERSEER (NES – Subpart 4 & others)

73) The Council is opposed to the proposal to use nitrogen caps requiring the use of OVERSEER as a regulatory tool. Our concerns exist both for the formulation of nitrogen caps in the Schedule 1 catchments and if nitrogen loss caps were to be more widely imposed.

74) The designation of OVERSEER as the obligatory regulatory tool, (either explicitly in the NES Schedule 1 catchments or implicitly elsewhere in the NES) by which farmers must calculate their diffuse losses of *E coli*, nutrient, and sediment to the wider environment, and by which councils must determine the magnitude of drivers of offsite effects and must regulate farmer practice, is opposed in full. The Council's analysis shows that OVERSEER use within regulation in the context of the proposed nutrient, sediment, and *E coli* limits will impose high additional individual on farm costs, and hence the community, with little or no demonstrable environmental benefits for our receiving waters, create a sense of inequity and frustration, and bring the credibility and integrity of the proposed NPS-FM into disrepute.

75) The Council's concerns, and those of many other authorities and experts, including the Parliamentary Commissioner for the Environment, are set out in Appendix 2. It is illogical that at the same time as the Government has announced major funding to review the OVERSEER model, it is simultaneously making its use compulsory in short order – with no certainty that that the plethora of issues relating to OVERSEER's use in regulatory framework can, or will, be able to be addressed. OVERSEER cannot be acceptable as a tool of regulation under such circumstances

76) A regulatory tool must be able to be to demonstrate, beyond reasonable doubt, its association with an environmental outcome. OVERSEER, as a model is unable to do this so regardless of how much money is spent upgrading it, OVERSEER will fail to meet the legal burden of proof requirement.

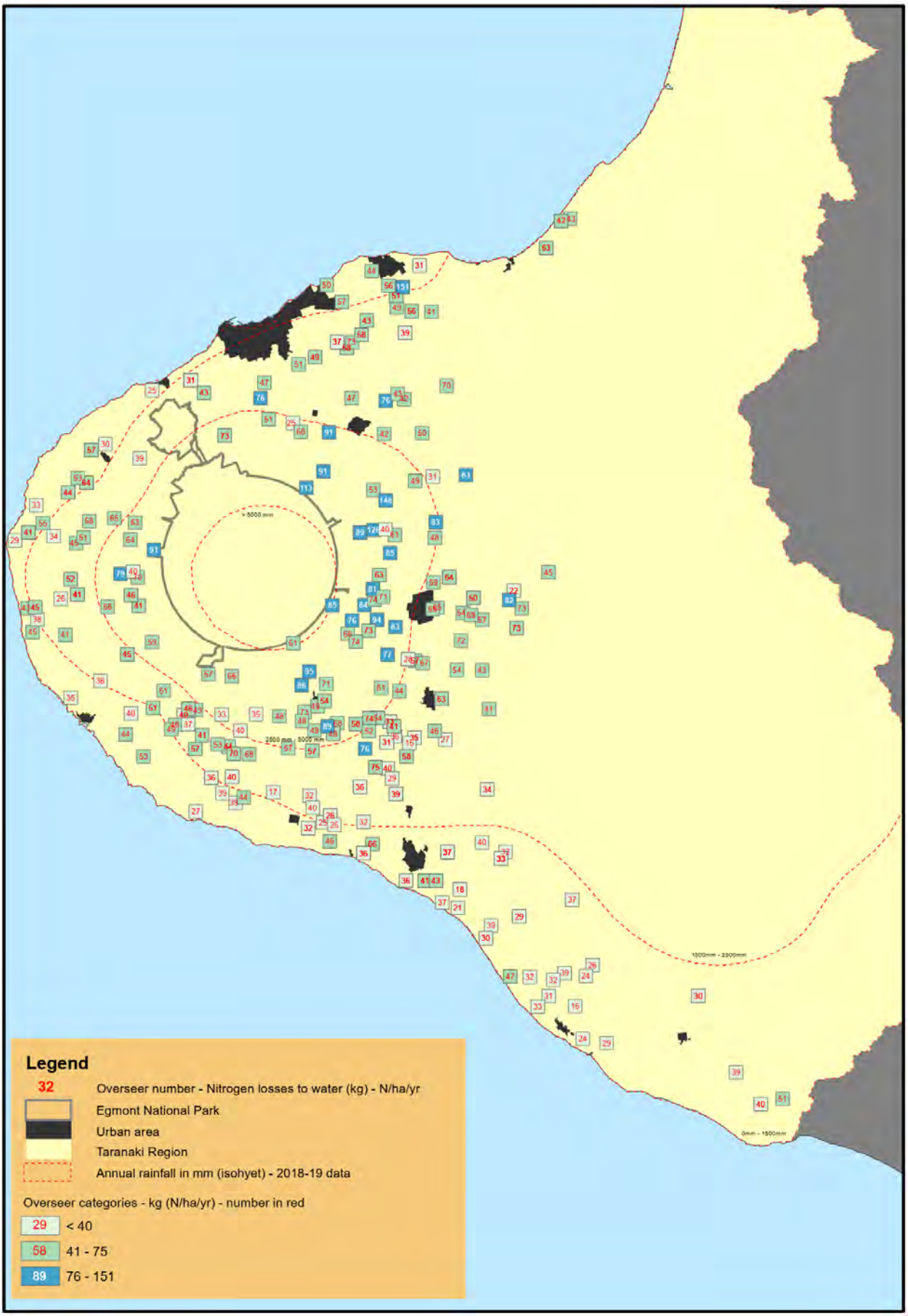

Figure 2 Overseer N losses (Kg / ha/yr) and annual rainfall in Taranaki

77) The Parliamentary Commissioner for the Environment (PCE) in his report on OVERSEER and regulation[21] noted that for farms with characteristics that are similar to those from which field data has been gathered and used to calibrate the model, the uncertainty for predicted nitrogen losses was 25-30% (excluding errors associated with measurement or uncertainty from data input). For farms that have characteristics that differ from those used for calibration (such as Taranaki farms), higher levels of uncertainty can be expected. It is likely that the uncertainty exceeds 50%, but could be much higher still. The PCE noted, for example, in Canterbury, OVERSEER estimates of nitrogen leaching from dairy farms on light and poorly-drained soils could be anywhere from nearly 40 per cent below to 60 per cent above the actual leaching rate. For one of the management areas in the Waimakariri Zone, the experts were 90% confident that the estimated nitrogen loads were somewhere between 399 tonnes N/year to 910 tonnes N/year. This variation is significant by any standard and it is highly inappropriate to base the viability of people's livelihood on such an exceedingly inaccurate tool.

78) The Environment Court has also recently released a decision that found OVERSEER is not fit for purpose as, and should not be used as, a regulatory tool in the absence of fundamental re-development. The Court also found that OVERSEER cannot be meaningfully applied at farm level to determine off-site effects without comprehensive (and thus very expensive) site-specific calibration and validation. This material is set out verbatim in Appendix 3C of Appendix 2 [The status of OVERSEER in the Environment Court]. The finding of the Court that '*It is important to note that OVERSEER is a long-term prediction model of nitrogen outputs and cannot be used to predict short-term management outcomes or changes that may be required to day-to-day farm operations*' must be given full weight.

79) Analysis by the Council of a suite of OVERSEER results across the ring plain (see Figure 2) demonstrates unmistakeably that OVERSEER modelling is dominated in Taranaki not by poor farm management and operations, but by annual rainfall. Initiatives to drive down DIN in receiving waters (even if they could be justified on the grounds of clear and significant benefits for stream ecological health) will founder if based around OVERSEER-weighted interventions. The inevitable outcome will be the loss of dairying above mid-catchment altitudes across the southern Taranaki landscape.

80) A NIWA study specifically investigated sources and flows of nitrogen in a catchment on the southern Taranaki ring plain[22]. The study found that calculated rates of nitrogen leaching using OVERSEER were very sensitive to rainfall, far more than to actual on-farm farm practice. Figure 3 below is reproduced from the independent study.

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[21] *Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways, Parliamentary Commissioner for the Environment, December 2018* https://www.pce.parliament.nz/media/196493/overseer-and-regulatory-oversight-final-report-web.pdf

[22] *Source and specific yields of nitrogen and phosphorus in the Waiokura catchment,* NIWA Client report HAM2015-124, October 2015

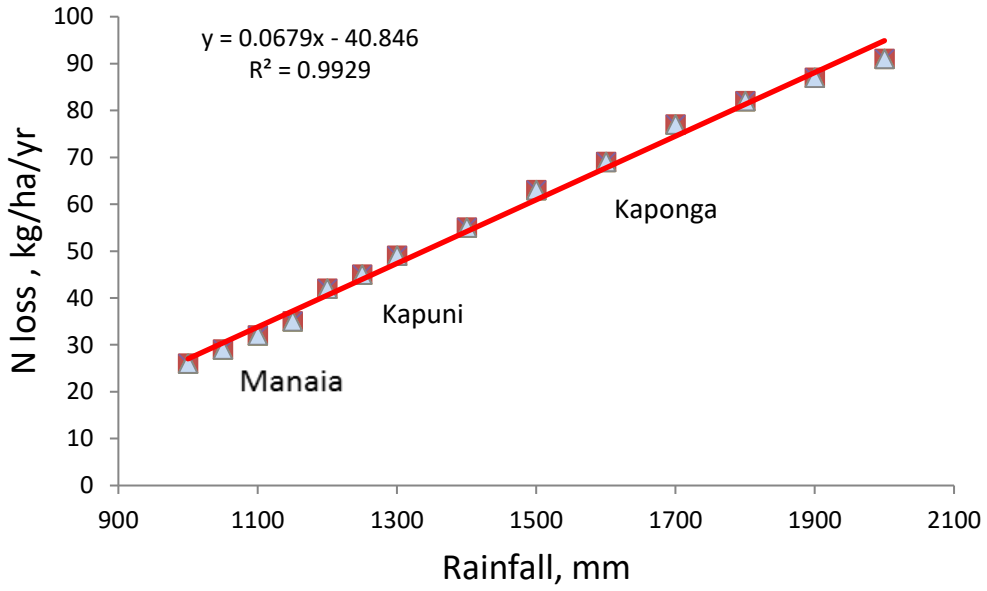


Figure 3 Effect of rainfall on predicted N losses from dairy farms in the Waiokura catchment

81) The catchments of Taranaki encompass rainfall that varies from below 1200 mm per year at the coast, to over 5000 mm at the Egmont National Park boundary. The farms in higher rainfall zones inevitably have higher leaching loss estimates.

82) Further to this, the Council's monitoring data shows that increased rainfall does not correlate with higher levels of nitrates in shallow, oxidised, groundwater in Taranaki (Figure 4). Clearly, while OVERSEER states there are high nitrogen losses in high rainfall areas, it is a false extrapolation to suggest this means high nitrogen concentrations in the receiving waters.

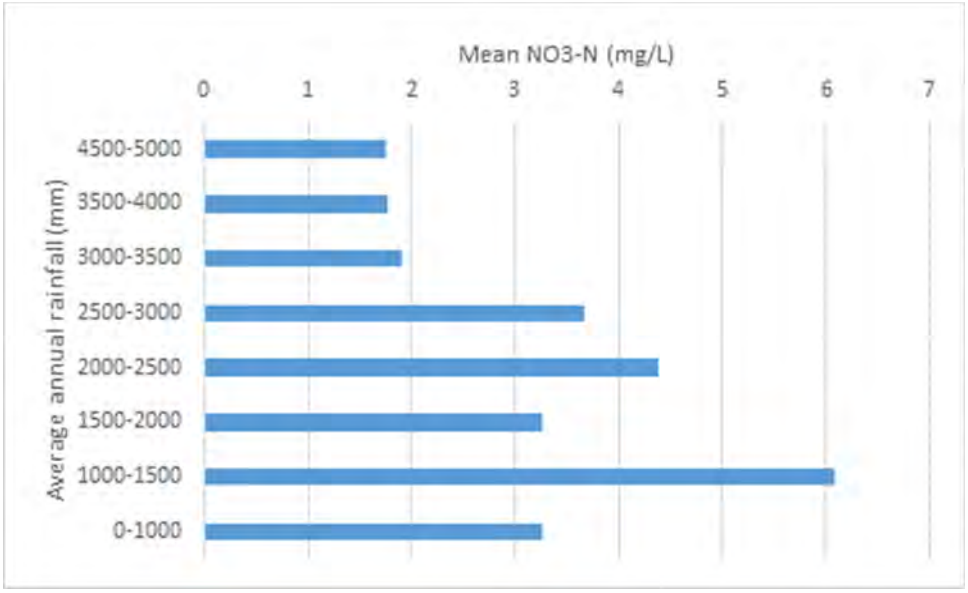


Figure 4 NO3-N levels in shallow oxidised groundwater with corresponding rainfall in Taranaki

83) Therefore, while the proposal's intent is to target farms with poor environmental practices, its design does not appear to distinguish farms in high rainfall zones versus those in lower rainfall zones. The controls to be imposed are just as likely to fall on those with best current management practices, as the lowest adoption.

84) Finally, there is going to be a significant added cost on ratepayers to enforce NES N-limitation requirements within a compliance regime, especially within the Waingongoro catchment if it is kept within Schedule 1, but equally and in any case across the entire Taranaki ring plain. The Council's current policy direction of stock exclusion and riparian planting on all waterways, together with diversion of essentially all remaining dairy effluent discharges to land irrigation instead of to surface water, and the promotion of good farm practices, requires the full attention of current policy, land management, consenting, and compliance staff. The NES addition of OVERSEER-based farm plan considerations and an associated second layer of consenting imposes a major increased and costly burden, without evidence of an efficient or effective environmental outcome.

Relief sought:

i) That the use of OVERSEER not be a requirement for any clause in the NPS-FM or NES.
j) That nitrogen caps not be used to manage the ecological health of freshwater.
k) Delete subpart 4 of Part 3 of the NES in full; and
l) Either delete 33(3)(c), 34(3) (c), 35(4)(c), and 36(3)(c), from subpart 2 of Part 3 of the NES (these subparts being those that generally require a consent condition showing the nitrogen, phosphorus, sediment, or microbial pathogen discharges of the farm will not increase as a consequence of the intended land use change), or alternatively, provide that these subparts can be satisfied by documenting equivalent farm practices or other means, and need not be satisfied by use of OVERSEER model.

Sediment (NPS-FM Subpart 2, Subpart 4, Appendix 2A, 2B and 2C)

85) The Council strongly opposes the use of sediment as an attribute requiring compulsory limits. As with nutrients, there is a demonstrably poor correlation in Taranaki between sediment concentrations and instream ecosystem health (and anticipated instream effects).

86) In Taranaki, hill country rivers have suspended sediment levels that are up to three times above the proposed new standard, due to the soft and highly erodible nature of the landscape. Given that the sandstone and mudstone soils of Taranaki's eastern hill country are naturally highly erodible, and that slumping and landslips are routine given the frequently wet weather patterns (with intensive downpours a common occurrence), there are high levels of sediment in waterways.

87) This is all despite around 70% of the Taranaki hill country already being indigenous vegetation, along with a further 10% exotic forestry with only a relatively small area of viable farm land remaining.

88) The Council's focus in the hill country has been on achieving sustainable land management practices, i.e. keep the soil on the slopes and out of the waterways. Sustainable management involves matching soils and slopes with the appropriate land use. This has been achieved via tailored farm plans with recommended interventions that focuses on reducing erosion and associated sediment loss. The challenge however as noted above is that Taranaki has naturally high sediment levels in its

hill country waterways and it is unlikely regardless of the interventions, that the proposed sediment limits could be achieved in Taranaki over any time frame.

89) Council monitoring shows that currently 82% of the most erosion prone land has a farm plan and 90% of farm plan recommendations to improve sustainable land use have been implemented in whole or part. With these plans being progressively implemented they are expected to deliver reductions in river sediment levels over time according to the New Zealand Empirical Erosion Model figures in Council's latest State of the Environment Report. However, the informed belief of the Council is that an unbridgeable gulf between achievable in-stream sediment concentrations and the NPS-FM limits would remain.

90) Despite hill country waterways having relatively high levels of sediment, Council monitoring shows that ecosystem health is good and generally improving and that Taranaki's rivers do not generally aggrade. State of the environment monitoring also shows that 87% of the hill country is being sustainably managed.

91) The Council is therefore concerned that the Government is proposing universally compulsory new bottom-line standard for suspended sediment that impose significant compliance costs on land owners and the region when local evidence shows an uncertain correlation between sediment levels and ecosystem health (while there may be an impact from high sediment levels on MCI scores this is not a linear relationship).

92) The compulsory new bottom-line standard for suspended sediment, if adopted will be highly problematic for sheep and beef farmers in the eastern hill country. The sheep and beef sector contributes approximately $112 million GDP per annum to the regional economy. This proposal will add significant cost for limited benefit over and above current initiatives and in some cases farming businesses are likely to not be viable into the future. With the time available the Council has not been able to undertake an economic impact assessment to quantify impacts of this proposed bottom-line on hill country farming businesses, but recommend that the Government should do so to fully understand the likely serious implications of such a proposal.

93) Based on the above, it is the Council's view that the proposed sediment limits are not the appropriate or necessary outcome measurement for the Taranaki hill country with its high sediment levels. The Council strongly urges the Government to focus on more appropriate intervention measures, notably ecosystem health and land use sustainability.

94) The Council notes that Section 3.23 of Subpart 4 of the proposed NPS-FM allows for exemptions from having to meet national bottom lines when a council is setting target attribute states for a water body or part thereof, and the effect of naturally occurring processes is to make even the national bottom line unattainable. The Council supports this in principle.

95) Given the above, it is apparent that the attributes of suspended and deposited sediment are too uncertain in their validity and effectiveness to justify inclusion at this time as compulsory attributes within a national regulatory instrument.

<u>Relief sought:</u>

m) That for the Taranaki hill country, sediment limits are not an appropriate measure and should not be used; and

n) That Table 10 (suspended sediment limits) be removed from the NPS-FM; and
o) Outcome monitoring of ecosystem health and sustainable land use should be the primary measures for water quality in the Taranaki hill country;
OR
p) That Table 10 be transferred to Appendix 2B [Action plan rather than national limits]; and suspend Table 10 for 5 years while pilot studies into its application can be undertaken for 'proof of concept', validation, and cost-benefit analysis. (Note: this was the approach endorsed by the regional councils' representative working group with which MfE consulted during the 2018/2019 period); and
q) That suspended sediment levels be required to show improvement but not to achieve national bottom lines, as is the case in Table 11 for *E.coli* ; and
r) That should the suspended sediment national bottom lines remain, it not be required to be met when the Ecosystem Health [Aquatic Life] attributes are above the national bottom line; and
s) That the provision for exemption from national bottom lines through 'naturally occurring processes' should be extended to include exemptions that can be applied where councils are dealing with the environmental consequences of current and past Government policies and incentives. These past policies could be identified explicitly within the NPS-FM, or recorded upon submission.

Freshwater Module of Farm Plans (NES Subpart 3)

96) The Council supports the use of non- regulatory farm plans which are bespoke and focused on the interventions that will achieve the outcomes sought at specific locations. Indeed this approach has been implemented by the Council and Taranaki landowners for a long time with significant improvements in water quality.

97) Most Taranaki farms have a farm plan already and have made significant progress implementing them. Within the intensively farmed area of the region 99.9% of farmers have a riparian management plan (refer Figure 5), and in the hill country 67% have comprehensive LUC based farm plans (refer Figure 6), with this figure rising to 82% of the area considered at risk of erosion.

98) In addition to the above tailored farm plans the Council encourages farmers to adopt good farm management practices. Council has worked with industry to support land owners to implement these.

99) With current programmes covering almost all farms in the region and achieving good results the Council does not see the need or value of mandatorily requiring additional freshwater farm plans (FW-FP). The merits (or otherwise) of a regulatory approach are best considered through local planning processes.

100) The proposal around FW-FPs in regard to what they would contain, how they would be developed and the auditing of them adds a layer of bureaucracy and cost which is unlikely in the Taranaki context to achieve any significant improvements for water quality over and above current initiatives. In particular, the proposed systems will result in large compliance costs for both land owners and Council. This will have knock-on effects to ratepayers.

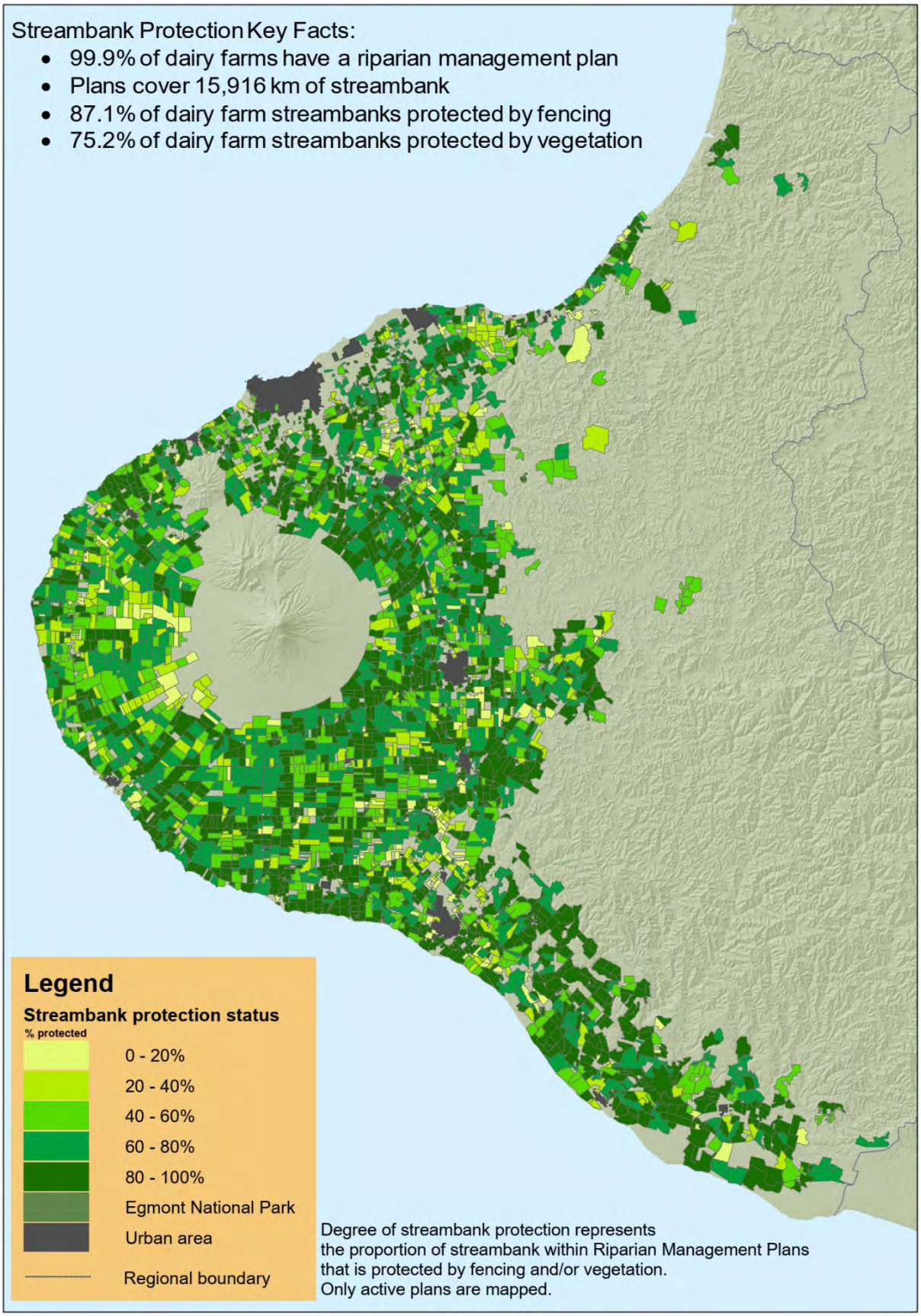


Figure 5 Streambank protection status of Taranaki streams (as at October 2019)

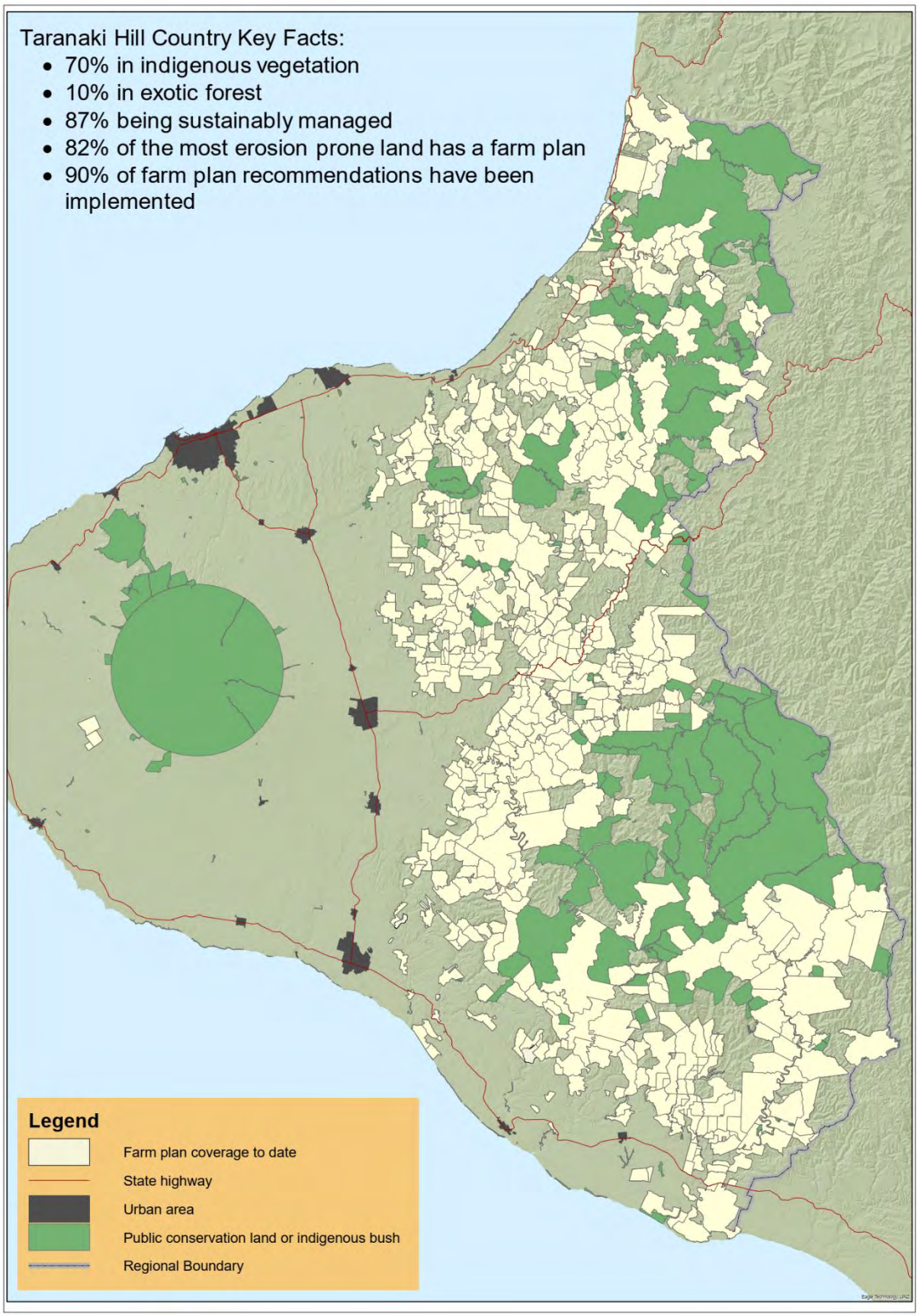


Figure 6 Farm plan coverage of Taranaki hill country farms (as at October 2019)

101) The Council would support FW-FPs, as we do now, as a non-regulatory tool implemented by industry and individual landowners with support from the Council to assist with integration of our current targeted farm plans focusing on riparian management and sustainable land use practices to reduce erosion and sediment.

102) Taranaki farmers are already achieving impressive results and undertaking vast amounts of work under the Council's voluntary farm plan regime. For example, Roger Pearce, is one of many Taranaki hill country farmers that have won environmental awards for their protection and enhancement of land, water and biodiversity on their properties. Roger's property is featured in the video below:

103) In addition to the above issues around costs and benefits of compulsory FW-FPs in Taranaki there would also be significant issues with available capacity to deliver FW-FPs if the Government's proposal is implemented as suggested.

104) For further information on the farm plans prepared by the Council that already cover the length and breadth of Taranaki please refer to https://extranet.trc.govt.nz/pydio/data/public/4e0535.

Relief sought:

t) That the requirement for FW-FPs to be implemented in Taranaki be removed with recognition that most of Taranaki is covered under existing farm plans which are being implemented effectively.

Intensification (NES Part 3, Subpart 2)

105) Whilst Council understands there may be a need to curb intensification with urgency in some areas of New Zealand, Taranaki is not one of those places as evidenced by our monitoring, low level of intensification over the last two decades and limited opportunity for it within the region.

106) In addition, if the purpose of this proposal is to 'halt further decline' in water quality, then that purpose is already being met or bettered across the region with only rare and often naturally induced minor exceptions.

107) Therefore this proposal for Taranaki would add additional regulatory requirements and associated costs for very limited benefits to the environment.

108) We are concerned that if implemented as proposed, low-risk land use will be the most impacted, effectively in some cases grand parenting current land uses for a period of time. This does not seem logical when on one hand these farms are likely to be required to reduce sediment outputs and therefore retire steep erosion prone land but on the other will be limited in their ability to intensify better land, without costly regulatory requirements.

109) This is a particular issue in the extensively farmed hill country of Taranaki. As noted earlier, much of this area is currently indigenous vegetation with only a small area in pasture. However in many cases the farm land is steep and has portions of the property that are susceptible to erosion. These areas are often better to be retired or in some cases planted in rotation forestry with the farmer concentrating on increasing productivity from the flatter areas of the property. Indeed the Council recommends such actions via its farm plans that cover much of the erosion prone hill country farm land.

110) The basis of farm plans in the Taranaki hill country focus on detailed Land Use Capability mapping, this identifies the limiting factors for differing land types such as erosion susceptibility. Council officers working with the landowner then match land type noting its limitations with appropriate land uses. This is the basis of sustainable land management, a farm-specific tailored intervention approach to problems and issues at the farm scale. Internationally this is considered best practice.

111) It is the Council's view that this approach is the best way of managing intensification in the Taranaki hill country. Most hill country farms have an existing Council farm plan and these are being implemented well. Monitoring also indicates that 87% of the hill country is currently being sustainably managed. The Council would therefore support the continuation of existing farm plan implementation which is focused on ensuring sustainable land use practices.

112) The Council also questions how practical the implementation of components of this policy would be. Matters such as the regulator knowing when a farmer has changed from beef farming to dairy support or increased the size of their crop paddock suggest a lack of reality and naivety in the proposals.

113) Similarly, the Council notes with concern that the NES proposal for "High-risk land use changes" will inadvertently capture a farm's scrub clearance cycle. Due to Taranaki's wet and temperate climate, natural scrub growth and clearance is a regular occurrence (gorse, broom etc.). In the absence of a definition for "wood vegetation," scrub clearance could be deemed land-use change. The Council supports keeping class 6 land clear for a sustainable land use in many cases. We also note that 10

hectares of scrub would not be deemed significant in the eastern hill country and should not require a discretionary resource consent to clear. Further to this, if farmers feared that they would not be able to re-clear scrub if left to grow then this could have flow-on implications for the Manuka honey industry as less Manuka may be available. Similarly, there is a risk that forestry will not be planted on erosion prone land if there is a penalty to revert to pasture.

Relief sought:

u) That intensification regulations be targeted to those regions where intensification is occurring; OR
v) That intensification regulations be shifted to the NPS-FM to be dealt with through regional planning provisions.

Stock Exclusion (Draft Stock Exclusion Section 260 Regulations)

114) The Council supports the proposal's intent to exclude stock from waterways and has considerable operational experience.

115) The Council already has a well-established riparian management programme which is yielding good results for the improvement of water quality in Taranaki. Currently 99.9% of Taranaki dairy farms have a riparian plan, 87.1% of streambanks covered by these plans have been fenced and 75.2% of streambanks protected by vegetation. This has cost the Taranaki community $128 million of which more than 70% of works is funded by farmers. Because of this work, alongside Council's move to require effluent disposal to land where practicable, 47% of freshwater ecology monitoring sites in Taranaki shows trends of improvement, and the remaining 53% show no evidence of a change in condition. No sites show significant deterioration.

116) The Council has publicly stated that its riparian management programme will become regulated through its Freshwater Plan review. This is intended to ensure that farmers that do not already have a completed riparian management plan will be required to do so.

117) The biggest difference between the Council's approach and the *Stock Exclusion 360 Regulations* is that the Council walks along each streambank and decides on a case-by-case basis what an appropriate setback is. This may or may not meet the Regulations requirement for a five metre average setback. Where it does not, it is because it is not necessary nor practical to do so. Please note that the Council requires that all waterways on a property are fenced and importantly planted – not just those over one metre wide, this equates to approximately 30% more waterways being protected to a higher standard in Taranaki than the Governments proposal.

118) The video below describes the success of the Taranaki Riparian Management Programme.

119) The Council also requires planting of riparian margins, which the SER do not. The Council argues that the planting aspect is of even more benefit to river health than the fencing setback due to the inception of runoff and the uptake of nutrients by the riparian plants, plus the shading benefits they provide. The Council believes that its Riparian Management Programme, involving property-specific setback distances and coverage of every waterway of any size and whether permanent or ephemeral, plus planting, provides a greater environmental benefit than the Government's insistence upon an average five metre setback proposal.

120) The Council is concerned that the SER will undermine the integrity and credibility of the Taranaki Riparian Management Programme with farmers being required to move their fences and no obligation to maintain planting. The SER, if not amended, has the potential to undermine the goodwill established by Council with farmers who have already heavily invested in protecting their streams – while producing lesser environmental benefits (because there is no planting component and no obligation to exclude stock from headwaters) and impacting farm economics.

Relief sought:

w) That properties with rivers and wetlands which are subject to Taranaki Regional Council's Riparian Management Programme be exempt from the *Stock Exclusion Section 360 Regulations* as they already have appropriate fencing, the additional protection of planting and are improving ecosystem health.

Wetlands (NPS-FM 3.15, NES Part 2, Subpart 1)

121) The Council is already actively promoting and thus supports enhancing protection for wetlands. Through the riparian planting programme the Council requires that wetlands on dairy farms be fenced and margins planted. The Council also has a wetland enhancement programme and the Key Native Ecosystems programme that works with land owners and others to promote the voluntary protection and active management of wetlands.

122) However, the NES and NPS-FM provisions are overly onerous in relation to the imposition of excessive and unnecessary monitoring obligations. Taranaki has approximately 3,000 natural wetlands. Many are already mapped through state of the environment monitoring programmes, riparian plans, farm plans, biodiversity plans etc. Council is looking at options for mapping the remaining wetlands. However, the NES requirement to ground truth all wetlands, particularly those in the hill country, would be difficult given access difficulties across rugged terrain as well as expensive and potentially dangerous.

123) The Council does not support the requirement to monitor every wetland, every year. We note that the Taranaki region has in excess of 3,000 wetlands to monitor and therefore the requirement to monitor their extent, vegetation, hydrology and nutrients (soil and water) will be is unjustified and unrealistic.

Relief sought:

x) That councils only be required to monitor representative samples from each freshwater management unit of wetlands for their extent, vegetation, hydrology and nutrients – as is required for rivers and lakes.

E.coli (NPS-FM Subpart 2, Subpart 4, Appendix 2A and 2B)

124) The Council challenges the inclusion of Table 11 for *E. coli*, which is set out in Appendix 2A [Attributes requiring limits] of the NPS-FM. The limits set out in Table 11 are irrelevant within the Taranaki region, where rivers are too cold, shallow, dangerous, and/or too fast-flowing to be widely used for contact recreation outside the bathing season. There is incongruity in still requiring compulsory monitoring of risk to public health at the times when the activity of swimming is itself dangerous.

125) The Council supports the inclusion of the second, new *E. coli* attribute [NPS-FM, Table 23], which is based on contact recreation at times and places when this activity is undertaken.

126) Notwithstanding that support, the Council seeks minor amendments to Table 23. Firstly, Clause 3.13 specifies that weekly sampling is required at primary recreational sites between 1 November and 31 March each year. These dates do not reflect the bathing season in Taranaki, which more realistically begins in mid-December and may continue into early April. The Council further notes that NPS-FM actually contains an internal contradiction: 3.18 (3) refers to a calendar period (1 November-31 March); on the other hand, Table 23 refers to a 'bathing season', with no mention of calendar dates.

127) The requirement that the regional council must take all reasonable steps to notify the public when a site is unsuitable for primary contact contradicts the 2003 guidelines, which assign the responsibility for public notification of health risk to the Medical Officer of Health (MoH). There is obvious potential for conflicting public advice, especially during a change of status when time delays between council notifications (the council inevitably being the holder of the monitoring data) and MoH notifications may occur. A regional council has no power or authority to direct the MoH to take steps of any nature. The NPS-FM needs to clarify authority and responsibility in this matter.

128) The Council notes that Section 3.23 of Subpart 4 of the proposed NPS-FM allows for exemptions from having to meet national bottom lines when a council is setting target attribute states for a water body or part thereof, and the effect of naturally occurring processes is to make even the

national bottom line unattainable. The Council supports this in principle but submits that the exemptions provisions need to be widened.

129) The Council notes that there is an ever-increasing body of evidence for naturalised *E. coli* to be found in waterways across New Zealand. The option of identifying such colonisation where it is occurring, and applying the exemption provision, would be a common-sense approach. The Council further notes that the worst bacteriological contamination of recreational waters in Taranaki is associated with large populations of waterfowl, both introduced and native- seagulls, ducks, and pukekos, for example. The interpretation of '*could have occurred before the arrival of humans in New Zealand*' becomes problematic in the case of introduced species of ducks and geese, for instance.

130) The Council believes that further exemptions should apply in the case of introduced species such as ducks. There is Government support in legislation and in financial provisions for the proliferation of aquatic game birds across New Zealand. This is in direct and obvious conflict with the Government's stated intention of requiring improvement of the recreational qualities of fresh water. Why should regional councils and communities have to bear the cost of the consequences of Government support for pollution of waterways by introduced aquatic species?

Relief sought:

y) That Table 11 is deleted from the NPS-FM, and that Table 23 is retained subject to minor amendments.
z) That each regional council be able to specify within its regional plan or other documentation, the recognised bathing season for that region (or parts thereof); and that the contradiction in responsibility for notifications of public health risk be resolved.
aa) Retain the provision for an exemption for processes beyond the Council's control – such as Taranaki's *E. coli* concern with native and introduced waterfowl be provided in the NPS-FM.
bb) That the provision for exemption from national bottom lines through 'naturally occurring processes' should be extended to include exemptions that can be applied where councils are dealing with the environmental consequences of current and past Government policies and incentives. These past policies could be identified explicitly within the NPS-FM, or recorded upon submission.

Monitoring (NPS-FM – 3.13 and Appendices 2A and 2B)

131) The Council strongly believes that the health of waterways is of great importance. It therefore questions why, given the NPS-FM also focusses on ecosystem health, that direct measures of ecosystem health (i.e. macroinvertebrate community measures) are attributes requiring action plans rather than limits. Conversely, the Council questions why measures of possible drivers of health (e.g. nutrient species) are attributes requiring limits, even though their presence may not affect ecosystem health.

132) The Council notes that generating data on QMCI and ASPM will impose additional analytical and calculation costs without necessarily providing a greater understanding of ecosystem macroinvertebrate health in the region's waterways.

133) The use of more quantitative methodology, as proposed in the draft NPS-FM, has the flavour of being driven by more 'research-minded' scientists, not those associated with ongoing environmental management through Regional Council programmes where the ratepayers of the region carry the

costs of state of the environment monitoring and costs versus value of data and information are critical considerations. It is fundamental to these programmes that data is collected for both representative baseline health and for evaluation of effects and consequences of management interventions to improve or maintain health [through temporal and spatial trending analysis]. The MCI provides the ability to perform these functions and only requires that a representative sample be collected (usually a kick-net) with taxon presence-absence identification (or semi-quantitative coded abundances) sufficient for processing purposes. Restricting methodology to this level, rather than introducing more fully quantitative procedures with consequent resourcing impositions, would enable wider coverage of regional sites and allow for more uniform reporting of data for national comparative purposes such as that currently available on the LAWA website.

134) Sampling for fish is to be undertaken using existing standard methods- trapping, spotlighting, or electric fishing. Problems with these methods are well-known, for example difficulties in physically determining presence and species; fish flight at the commencement of sampling; limited and/or non-representative sampling zones. These highly prescribed methodologies do not recognise emerging alternatives e.g. eDNA, which is being actively developed within the NZ context[23]. Prescription of methods within the NPS-FM will restrict what appears to be a very powerful and relatively cheap new technique for fish management. It is more than likely that within the timeframe of regional plan revision/development (2023), this methodology will be proven and available. The Council seeks that the NPS-FM not preclude the option of adopting better techniques, to the same end, from being utilised.

135) To identify the numeric attribute state of the condition of native submerged plants, a survey at least once every three years is required, but to assess invasive submerged plants, a survey is required at least annually. There seems to be no rationale for either the frequency or inconsistency. The proposed NPS-FM methodology is contrary to the findings of the Science and Technical Advisory Group[24], who specifically commented '*Monitoring every five years may be suitable for picking up changes in the extent of macrophyte communities, but a three-year cycle of monitoring may be valuable if combined with a surveillance programme for invasive species and if sites vulnerable to invasion were included in the monitoring programme (ie boat ramps).*'

136) The recommended approach to use LakeSPI has been criticised by the regional councils' Lake Special Interest Group (SIG) as unsuitable for the intended purpose. The Lake Special Interest Group (SIG) has found the LakeSPI to be unable to robustly estimate vegetation cover, especially in shallow lakes, and is actively seeking investment in and development of an alternative vegetation assessment method. Given that NIWA are currently the only providers of robust vegetation surveys in NZ, requiring them to use only the somewhat outdated (2006) LakeSPI would serve as a disincentive to investment in developing and implementing a more fit for purpose methodology, as well as encouraging a monopoly provider position.[25]

137) Initial resourcing costs for the Council's Science Services team, covering the increase in regular regional environmental monitoring that is proposed within the draft NPS-FM and NES have been carefully estimated. The Council will be required to establish 13 new monitoring programmes and

[23] Cawthron Institute, funded through Envirolink and Biological Heritage National Science Challenge. Contact: Joanne Clapcott

[24] *Freshwater Science and Technical Advisory Group Report to the Minister for the Environment June 2019, Pg 35.*

[25] The regional sector Lake Special Interest Group advise that details will be incorporated within the LGNZ submission

monitor numerous new sites to meet the requirements of the NPS-FM. The estimated additional staff costs for this are $630,000 each year, together with $406,000 of capital expenditure progressively resourced over the first 5 years. This additional regional environment monitoring represents approximately an average 9% annual general rate increase. This is in addition to current state of the environment monitoring cost in excess of $2.35 million.

138) The costs of monitoring the proposed attributes within the regional environment can be calculated reasonably accurately. The costs of monitoring for compliance with the suite of proposed environmental standards must of necessity be less certain, as the extent to which farmers and land owners (including the Department of Conservation) would wish to undertake activities in respect of wetland management and farm operations that are now to require consents remains unclear. Assuming that the intent of the proposed NPS-FM and NES is to constraint current activities within the ambit of the proposals, so that there is only a limited application of the NPS-FM/NES controls, then a conservative estimate of additional monitoring and enforcement staff across land management and inspectorate staff, together with a minimal increase in policy and consenting staff, is for a further 11-19 FTE staff members.

139) To resource this increase in staff numbers (including Science Services staff as discussed earlier) would mean a **general rates increase of between 25% and 45%**.

140) The Council is clear that this very significant burden (which will fall in part on those undertaking specific activities and in part on the general ratepayer, but in either case represents an adverse impact upon the region's economy) would offer at best a marginal improvement in farmer commitment to good practice and to the state of the receiving environment. The Council reiterates that given the absence of a robust evaluation of costs, necessity, efficiency, effectiveness, or certainty over the significance of additional outcomes and benefits, that would justify the multiple interventions and new attributes set out in the proposed NPS-FM, NES, and SER, then MfE should urgently undertake a review of all proposed measures with a view to their withdrawal.

141) These costings also do not make any allowance for any obligations or functions that may arise from the Government's 3-Waters Programme (still to be announced).

Relief sought:

cc) That Table 13 and 14 of the NPS-FM be shifted into Appendix 2A [Attributes requiring limits].
dd) That Table 15 of the NPS-FM be amended to allow for emerging equivalent techniques.
ee) That the survey frequency for invasive submerged plants be amended to at least once every three years, instead of annually.
ff) That Table 16 of the NPS-FM be suspended for 5 years while an alternative submerged plant assessment tool is researched and developed.
gg) That the number of attributes requiring monitoring in the NPS-FM be reassessed in light of the significant cost burden on Councils and their ratepayers, because of the lack of clear and significant added value for resource management purposes.

Te Mana o te Wai (NPS-FM Part 1: 1.5 Fundamental Concept)

142) The proposed NPS-FM introduces Te Mana o te Wai as a 'fundamental concept'. The authority and significance of a 'fundamental concept' within a RMA planning framework or as an instrument of regulation is not further defined, and further, is novel. The meaning of Te Mana o te Wai is explored

in general and vague metaphysical terms, as equivalent to the 'health and wellbeing of water'. This is now to be prioritised above all other matters, including any provision for human health 'needs' (second priority) and then all other purposes, characterised as 'wants' (third priority). The Council notes that Te Mana o te Wai is already a key objective of the 2017 amended NPS-FM 2014.

143) The purpose of an NPS-FM is to set out objectives and policies in relation to freshwater management, and to specify what local authorities must do to achieve those objectives and policies. But the vagueness of the proposed NPS-FM in respect of what Te Mana o te Wai means and how it is to be understood and applied can bring only frustration and uncertainty to councils and communities alike. Attainment will of necessity remain ambiguous and illusive. To quote the NPS-FM itself: [the features of the framework Te Mana o te Wai] "*…may be interpreted differently by different people in different contexts…features are relevant to this NPS…may include other things as determined locally…*". Such vagueness as to how Te Mana o te Wai is to be interpreted, and how its meaning (and therefore its application) are subject to moment by moment re-interpretation and are highly contextual, mean that councils, communities, and the Environment Court can never definitively and with finality establish how the concept is to be given effect to, but instead must be constantly second-guessing its status and who makes the final adjudication.

144) Further, the hierarchy of prioritisation described within the proposed NPS-FM is potentially conflicting and definitely confusing when embedded into the framework of the purpose statement [S5(1)] of the RMA itself. 'Upholding the mauri of the water' is obviously different from managing its 'use, development and protection', or 'avoiding, remedying, or mitigating any adverse effects of activities' on water. It is anticipated this confusion (if not contradiction) will need extensive testing and clarification through statutory and/or judicial processes, before its interpretation is settled.

145) The expression within clause 2.1(c) that social, economic and cultural wellbeing is somehow separate from and of lesser importance than human health (2.1 (b) is a false and dangerous dichotomy. The need to provide for the social, economic, and cultural wellbeing, security, and resilience of each individual and community are widely recognised as integral components of and contributors to health.

146) The lack of a section 32 analysis of implications of the adoption of the concept of Te Mana o te Wai, and the absence of any well-considered legal analysis undertaken from within the context of existing case law re the interpretation and application of the RMA, around the potential use of Te Mana o te Wai within the NPS-FM, make the emphasis upon the concept appear precipitate and premature. There is no evidence that its proposed introduction as a 'fundamental concept' reflects the outcome of a considered choice.

147) Indeed, taken simply at face value, the concept of Te Mana o te Wai and safeguarding the mauri of wai taken in conjunction with the Minister's stated intention to stop all further degradation of waterways would appear to immediately deem all waterways in New Zealand to be fully allocated as of now. Even giving effect to either the second or third priorities within the new objective (Part 2.1) would at first glance involve a conflict with the primary obligation to uphold the health and wellbeing of waterbodies, as they would of necessity require diminution through abstraction or degradation through discharge of contaminants into the waterbody (even at the most local and limited of scales). Is it the intention of the NPS-FM that New Zealand is forthwith closed to any new 'business' (e.g. flow appropriation for municipal services to supply growing populations, with consequent increases in wastewater discharges; new industries and energy utilities needing cooling, washdown, and boiler water supplies or as raw material for products; or greater local, regional and

national self-sufficiency in arable and horticultural production and market gardening)? Clarification in its interpretation and application and reassurance around the robustness of its incorporation into the NPS-FM are urgently needed.

Relief sought

hh) That clear and comprehensive expert advice be sought, publicised and consulted on as to the application of Te Mana o te Wai within the framework of existing RMA definitions and case law, prior to furthering its adoption;
AND

ii) that any compulsion around Te Mana o te Wai be withdrawn, and Te Mana o te Wai be made a value that must be considered (Clause 3.7 (1) (b) and Appendix 1B);
OR

jj) That Te Mana o te Wai remains as it is in the 2017 amended NPS-FM 2014 – a key objective of the NPS-FM but without a hierarchy.

New Planning Process for Freshwater (Resource Management Amendment Bill)

148) The Council strongly supports proposals to amend the RMA to introduce a new planning process for regional plan involving hearings by composite national/regional/ tangata whenua panels and only allowing appeals to proposed plans in circumstances where councils depart from hearing recommendations. The Council supports this proposal as it will promote plan agility. It will help councils to move more swiftly through RMA schedule 1 processes to address community concerns regarding freshwater management, thereby reducing overall costs for all parties involved in plan reviews. If anything, this concept merits being applied to all RMA plan development and review processes rather than just being confined to freshwater plan reviews.

149) Notwithstanding that support, there are matters of detail that need to be addressed. Given the limited number of qualified hearing commissioners experienced in water management, and the likely occurrence of concurrent plan review processes for many of the 16 regional councils, there would obviously be constraints in the availability of independent panel members.

150) The notion that the hearings panel may make recommendations on matters that are beyond scope of the proposed freshwater planning instrument and/or submissions is alarming and contradictory to principles of natural justice.

151) The 20 working day time frame for councils to consider whether to accept or reject the panel's recommendations is not practicable taking into account meeting schedules, agenda production, notice of meetings, etc. Especially if councils need to give due consideration to recommendations from the Panel that are beyond the scope of submissions.

Relief sought

kk) Retain proposals to introduce a new RMA planning process for regional freshwater plan reviews subject to addressing the following qualifiers:
- that the new planning process be available to all RMA plan development and review processes, rather than just being confined to freshwater plan reviews
- that the hearings panel only make recommendations on matters that are in scope of the proposed freshwater plan and/or submissions
- that the 20 working day time frame for councils to consider whether to accept or reject the panel's recommendations be amended to 60 working days (assuming the Council is only considering panel recommendations in scope of submissions).

Further submission points

152) Notwithstanding Government decisions on the relief sought on the larger issues of concern discussed above, a detailed reading of the draft provisions of the NES and NPS-FM identifies a large number of drafting issues that need to be addressed to effectively implement the NES and NPS-FM and/or avoid perverse outcomes.

153) At the Resource Managers Group (RMG) meeting with MfE staff the many drafting issues were highlighted. In particular, the RMG members noted that there was a significant lack of operational and compliance knowledge missing from the NES and NPS-FM. Rather than all councils submitting on them a working group should be formed to provide feedback. Whilst some examples have been raised below, the Council supports establishing a working party to address the numerous additional issues.

National Environmental Standard (NES) for Fresh Water	
Reference	**Discussion**
Wetlands [NES 7]	The Council notes that often wetland weed control involves incidental destruction of indigenous wetland vegetation (e.g. willow control or removal of blackberry or spraying of Glyceria). Clause 7 of the NES, as drafted, would make routine weed control for wetland restoration work a discretionary activity. While the effects of vegetation disturbance do need to be managed, wetland maintenance and restoration should be encouraged and making it a discretionary activity is unduly onerous as well as potentially leading to the perverse outcome of reductions in weed clearance and removal of invasive species. The Council notes that the *National Environmental Standards for Plantation Forestry* allow for harvesting as a controlled activity with, amongst other things, control reserved over measures to address effects on wetlands. The Council feels that similar provisions could be written to provide for wetland maintenance and restoration as a controlled activity.
Wetlands [NES 9, 10,12, 12, 13, 14]	The Council has concerns regarding the earth disturbance rules in the NES. The NES prescribes setback distances from wetlands of 10 metres for general earthworks and 100 metres for drainage earthworks as part of its rules framework. Given the highly dissected nature of the upper catchments in Taranaki, 100m away might well be in a different groundwater catchment altogether. Further, it is noted that drainage works at a distance of, say, 50-100 metres downslope will have much less effect than drainage works 50-100 metres upslope. The Council's experience in Taranaki is that a protection zone of 25 metres (a distance used in the current Regional Freshwater Plan for various purposes) is adequate. Any greater distance is unduly restrictive and would impose an unnecessary administrative burden for no

National Environmental Standard (NES) for Fresh Water	
Reference	**Discussion**
	environmental gain. The Council suggests that if the activity causes adverse effects (such as those described in clauses 11(a) and 13(b)) then the distance it occurred from the wetland is irrelevant in any case.
Wetlands [NES 10(2)(a), 12(3)(b)(i), 16]	The Council seeks that clauses 10(2)(a) and 12(3)(b)(i) be deleted. If the effects described in 10(2)(b) or 12(3)(b)(ii) are occurring then it should not matter if the water level change is >0.1 m or not. The Council is also concerned that monitoring whether an activity has caused a change in the natural wetland annual median water level will be unfeasible. Wetland water levels can be highly variable between days, seasons, and year to year. Monitoring these to the detail specified will be problematic and require long periods of time to determine if changes are due to an activity. The Council is unsure if detecting a 0.1m change will be a reliable measure of an effect.
Microbial pathogens: [NES 33(3)(c), 34(3)(c), 35(4)(c), 36(3)(c)]	The Council seeks that NES obligations to impose through resource consents, estimations (whether through modelling or monitoring) by farmers of either pathogenic microbes or E. coli in discharges be removed. The term 'microbial pathogens' is used in NES provisions (e.g. that farmers have to know their average discharges of these microbes before and after any land use change). However, standard scientific practice is that microbial pathogens are not and cannot be practically accounted for. In general practice faecal indicator bacteria (FIB) known as *E. coli* are determined through analysis. *E. coli* are present in very high numbers in fresh faecal matter and in receiving environments of any such discharge. Most *E coli* strains are harmless (with the exception of a few particular strains of *E. coli* which produce illness-inducing toxins). Die-off of *E. coli* can be rapid, depending on temperature, sunlight, or exposure to antibiotics and disinfectants (e.g. in dairy sheds), while attenuation is affected by (amongst other factors) soil geochemistry, soil porosity and permeability, soil moisture content, overland flow volumes and velocities, and vegetation and surface roughness filtering. Accounting for FIB in a meaningful or accurate manner is impractical. The concept that farmers having to track comparative quantities of pathogens that might leave a property under varying land management practices defies credulity.
Base year of measurement: [NES 33(3)(c), 34(3)(c), 35(4)(c), 36(3)(c)]	The Council seeks that the obligation to require, through resource consents, estimations (whether modelling or monitoring) by farmers of nitrogen, phosphorus, sediment, and pathogenic microbe discharges from the farm compared with a base year of 2017/2018 be

National Environmental Standard (NES) for Fresh Water	
Reference	**Discussion**
	amended within the NES, to be calculated on the basis of a normalised hydrological year or flow-adjusted water quality data, not a specified year or period. NES provisions require that farmers demonstrate no increase in discharges of nitrogen, phosphorus, sediment, or pathogen microbes, from a base year of 2017/2018, if they increase the area of farm involved in intensive winter grazing, irrigation, or high-risk land uses. But in the case of changing land use to commercial vegetable growing, the basis for comparison is the discharge averaged over the period 2013-2018, not the discharge within the single farm year 2017/2018. The Council notes that there is no rationale offered for why in one situation it is a five year average, but in the other cases it is a single specific year; nor the significance of the 2017/2018 year that it should be the designated comparative year. Further, the Council notes that there is a contradiction between the actual wording as presented within the NES, and the description of these provisions offered by MfE in its explanatory documentation. "*For any of these activities, a resource consent will only be granted if the activity does not increase nitrogen, phosphorus, sediment or microbial pathogen discharges above the enterprise of property's 2013-2018 baseline (average for this period*")26. Why the resource consent limit should be based on the 2017/2018 year in some cases but on the 2013-2018 period in other cases, but the need for a consent should be based on the 2013-2018 period, is not explained. Further, in clause 46 of the NES, for Schedule 1 catchments, the baseline year is to be calculated from the higher of either the 2017/2018 year or the 2018/2019 year. All parameters listed in these NES provisions- nitrogen, phosphorus, sediment, and microbes- have discharge rates that are highly affected by hydrological patterns. Wetter years (longer durations of saturated soils and greater or longer overland flows) will inevitably cause much higher contaminant discharges to waterways, yet are completely outside the control of a farmer or any farm management system. A change to a more sustainable (less impactful) farm management framework could very easily coincide with increased runoff of contaminants. Indeed, this is likely, as the OVERSEER model is highly susceptible to rainfall inputs (see my notes elsewhere).
Sediment: [NES 33 (3) (c), 34(3) (c), 35(4) (c), 36(3) (c), etc].	The Council seeks that the obligation to impose through resource consents, estimations (whether modelling or monitoring) by farmers of 'sediment discharges of the farm' be clarified within the NES.

[26] *Action for healthy waterways*, pg67.

National Environmental Standard (NES) for Fresh Water	
Reference	**Discussion**
	The NES refers to 'sediment', while the NOF tables refer to 'suspended sediment' (expressed as turbidity) and 'deposited sediment' (measured via a particular methodology). In clause 38(2)(h) of the NES, and elsewhere, the term used is 'soil loss'. As with 'nutrients', the lack of specificity leads to confusion as to what information a consent is to require and a farmer is to supply. Is erosion of stream and river banks within, or on the boundary of, a farm to be part of the measurement/modelling?
Nitrogen: [NES 33(3)(c), 34(3)(c), 35(4)(c), 36(3)(c), 38(1)(j), 43]. See comments and relief sought above Phosphorus: [NES 33 (3) (c), 34(3) (c), 35(4) (c), 36(3) (c), etc]. See comments and relief sought above	The Council seeks alignment across the NES and NPS-FM with respect to references to 'nutrients' and that references to 'nitrogen' and to 'phosphorus' be explicit as to what chemical elements and what form(s) of elements are intended, singly or by grouping In clause 5(10)(a) of the NES and claise3.15(9)(a) of the NPS-FM the term 'nutrients' is used. Elsewhere, the terms 'nitrogen, phosphorus, …' (e.g. clauses 33, 34, 35, 36, 38(2)(h)) of the NES are used to describe two particular chemical elements that are plant and animal nutrients, but are not the only nutrients that are essential for either plant life or animal life to survive and flourish. There is presumably a difference in intention between clauses where 'nutrients' are referenced generically, and those where specific identifiers are used, otherwise why use two different terms; or else there is confusion and lack of specificity by the authors. 'Nutrients' would normally be taken to include not only nitrogen and phosphorus, but iron, copper, magnesium, sulphur, potassium, calcium, oxygen, and so on. Further, several of the dissolved forms and total forms of nitrogen and phosphorus are used in Schedules 2A and 2B of the NPS-FM with explicit and particular meaning, adding to the confusion as to what is intended within the NES.
NES Drafting	Where a discretionary activity rule requires specific consent conditions, the Council seeks that the following wording or equivalent be adopted "*…must include consent conditions to ensure that:*" (rather than the current NES wording, i.e. "*… must include the following consent conditions:*"). This revised wording would allow councils flexibility in the drafting of the conditions. If the actual wording of the condition is to be prescribed in the NES (which appears to be the intention as it is currently drafted) then much further work is required to ensure the drafting meets the requirements of a proper consent condition.
River bed infilling [NES 18]	The Council seek clarity on the term "no net loss" and in relation to what it relates to, e.g. riverbed, habitat, biodiversity? On the face it the mandatory condition requires new riverbed to be created somewhere

National Environmental Standard (NES) for Fresh Water	
Reference	**Discussion**
River bed infilling [NES 18]	The Council notes that the condition to monitor an infilled river is impractical. What would be the accepted methodology and the premise that any decline in ecological condition over the duration of a consent must result from the infilling would be wrong.
Fish passage [NES 19]	The Council questions why dams, fords, and non-passive flap gates have no fish passage conditions. The key issue being addressed is to ensure fish passage. There is no need to have different clauses for individual types of structures. It is the Council's view that all structures need to allow fish passage. However, the detailed information required to be provided by the NES about each type of structure is not necessary. It makes the NES unnecessarily cumbersome to administer and does not aid in ensuring fish passage.
Fish passage [NES 20]	The Council suggests that the definition of "culvert" requires further work. As currently drafted the definition would include a reticulated stormwater system and any kind of constructed channel. The Council suggests that the key characteristics of a culvert are: it's on a river or lake bed, includes a pipe or similar structure as a conduit for a river.
River bed infilling [NES 18] and structures [NES 22, 23, 24]	The Council seeks that relevant NES provisions for structures refer to erecting (that is the term used in S13 RMA, i.e. not 'constructing') and using a structure. Including the use of the structure in the rule ensures that the structure continues to be captured by the NES. Activities such as infilling a river bed and constructing a culvert are specific actions of limited duration. Once the infilling or construction is completed there is no further need for a consent so consents are often issued for only as long as it takes to place the structure and to check that it is completed in accordance with the consent conditions.
Structures [NES 21, 22, 23]	The Council seeks amendment to relevant NES requirements relating to the notification of permitted activities Requiring the notification and provision of a significant amount of information as a standard for a permitted activity is not good practice and is very difficult to ensure compliance. For example, clause 21(3)(b) of the NES requires a significant amount of information to be provided to the Council within 20 days of a culvert construction being completed.

National Environmental Standard (NES) for Fresh Water	
Reference	**Discussion**
	Firstly the council does not know and cannot ascertain the completion date. Advising the Council before commencing construction is far more practical. Also if the 20 day deadline is missed or the information provided is not complete the structure is non-complaint. There will be a lot of non-compliance and retrospective consenting of structures.
High-risk land use change [NES 35]	The Council notes with concern that the NES proposal for 'high-risk land use changes' are likely to inadvertently capture a farm's scrub clearance cycle. Due to Taranaki's wet and temperate climate, natural scrub growth and clearance is a regular occurrence (gorse, broom etc). In the absence of a definition for "*wood vegetation*," scrub clearance could be deemed a land-use change. The Council supports keeping class 6 land clear for a sustainable land use in many cases. The Council further notes that 10 ha of scrub would not be deemed significant in the eastern hill country and should not require a discretionary resource consent to clear. The Council is concerned that the proposals will have perverse outcomes whereby farmers would not be able to re-clear scrub (if left to grow) with flow-on implications for the Manuka honey industry. Similarly, there is a risk that forestry will not be planted on erosion prone land if there is a penalty to revert to pasture

NPS-FM	
Reference	**Discussion**
Setting attribute states [NPS-FM 3.9(2)a)]	The Council seeks amendment to the NPS-FM so that the target requirements for each FMU not to be set below its current state and that overall the target states of monitoring sites are to be set above their current collective state (with the exception of monitoring site already in the 'A' band). The draft NPS-FM requires that for attributes relating to human health (ie, E. coli-regional; cyanobacteria, and E.coli-primary contact sites) the target attribute state must be above the current state. However, this should not be necessary where sites are already in the 'A' band. Furthermore, this means that good sites receive equal priority to poorer sites with no differentiation in effort or importance.
Visual clarity [NPS-FM 3.18(1)(b)]:	The Council seeks Relief sought: that MfE confirm whether 'visual clarity' or 'turbidity' is the measure intended for sites being assessed for suitability for primary contact recreation. 'Visual clarity' is a different measure in water quality science from 'turbidity'. The NPS requires that turbidity be recognised as a compulsory attribute (Table 10), but refers above to a different measure.
Streams [NPS-FM 3.16]	The Council seeks clarification on what the policy intention is in relation to clause 3.16 [Streams] of the NPS-FM and how stream loss/gain would be quantified. General questioning of the 'effects management hierarchy' and relative prioritisation therein. It is not clear on the 'no net loss of habitat' definition and whether that is measured at the specific location of the activity, i.e. where a culvert is installed or the wider river/stream environment. Council notes that it is not possible to have no loss of habitat when installing culvert for instance, but it could be offset by habitat improvements in the vicinity of the installation site, offsetting the loss, and resulting in no net loss of habitat.
Fish passage [NPS-FM 3.17]	The Council notes it must establish and implement a work programme to improve the extent to which existing structures achieve aquatic life objectives for fish. The programme must include identifying all structures within the region ('all' suggests consented and permitted) and assessing the risk each poses to fish passage, prioritising structures for remediation applying criteria in Table 5.1 of the NZ Fish Passage Guidelines, documenting prioritisation remediation required and how and when this will be achieved, documenting which structures have been remediated since commencement date and how ongoing performance of the remediated structure will be monitoring and evaluated. This is a significant piece of work of work in Taranaki noting Council could be looking at 10,000+ structures. Inspection of these will likely result in large volumes of follow-up monitoring, consenting and enforcement work as well.

NPS-FM	
Reference	**Discussion**
	The most practical approach for this in relation to existing structures would be for these locations to be identified through riparian plan audits or when developing FEPs, although a requirement to do so it not a specific requirement of FEPs as set out in Clause 38. Under the proposed NES we will be able to charge for monitoring of permitted culverts built after the NES comes in to effect, that leaves a lot of pre-existing permitted activity culverts for which charging will not be possible. Requiring the ID and assessment of structures through the FEPs would put the costs back on the landowner. There will also be significant costs in remediating orphan structures and we suggest the government should create some funding for such works.
Accounting systems [NPS-FM 3.2]	In terms of water quality accounting, this is a significant challenge and a massive volume of work for potentially very little gain given uncertainties in calculating contaminant loads and source apportioning. The Council notes massive uncertainties in any approach currently available to apportion contaminant inputs from diffuse sources. Long-term trend monitoring as part of SEM work has been demonstrated to be more valuable, with targeted mitigations implemented where trends indicate deterioration in water quality.
Identifying and setting target attribute states; (NPS-FM 3.8 and 3.9)	The Council seeks that the obligation (explicit or implicit) to include current and target attribute states within notified regional policy statements or regional plans by 2023 be deleted; and instead, that regional councils be required to include within the relevant policy statements and/or plan a timeframe by which these attribute states will be identified and notified. Every regional council is obliged to identify the current state of each water quality attribute, and the target state for each attribute, at each monitoring site. The implication is that these must be recorded within a regional policy statement or plan, after determination through a consultative process involving the regional community although this is not clear upon a reading of the proposals. New/revised RPSs and regional water plans must be in effect by 31 December 2025 (NPS-FM Part 4). The advice from MfE officials is that therefore RPSs and regional plans must be prepared for submission to the new water panel by 2023. That is, RPSs and plans must be prepared within the next three years at most. But:- • to identify the current trophic state of periphyton attribute, the NPS-FM specifies that five years' worth of monitoring data is required (Table 2); • to identify the numeric attribute state of DIN, 5 years' worth of monitoring data is required (Table 5); • to identify the numeric attribute state of DRP, 5 years' worth of monitoring data is required (Table 6);

NPS-FM	
Reference	**Discussion**
	• to identify the numeric attribute state of suspended fine sediment, at least 24 samples gathered monthly over at least 2 years is required (Table 10); • to identify the numeric attribute state of E coli, at least 60 samples gathered over a maximum of 5 years' worth of monitoring data is required (Table 11); • to identify the numeric attribute state of cyanobacteria, 3 years' worth of monitoring data gathered monthly is required (Table 12); • to identify the numeric attribute state of MCI, QMCI, and ASPM, 5 years' worth of monitoring data is required (Tables 13-14); • to identify the numeric attribute state of deposited fine sediment, at least 2 years' worth of monitoring data is required, but if flow conditions do not permit monthly sampling, then sampling must be undertaken over a longer period (Table 18). The contradiction between the determination of current and target states, and the timeframes allowed for preparation of statutory instruments, is obvious and impossible to reconcile.
Phytoplankton [NPS-FM Table 1]	The Council seeks that Table 1 sets or allows a sampling frequency of quarterly sampling, and calculation of state over five years. No sampling frequency is specified in the NPS-FM. Numeric state is based on median and maximum values. The Council monitors Lake Rotorangi quarterly and can generate these data from that data set. Phytoplankton is subject to the same periodic fluctuations as periphyton (eg a warm, windless year vs a cloudy, cooler, more windy year), and for meaningful classification of the state of a lake, it is submitted that the calculation of state is based on a five-year rolling median rather than the median re-calculated for every individual year.
Periphyton (rivers) [NPS-FM Table 2]	The Council seeks that Table 2 in the NPS-FM be amended to clarify its intent and interpretation The stated methodology for determining state is ambiguous. Table 2 requires no more than 8% of samples above the numerics given within each category in the columns of Table 2, but the footnote specifies the calculation of a rolling median across 5 years. The association between the median so generated, the discounted 8%, and the numeric in the table columns is not identified. Such ambiguity within a regulatory document is unacceptable. Table 2 seems to imply that both the median, AND ALSO at least 92% of all results, must lie below the threshold, for the river to be within any particular category. For example, if the rolling five year median and at least 92% of all results over the five years are below 50 mg chl-a/m2, then the river is in the A attribute state, but if the median was below 50 mg chl-a/m2 and 20% of results were between 50 and 120 mg chl-a/m2, then (it is assumed) the river drops into the B attribute state.

NPS-FM	
Reference	**Discussion**
Total nitrogen [NPS-FM Table 3] and total phosphorus [NPS-FM Table 4]	The Council seeks that Table 3 and 4 set or allow a sampling frequency of quarterly sampling, and calculation of state over five years. No sampling frequency is specified in the NPS-FM. Numeric state is based on median and maximum values. The Council monitors Lake Rotorangi quarterly and can generate these data from that data set. Phytoplankton is subject to the same periodic fluctuations as periphyton (eg a warm, windless year vs a cloudy, cooler, more windy year), and for meaningful classification of the state of a lake, it is submitted that the calculation of state is based on a five-year rolling median rather than the median re-calculated for every individual year.
Sediment (NPS-FM Table 10,)	The Council seeks that Table 10 (suspended sediment limits) be removed from the NPS-FM to focus more on outcome monitoring of ecosystem health and sustainable land use as the primary measures for water quality in the hill country. If that relief is not acceptable, the Council seeks that Table 10 be transferred to Appendix 2B [Action plan rather than national limits]; and suspend Table 10 for 5 years while pilot studies into its application can be undertaken for 'proof of concept', validation, and cost-benefit analysis. It is noted that this was the approach endorsed by the regional councils' representative working group with which MfE consulted during the 2018/2019 period. Table 10 in Appendix 2A of the NPS-FM sets out a series of bands that apply to specific REC classes of catchments, recognising that natural sources of turbidity have a significant and highly differentiated effect upon water quality. There are a number of issues with this attribute: • There is no statement as to whether the median, the mean, or the maximum result is intended for use in grading purposes; • The bands are extremely narrow. In some cases, a variation of only 0.2-0.3 FNU is enough to change a state from the A band to the C band (or vice versa). Such a narrow range fails to recognise variability inherent in grab sampling (at a single point in time and space) to represent a continuously flowing water body throughout an entire catchment; uncertainty and bias within laboratory analyses; and natural variations within water quality itself. While these fluctuations and uncertainties are intrinsic to any sampling regime, the extremely constrained bands developed for this attribute mean the effects are far more pronounced, with the consequence their application becomes unreliable if indeed not meaningless altogether. The Council's consulting laboratory advises that the uncertainty in any one measurement is +/- 0.05 FTU: effectively this means that the laboratory uncertainty spans half the entire band for some classes. • The proposed attributes are complex. On one level this has some attraction; i.e., the 12 level classification allows a degree of differentiation that reflects natural variability in geology and hydrology. However, the consequence for a compulsory attribute is that this translates into real challenges in terms of the resource needed to measure and monitor in stream, especially within first and second order streams as was flagged by MfE staff to regional council representatives during discussion of the proposed attribute.

NPS-FM	
Reference	**Discussion**
	Councils will be faced with moving monitoring networks and/or creating new monitoring sites from scratch, the cost of which is substantial, and will need to be secured through long term planning or annual budget reprioritisation. • The attributes potentially move us away from an FMU / catchment planning approach which is the foundation of NPS-FM implementation and discussions with communities and iwi, to small headwaters and disparate streams. This will add unhelpful complexity to the resource management consultation, policy development, and target state framework. • Sediment is a new attribute in terms of the protocols within the NPS-FM. Existing datasets will not easily or widely apply. It will take time before monitoring data is available to support development and implementation of policy. • The level of complexity makes it difficult for communities faced with taking action on sediment to understand what they are trying to address. Conversation with communities and iwi are often in terms of 'total load' of sediment – the 12-band classification will need to be converted to land types and land use source loads to make it intelligible to the lay person. • There are some potential challenges in linking land use management to changes in attribute bands. This may be further complicated by the rapid changes in land use in some catchments (e.g. those subject to urban growth) which occur well within the two years/ minimum sampling period before the state of an attribute can be determined. • Compulsory attributes lock in a cycle of council planning and monitoring potentially at the expense of resourcing that addresses the root causes of sediment loss i.e. in many cases lack of policy is less of an issue than the scale of the on the ground challenge. • The proposal does not deal with conflicting national policy drivers e.g. urban development vs freshwater quality. • The link to the coastal / marine receiving environment is yet to be developed and this is an important aspect of community values.

Conclusions

154) The Taranaki Regional Council again thanks the Ministry for the Environment for the opportunity to comment on the *Action for healthy waterways* proposal.

155) In many areas, the relief sought has been deliberately high level due to the need to focus on the major areas for concern. The Council notes that it could have sought relief for a large number issues particularly relating to drafting and practicalities. The Council recommends that the proposal be workshopped with experts in writing and implementing regional resource management plans and monitoring.

156) The Council requests a hearing from the review panel.

Yours faithfully

B G Chamberlain

Chief Executive

Appendix 1

Overview of Taranaki Regional Council's Riparian Management Programme

Transforming Taranaki, 2019

TRANSFORMING TARANAKI

A strong community is one that comes together and collectively takes action for a common and worthy cause. This is the story of such a community. Our Taranaki community.

The common cause is healthier ecosystems. The Riparian Management Programme is transforming Taranaki.

Nearly 30 years ago, the community picked up a mammoth challenge: Fencing and planting thousands of kilometres of waterways. They made the project their own. Today, our waterways are at or near the healthiest state ever recorded, and the ring plain's indigenous biodiversity is on a firmer footing.

It's a world-scale ecological restoration project. This booklet celebrates its achievements and looks forward to more gains in the future.

David MacLeod,
Chairman, Taranaki Regional Council
October 2019

Taranaki
Regional Council

Taranaki at the forefront

As a field ecologist, there are many disadvantages in growing older. But one special advantage is being aware of the rate and magnitude of change on the landscape, especially when the change is for the better. I first became interested in indigenous nature in Taranaki 60 years ago and began formally documenting ecosystems, particularly in Egmont National Park, more than 40 years ago. It was possible in those earlier days to swim in and drink from waterways without any danger of a stomach complaint. And kōkako, kiwi and whio could still be encountered in many parts of the region. I distinctly remember the many 'dead areas' of the lower subalpine shrub belt infested by herds of goats, the regular cattle trespass within the park and the massive foliage loss of palatable native trees caused by rapid increases in possum numbers. Then there was the 'tidying up' of smaller remnants of lowland forest on the ring plain.

Who would have believed back then the potential for a turnaround in attitude and management practice evident today? This is beginning to gather pace. The Taranaki Regional Council has been instrumental in this shift through a collaborative partnership approach to management of our land and water ecosystems. A wide range of innovative projects, including the riparian planting programme, Towards Predator-Free Taranaki, Wild for Taranaki and Project Mounga, are helping to reconnect and restore the health of our unique Taranaki landscapes and ecosystems.

"Who would have believed back then the potential for a turnaround in attitude and management practice evident today? This is beginning to gather pace."

A good number of the sites I documented at the beginning of my career are now in better condition than previously and many of our native birds have been returned to areas they have been absent from for decades.

My own connection with this land, while inspired by a love of nature, is tempered by the more cautious analysis of an environmental scientist observing progress nationally and internationally. However, the evidence is gathering that Taranaki is on a trajectory, which puts it at the forefront of a more sympathetic and intergenerational approach to land and water management. This comes in the form of regenerative and sustainable agricultural practices and landscape-scale ecological restoration.

But we cannot be complacent. Significant challenges, including the climate change emergency and the arrival of new diseases such as myrtle rust, mean that conventional siloed approaches will be inadequate in scale and magnitude. Only with collaborative partnerships that empower and support community-level action can these challenges be met.

Professor Bruce Clarkson
Deputy Vice-Chancellor Research, University of Waikato

A region **transformed**

Since the 1990s, landowners and farmers on the Taranaki ring plain and coastal terraces have voluntarily protected rivers, streams and wetlands with 5.6 million plants and 13,000km of fencing, with more of each to come. This work is:

- Transforming the landscape, breaking monotonous grassy monoculture with dense green ribbons, rich in biodiversity values, radiating from all sides of the mountain.
- Transforming rivers, streams and wetlands after decades of riparian vegetation being removed and waterways being used as disposal channels for pasture run-off and raw waste. Today they are at or near the best ecological state ever recorded, thanks to streamside fencing and planting along with major investments by communities and industries to clean up their acts.
- Securing the future of native plants and wildlife on the ring plain, where riparian protection now offers 6,000 hectares of protected native habitat alongside waterways. The community is currently rallying around an ambitious new campaign to build on this by ridding the region of introduced predators to help indigenous biodiversity recover and thrive.

Video: www.bit.ly/TransformTaranaki

15,409km streambanks

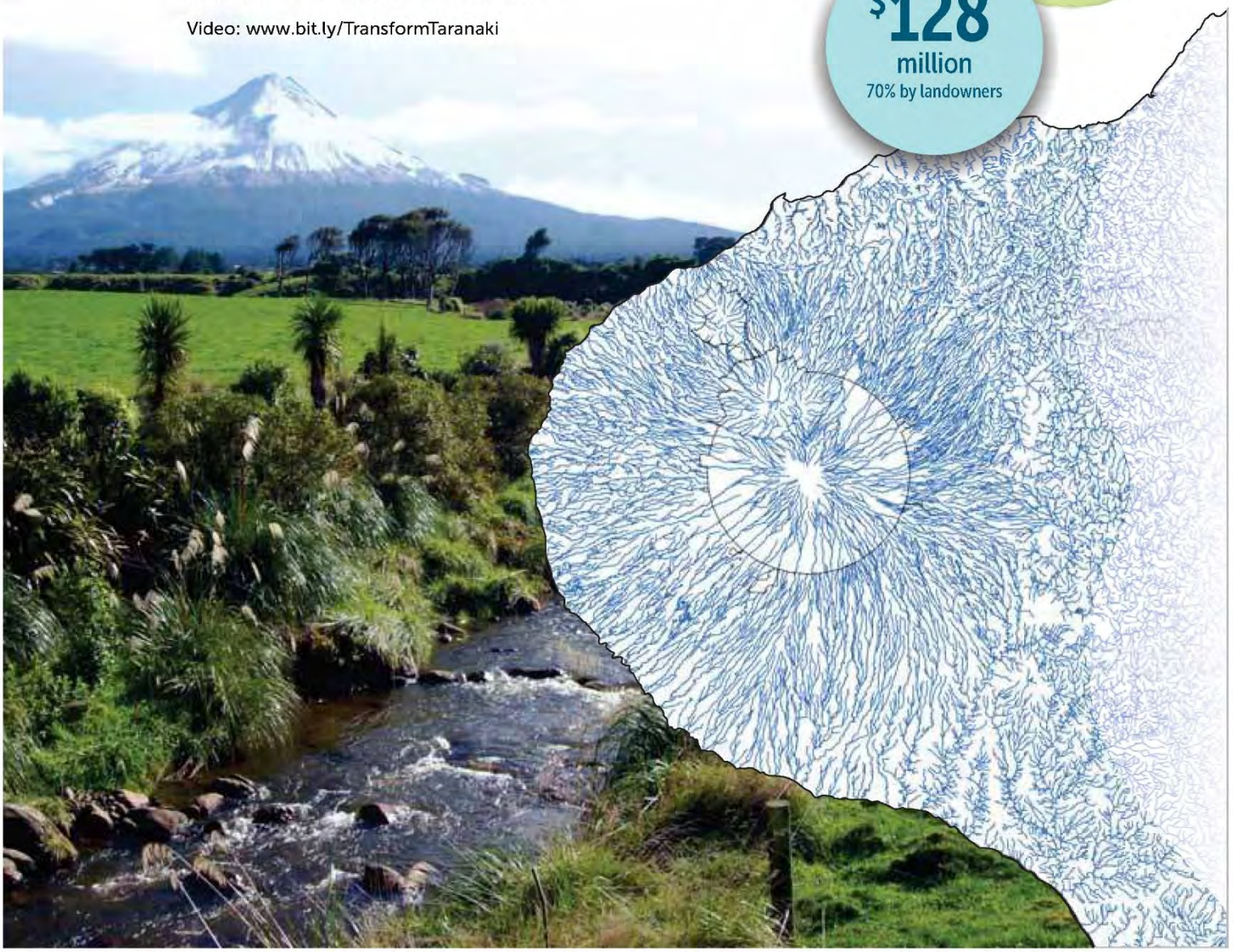
13,756 km fenced

8,928 km riparian vegetation

5.6 million plants

6,000ha native habitat protected

$128 million
70% by landowners



How do we know **it's working?**

Monitoring by the Taranaki Region Council in recent years shows our rivers and streams are at or near the best ecological health ever recorded.

The Council and independent NIWA scientists say riparian fencing and planting is a strong factor in the improved ecological health of Taranaki's rivers and streams, along with a reduction in bacteria levels. Other factors include investment by communities and industry to eliminate or drastically reduce the impact of direct discharges.

www.trc.govt.nz/taranaki-waterways-updates

River ecology trends
1995-2018

47% Improvement
53% No obvious trend
0% Deterioration

Physical and chemical trends 2011-2018

3% Improvement
81% No obvious trend
16% Deterioration

The bugs tell the story

The best way to gauge the overall health of a waterway is to study what sort of insects, molluscs, worms and other small creatures live in it. Are they fussy ones, who don't tolerate poor-quality water? Or do they thrive in filth? Using a scoring system based on the sensitivity of different species to water quality, and monitoring the same sites over a long period, the ecological health of our rivers and streams can be assessed and tracked. Taranaki's waterways have shown consistent improvement in recent years.

Think carefully about nutrients

Ecological monitoring gives a more complete picture than nutrient levels and other physical and chemical measurements such as bacteria levels, water clarity, conductivity and acidity, nutrient levels and oxygen levels. At best, these intermittent measurements give an indication of the health pressures a waterway may be under. But they can also vary according to weather conditions and how high or low the river is running.

Crucially, the Council and NIWA scientists have found that ecological health is improving even where nitrogen levels are increasing. The relationship between nutrient levels and stream health is clearly not as simplistic and straightforward as often suggested.

The verdict of science

Taranaki Riparian Management Programme has had beneficial effects on stream health and water quality for human health and recreation in the region . . .

Analysis of stream responses to riparian management on the Taranaki ring plain, NIWA, 2008 www.bit.ly/RiparianReport2018

What's different about this project?

- Scope and scale – it captures every waterway of any size, whether permanent or seasonal.
- It doesn't stop at stock exclusion also but includes the far bigger task of planting. This brings greater ecological and freshwater-health benefits.
- Fencing and planting plans are individually tailored for each property – because clearly, one size cannot fit all.
- Landowners (mostly farmers) meet the cost of the physical work and materials. There are no subsidies. Only occasional minor grants have been made in some places.
- It has been voluntary, not required by regulation. Farmers knew it was the right thing to do and took ownership of it. Compliance and enforcement have not been costly issues.
- It is a happening reality, not a concept. It's well-established and heading towards completion.

What the **farmers say**

"This is our little slice of paradise, but it wasn't always like this. I can remember trying to cross the river and the rocks would be all slimy and slippery and the water level was low and warm, like unnaturally warm – it's because there wasn't the shade. Now it's a pleasure that my children get to enjoy this."

– Megan Symons, Opunake www.bit.ly/TransformTaranaki

Megan and Matt Symons run the family farm where Megan's father, Gordon Symes, was one of the first Taranaki dairy farmers to start streamside fencing and planting in the 1990s.

"It's a matter of complying with requirements and expectations, and it goes beyond that. We want cleaner waterways too, and we're also enjoying the visual impact and the return of bird life. And from a stock-management point of view, it's been useful … we see our fencing and planting as an investment for the future."

– Rob and Di Bridgeman, Okato. www.bit.ly/Riparian2018

Rob and Di Bridgeman have planted nearly 5,000 native plants and erected fences to protect 3km of streambank and a small wetland on their dairy farm.

"I certainly feel that Taranaki's further ahead than most regions because we've been doing it for longer and it's been voluntary, with help. We don't get paid to do it, we don't get subsidised to do it, but we get helped to do it – farm plans, plants at cost."

- Blue Read, Pukearuhe www.bit.ly/TransformTaranaki

Blue Read had one of the first riparian management plans, pre-dating the launch of the region-wide programme.

Substantially **farmer-funded**

This has been a voluntary scheme, funded largely by farmers. Great progress has been achieved because people understood what they needed to do, not because they were forced to by a rule in a Regional Plan.

Run-off from pasture – 'diffuse-source discharges' – was recognised in the 1990s as a key factor behind the poor state of many Taranaki waterways. After consulting specialists and engaging with the community, the Taranaki Regional Council determined that fencing and planting streambanks would be the most effective response. Fences prevent stock from entering and fouling waterways, and vegetation provides a buffer to run-off and shades the water, promoting stream health.

The Council then geared itself up to deliver this project, and started bringing key players on board by encouraging them to understand why it was important to be part of it.

This was the deal

Council staff have worked one-on-one with landowners to draw up individual, property-specific Riparian Management Plans setting out the areas to be fenced and planted, the best native plant varieties to use, and a timeframe for completion. The advent of digital technology has made this more efficient and speedier as the programme progressed. The Council has also organised the supply of suitable riparian plants at cost, and coordinated contractors for those unable to attend to fencing/planting/maintenance themselves. The Council's one-on-one advice and support continues as plans are implemented.

Farmers are implementing their plans by making annual plant purchases, getting them planted and completing the required fencing.

Are we there yet?

Freshwater management has been undergoing great change, with the Government issuing a raft of new requirements and proposing more. Whatever eventuates, the riparian fencing and planting effort by Taranaki landowners means they're well placed to meet any reasonable responsibilities they may face in the future.

The Council, too, is thinking ahead. Taranaki's new Regional Freshwater and Land Plan, due for public notification in mid-2020, will include compliance requirements aimed particularly at the small number of landowners who have stayed distant from the riparian programme. Council staff have begun auditing all riparian plans to ensure they include all waterways and regionally significant wetlands to meet future regulatory requirements.

Meanwhile, under direction from the Council, the dairy-farming community is also investing in improvements to effluent disposal, switching to land-based systems that leave waterways out of the equation. Together with continued riparian fencing and planting, this is expected to result in further improvements to waterway health.

Strong focus on biodiversity

As with the Riparian Management Programme, enthusiastic community support is the bedrock of more recent initiatives to protect and restore the region's native biodiversity.

Towards Predator-Free Taranaki, launched in mid-2018, is already showing results in urban New Plymouth, where rat and possum numbers are decreasing, and the trapping network is expanding rapidly in rural areas as well, building on the success of the long-running Self-Help Possum Control Programme.

Led by the Taranaki Regional Council, the project will cost $47 million in the first five years, with $11.7 million from the Government. It is the biggest project of its kind in the country. www.trc.govt.nz/pf-taranaki2050

The region's voluntary Key Native Ecosystem (KNE) programme has also been growing rapidly. The Council has identified 293 KNEs covering almost 123,400 hectares, most partly or fully in private ownership. Council staff are working with the owners of 132 of them, covering 5,300ha, to prepare and implement individual Biodiversity Plans, mostly involving fencing, predator and pest-plant control, and restoration planting. Twenty to 25 new Biodiversity Plans are prepared every year.

Many lessons in long journey

Taranaki's achievements offer useful pointers for all involved in resource and environmental management:

- Community buy-in is essential. Taranaki farmers are devoting millions of dollars and thousands of hours to riparian protection not because they have been forced to by a rule or regulation, but because they understand and accept the need for it.
- One size doesn't necessarily fit all. New Zealand's river catchments vary widely by soil, climate, hydrology and land use. To be effective, remedial work is best tailored by the local community to suit local conditions.
- The strategy must be clear. The success of Taranaki's Riparian Management Scheme is built on three foundations: establishing a sound case for the project, ensuring that it can be delivered, and crucially, bringing key players on board by encouraging them to understand it and want to be part of it.

Taranaki is on a trajectory which puts it at the forefront of a more sympathetic and intergenerational approach to land and water management.

Professor Bruce Clarkson, University of Waikato

It is likely one of the largest and longest-running restorative freshwater programmes in the world.

Dr Elizabeth Graham, NIWA

National and international **recognition**

The Riparian Management Programme has been recognised with a number of awards

2019 Excellence Award for Environmental Well-Being (Local Government NZ)

2013 Green Ribbon Award (Ministry for the Environment)

2011 Geospatial World Forum Excellence Award for Land and Resource Management

2010 NZ Resource Management Law Association Project Award

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Appendix 2

Internal report reviewing DIN limit proposal in Essential Freshwater

Commentary on nutrient and other NOF attributes in EFM proposals package

Purpose

This memorandum, sets out an assessment of the additional NOF attributes (measures of water quality, together with bands categorising the degree of quality associated with each level of the attribute) that are being proposed in the September EFM package. In particular it considers the new nutrient attributes Dissolved Inorganic Nitrogen (DIN, comprising nitrate, nitrite, and ammonium) and Dissolved Reactive Phosphorus (DRP). It also comments more briefly on others of the proposed attributes.

Executive Summary

The memorandum considers the nutrient attributes in the light of:-

a. how the proposed numerical values defining the attribute states compare with international guidelines or standards;
b. how the proposed numerical values defining the attribute states compare with the ANZECC guideline values that recognise varying degrees of modification of landscapes;
c. the implications of reliance upon control of nutrients as a means to enhancing in-stream ecological health;
d. the robustness of the correlation between nutrient concentrations and measures of stream health;
e. the meaningfulness of requiring year-round data as a measure of likelihood of summer low-flow based events;
f. the adequacy and relevance of land-use controls on DIN and DRP as a means to achieving water quality outcomes.
g. the *E coli*, sediment (turbidity), and deposited sediment attributes.

Background

Set out below is a summary table and explanation of the NES/NPS-FM requirements concerning the new DIN and DRP attributes, provided by LGNZ. The attribute tables themselves are attached as Appendix 1 to this memo.

1. Every council-
    a. Must identify the current state of every attribute listed in the NPS-FM, together with any other attributes it identifies for any compulsory or other value of water
    b. must set a target attribute state for every attribute including DIN and DRP, for every monitoring site in each FMU.

2. Attributes are given in 2 categories- those that require imposition of limits, and those that require action plans. For those that require **limits** [chl-a measures for phytoplankton and for periphyton, TN (lakes), TP (lakes), DIN for ecosystem health (rivers), DRP for ecosystem health (rivers), ammonium (toxicity- rivers), NO3 (toxicity- rivers), DO (rivers- below point sources), turbidity (rivers and streams), *E coli* (swimmability), cyanobacteria (lakes)], councils-

a. must identify limits on resource uses that will achieve the target attribute state;
b. must include the limits on resource use as rules in its regional plan;
c. may prepare and publish action plans; and
d. may impose conditions on resource consents.

3. For attributes requiring action plans, councils
   a. must prepare an action plan to achieve the target attribute state with the timeframe;
   b. must publish the plan
   c. may identify and impose limits on resource use as rules in a regional plan, and
   d. may impose conditions within resource consents

4. If the current state of an attribute is worse than the national bottom line for that attribute
   a. the target attribute state must be set at, or better than, the national bottom line; and
   b. must specify a timeframe for achieving it.

5. Timeframes for achieving target attribute states may be of any length or period; but must include interim targets (set for intervals of not more than 10 years) to be used to assess progress towards achieving the target attribute state in the long-term.

6. An action plan must be prepared if there is any deterioration in any attribute

Exception for naturally occurring processes

1. If all or part of a water body is affected by naturally occurring processes that mean that the current state is worse than the national bottom line, and a target attribute state at or better than the national bottom line cannot be achieved, the regional council may set a target attribute state that is worse than the national bottom line, but must still set it to achieve an improved attribute state to the extent feasible given the natural processes.

2. In any dispute about whether this exception should apply, the onus is on the relevant regional council to demonstrate that it is naturally occurring processes that prevents the national bottom line being achieved.

3. For the purposes of this section, **naturally occurring processes** means processes that could have occurred in New Zealand before the arrival of humans.

Note: Nitrate and ammonia tables are still in the draft NPS-FM but would be redundant if DIN table is introduced, as the latter is much more stringent. The existing periphyton table is still in the NPS-FM along with the current note directing councils to set DIN and DRP exceedance criteria for periphyton and other values, and N and P criteria for achieving outcomes for sensitive downstream receiving environments (eg lakes and estuaries). STAG proposed a default DIN and DRP table that was much more stringent than the more generic DIN and DRP attributes that are to be applied universally. No amendment to periphyton table (as recommended by STAG) is currently included.

It can be assumed that any stream that is susceptible to periphyton blooms or which has a sensitive downstream receiving environment already requires stringent N and P criteria under the NPS-FM 2017, so the new DIN and DRP attributes would apply in all other remaining streams that are currently below the national bottom line (assuming that councils cannot prove that non-compliance is due to natural causes (e.g., geology or geothermal).

Discussion

NOF states and international guidelines

Taranaki is not alone in having DIN and DRP concentrations in its waterways that are higher than the proposed national nutrient bottom lines. From McDowell et al[27], average concentrations of Dissolved Inorganic Nitrogen (DIN) and Dissolved Reactive Phosphorus (DRP), the two key nutrients associated with farm runoff and its impact on water quality, are in fact lower in Taranaki than in most other intensive dairying regions (while above the proposed standards, especially in the case of phosphorus). The Council's review of all sites on the LAWA website shows that 30% of all sites fail the proposed DRP bottom line, and 20% fail the proposed DIN bottom line. Attainment of the proposed NOF attribute bottom lines for DIN and DRP will challenge every dairying region in New Zealand.

It is highly informative to contrast the criteria being proposed within the draft NPS-FM, with those in effect in the UK and across Europe for the same environmental objectives. The UK Technical Advisory Group (UKTAG) is responsible for providing the government (Department for Environment Food and Rural Affairs, or DEFRA) with instruction on the implementation of the Water Framework Directive (2000). The WFD requires the setting of biological and physico-chemical standards necessary to protect and enhance the ecological condition of the country's waterways. A Phase 1 report was issued by the UKTAG in 2008[28]. In May 2014 the standards were updated and extended[29].

The descriptions used within the TAG reports are as follows: -

> The Water Framework Directive provides, in the 'normative' definitions of Annex V, a description of high, good, moderate, poor and bad ecological status. Each describes a different degree of impact on the plants and animals.

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[27] *Nitrogen and phosphorus in New Zealand streams and rivers: control and impact of eutrophication and the influence of land management,* New Zealand Journal of Marine and Freshwater research 2009 Vol 43 pp 985-995, RW McDowell, S Larned, and DJ Houlbrooke

[28] *UK Environmental Standards and Conditions (Phase 1),* April 2008, WFD UK TAG, at https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/Environmental%20standards%20phase%201_Final v2_010408.pdf

[29] *Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment* May 2014, DEFRA, at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/307788/river-basin-planning-standards.pdf

> For example, for high status: *there are no, or only very minor, anthropogenic alterations to the values of the physicochemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions. The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion.*
>
> And for good status: *the values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.*
>
> *….The standards and conditions associated with Good Status give, for example, the concentrations of a pollutant, or the change in water flows, that we believe can be accommodated without causing any significant harm to aquatic plants and animals.*

All standards set out within the UKTAG reports are intended to support at least good ecological status in surface water bodies. The study focused on identifying the relationship between the biology and the pressures on the environment.

The UKTAG reports note that there is consistency in ecological status objectives in all member countries adhering to the WFD across the European Union.

Further, the UKTAG assessment considered and rejected any scientific validity behind imposing a DIN or nitrate criterion.

> Although nitrogen may have a role in the eutrophication in some types of freshwaters, we consider the general understanding of this to be insufficient at present for it to be used as a basis for setting standards or conditions. The possibility is too strong that the statistical associations produced by these methods would represent correlation between nitrogen and phosphorus (and other factors), and not the standards for nitrogen that are truly needed to protect the biology. For these reasons no standards for nitrogen are proposed in this report.[30]

The WFD standards were updated in 2014. Within the 2014 assessment, conducted by the UKTAG, the implications of sustainable management of water quality were explored further. In particular it was noted:

> Adopting these new and updated standards has implications for classification of water bodies and where we target our efforts to protect and improve the water environment. However, the standards do not dictate the achievement of the WFD objectives, since the latter strikes a balance between protecting the water environment and enabling its sustainable use. Where, for example, making the improvements needed to achieve the standards required for good status would be disproportionately expensive, we will extend the deadline for the achievement of the objectives or set less stringent objectives. When Ministers agree the final plans they will take into account the balance of costs and benefits and the appropriate phasing of improvements over this 2nd cycle period (to 2021) and beyond to 2027.

[30] Pg 31, UKTAG 2008

The nature of the 2014 review was described:

> In developing its standards, where possible UKTAG has used ecological data collected from hundreds or thousands of sites. UKTAG has compared these with information for the same sites on the environmental conditions to which the plants and animals are sensitive. This process can identify standards that correspond directly with the ecological definition of good status. In other cases, in estuaries and coastal waters for example, and generally for pollutants not historically subject to big programmes of monitoring, there are insufficient data to derive standards in this way. In such cases, UKTAG has used the current scientific understanding of the causes of ecological change, or the risk of harm in the case of chemicals. UKTAG has compared this understanding with the Directive's biological descriptions of the classes. In doing this, UKTAG has sought advice from independent experts from a range of scientific disciplines. UKTAG has used this approach to identify limits for river flow and water levels, and for standards for particular chemicals.
>
> Environmental standards form the foundation of a risk-based approach to river basin management planning. Updating environmental standards in light of improved scientific understanding enables us to ensure we appropriately protect the water environment without imposing unnecessary constraints on development. It also enables us to refine our understanding of where the water environment is under pressure and the scale of environmental improvements we would need to achieve good ecological quality[31]….
>
> The standards are based on the latest scientific understanding of aquatic ecosystems and take account of the evidence gained from using the existing standards and environmental monitoring programmes from across the UK and beyond.[32]
>
> The standards for good and high status applicable to all but two of the methods have been harmonised with the corresponding standards used by other countries across the EU as part of the harmonisation exercise facilitated by the European Commission[33]

In 2014, the UKTAG moved to river classification-based DRP criteria, that were more site-specific that in 2008. The full range of possible DRP values, across all classifications, together with the 2008 values, are set out below (reproduced from Table 5.1a, UKTAG 2014). These standards are specific to the particular conditions at a site. It is informative to note the explanation within the 2014 report:

> This approach is designed to take account of the natural variation of nutrient concentrations along rivers and site-to-site differences in the ecological response to elevated concentrations….the proposed standards represent a major step forward in matching nutrient concentrations to ecological change. However, it is also clear that factors other than those taken into account in the method for setting the standards

[31] Pg 8, UKTAG 2014

[32] Pg 10, UKTAG 2014

[33] Pg 12, UKTAG 2014

can affect the extent to which water plants at any individual sites respond to a given nutrient concentration…the proposal is not to seek costly action to reduce phosphorus concentrations at individual sites without appropriate ecological evidence of nutrient-related impacts[34]

Type (for 2008 standards)	Annual mean of reactive phosphorus (µg per litre)							
	High		Good		Moderate		Poor	
	2008	New (2014)	2008	New (2014)	2008	New (2014)	2008	New (2014)
Lowland, low alkalinity	30	19 (13-26)	50	40 (28-52)	150	114 (87-140)	500	842 (752-918)
Upland, low alkalinity	20	13 (13-20)	40	28 (28-41)	150	87 (87-117)	500	752 (752-851)
Lowland, high alkalinity	50	36 (27-50)	120	69 (52-91)	250	173 (141-215)	1000	1003 (921-1098)
Upland, high alkalinity	50	24 (18-37)	120	48 (28-70)	250	132 (109-177)	1000	898 (829-1012)

Notes:
1. The revised standards illustrated are the medians from, respectively, 456 lowland, high alkalinity sites; 129 upland high alkalinity sites; 137, lowland, low alkalinity sites; and 97 upland, low alkalinity sites. The numbers
in parentheses are the upper and lower 5th and 95th percentiles of the standards for the sites in each type.
2. "Lowland" means less than or equal to 80 metres above mean sea.
"Upland" means more than 80 metres above mean sea level.
"Low alkalinity" with a concentration CaCO3 of less than 50 mg per litre.
"High alkalinity" with a concentration CaCO3 of greater than or equal to 50 mg per litre

Comparison of UKTAG standards with MfE proposals

It is immediately obvious that the proposed universal NPS-FM bottom line for all of New Zealand, of 18 ug/L, is much more stringent than that which is being applied across Europe, for the same designated ecological outcome. The threshold for 'good' ecological condition in the UK is 2- 3 times higher than is being proposed by MfE for New Zealand for even the national bottom line for an acceptable concentration of phosphorus. Attainment of the highest category of attribute state in New Zealand would require a phosphorus concentration 2-6 times lower than is applied for the highest attribute state in Europe.

Many sites in the UK in even the best ecological condition ('high') would fail to reach even the bottom line that the government is proposing for New Zealand, let alone almost every site in the UK that is only in the 'good' category. And as noted above, in the UK, sites that fail to meet the 'good' category may on the merits of their case have lower objectives established.

Conversely, every physico-chemical monitoring site in Taranaki would meet its corresponding 2014 UK 'good' standard for phosphorus, with the exception of the lower

[34] Pp18-19, UKTAG 2014

Punehu Stream (median of 44 µg/m^3, against a UK 'good' standard of 40 µg /m^3), yet every ringplain river with a source on Mt Taranaki has a DRP median concentration at or far over the proposed NOF bottom line.

And notably, the UK continue to have no place for any DIN or nitrate standard for protection of the ecological status of inland waters.

The clear interpretation is that by comparison with relevant standards elsewhere around the world, the proposed NPS-FM limits are out of kilter, severe in the extreme, and on the face of it indefensible, given that the end ecological objectives have been framed in similar terms for both the UK and NZ but the numbers are so radically different.

ANZECC (2003) unmodified and modified ecosystems approach, vs the NOF / NPS-FM approach

Relevant reference data for this discussion are presented in Appendices 1 and 2 of this report.

There is a fundamental divergence of philosophy, to the extent of contradictory interpretation and application of data, between the ANZECC 2003 and the EFM NPS-FM approaches to nutrients.

ANZECC presents two sets of trigger values. The first set offers a suite of chemical and physical measures of water quality data that represent the state of water quality found at reference sites around New Zealand. The second set of data provide for variable levels of protection of in-stream ecology, based on the number of species that may be affected. More specifically, the first set answers the question 'what's the best water quality that can be found', while the second set answers the question 'for a pre-determined level of effect, what's the water quality criteria that should be required?'.

On first inspection, the NPS-FM has conflated the two functions.

The default low-risk trigger values were derived from reference sites around New Zealand. Such sites are defined[35] as data from unmodified or slightly-modified ecosystems. That is, to all intents and purposes such data has come from pristine or relatively pristine sites, those with minimal disturbance. A further selection criterion was then applied to the data set itself: the 'worst' 20% of data was rejected, and the trigger level set at the 80th%ile value. That is, even 20% of the sites that would be expected to have the highest water quality attainable under real world, least disturbed scenarios, fail to make this trigger value. The interpretation of the trigger values, so derived, is that these trigger values are to be used to identify whether a risk of any effect (perturbation in biological condition) of any magnitude is more than low. The trigger values do not indicate whether any consequent perturbation will have an effect of any magnitude, nor whether such an effect if it occurs should be considered acceptable or unacceptable.

[35] Pg 3.3-8, ANZECC 2003

The 2003 ANZECC guidelines state that water quality at the reference sites has not been assessed against any specific biological state. That is, the criteria do not have any validity when trying to identify the water quality necessary to achieve any specific ecological outcome. *([T]he choice of these reference systems was not based on any objective biological criteria.*[36]) In other words, the trigger numbers are not equivalent to and cannot be used to justify establishing criteria to be applied for ecological condition. The ANZECC values do not establish that there will be unacceptable effects of any exten:*; if exceeded, they are to trigger further investigation to determine whether or not a real risk to the ecosystem exists*[37].

When the ANZECC 2003 trigger values are compared with the proposed NOF attribute bands (see tables in appendices 1 and 2), it is immediately obvious that the top two of the 3 'acceptable' NOF bands lie below (that is, they are more stringent) than the ANZECC trigger values denoting the threshold of any more than a low risk of any degree of effect. Effectively there is only one NOF band, the 'C' band, that would provide for any degree of nutrient input above that to be found at reference sites but is still above the national bottom line.

What this means is that in essence, the NOF is instigating predominantly a 'zero tolerance for risks, and zero room for effects' philosophy in water management, through the selection of attributes and their associated band values. This contrasts with the second table in ANZECC, which sets out four bands of degrees of effect (with aligned limits on input concentrations) that thereby allow communities to determine their own objectives for water quality maintenance and enhancement, and provide corresponding criteria.

Further, what is noticeable is that NOF uses quite different descriptions of the significance of the bands, from those in ANZECC. ANZECC describes the reference sites as undisturbed ecosystems upstream of possible environmental impacts, and representing desirable conditions[38], and the trigger values as those *below which ecologically or biologically meaningful changes do not occur*.[39] By contrast, the NOF language suggests that even at better than ANZECC trigger levels (B band), there might be *slight impact*, and under some circumstances some effects upon *sensitive ecosystems*. The A band is reserved for sites where *communities and processes are similar to those of natural reference conditions. No adverse effects attributable to DIN/DRP enrichment are expected.* But according to ANZECC, this description would also apply to sites with nutrient concentrations in the B band. That is, the NOF downgrades site ratings to lower bands if there is or might be slight impact, whereas the ANZECC guidelines deem this same degree of effect as non-meaningful.

I note that the 2018 ANZECC[40] updates modify the above assessment slightly, in that the NPS-FM A band for DIN is reasonably consistent with the 2018 ANZECC trigger thresholds (the latter are REC-specific in the 2018 ANZECC, so there is some degree of variation around specific applicable trigger values), so the two frameworks are coherent to that extent; however the DRP trigger values for denoting reference conditions in 2018 ANZECC still align, not with the A band, but with the bottom of the B band in the NPS; thus the latter is clearly still much more stringent.

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[36] Pg 3.3-9

[37] Pg 3.1-17

[38] Pg 3.1-16

[39] Pg 3.3-7

[40] https://www.mfe.govt.nz/fresh-water/freshwater-guidance-and-guidelines/australian-and-new-zealand-guidelines-fresh-and

Further, there is internal inconsistency between NOF attributes. For the DIN and DRP attributes, the national bottom line is equivalent to concentrations at which there '**may'** be some enrichment causing increased growth, or loss of sensitive taxa. On the other hand, for ammonia toxicity and for nitrate toxicity, the NOF bottom line is that the loss of even up to 20% of species is deemed acceptable. This degree of toxic impact represents a far greater impact that that which is tolerated for DIN and DRP enrichment. Within the ANZECC context, a 20% species loss is the worst degree of impact that is envisaged and that is provided for, with the suggestion that such criteria should be applied only in the case of highly degraded and disturbed systems, where there is no intention to rehabilitate.

But no matter how well or how badly the ANZECC and NOF band trigger values align or do not align, there remains a more fundamental issue- that of identifying robust and meaningful numeric descriptors of appropriate water quality that correlate with a clearly identifiable and quantifiable change in ecological condition or drivers of water quality. This is expanded on further in Section D below and Appendix 4 attached, but for the present argument the statement within the STAG report on pg 12 must be noted: '*Given the complex and dynamic relationship between attributes and ecosystem health, however, we have used these [attribute selection] criteria for guidance rather than as prerequisites, choosing to consider somewhat broader implications and imperatives….while we have worked hard to define ecologically meaningful bottom lines derived from empirical research, we are conscious that defining bottom lines will in some cases be as much a normative process as it is a scientific one. In providing our recommendations we have attempted to define our bottom lines considering both our understanding of New Zealanders' views as to the bounds of acceptability, and, from a technical perspective, the points at which impacts on the health and functioning of aquatic ecosystems shift from moderate to severe'*. There is thus no clear and unambiguous effects-based principle at work, yet the NPS-FM attribute DIN and DRP tables are both onerous and prescriptive.

This shifting definition of what is a meaningful or non-meaningful change in ecological condition, together with variation in the scale of acceptable effects and re-casting of associated nutrient criteria, does not engender confidence in the integrity and credibility of the science. Tables 5 and 6 should therefore not be made compulsory to be attained and enforced, but rather used as the basis for action plans to more generally enhance water quality in a progressive manner, adopting a 'no regrets' philosophical approach.

Returning to the stated purpose of the EFM proposals, that the Government's objectives include stopping further degradation of NZ's freshwater resources and to reverse past damage, and given both the scientific uncertainties and acknowledged lack of appreciation re social acceptability of the proposed bottom lines, it is advocated that a much more meaningful and defensible banding of the attributes would be achieved by the simple expediency of ranking and banding nutrient concentrations at all monitored sites in New Zealand, with no national bottom line, in the style of Table 11 (*E coli),* and requiring instead that councils set targets for progressive improvement as shown by decreasing proportions of rivers in lower bands and increasing proportions in higher bands.

This approach offers integrity in the face of uncertain science and its inconsistent application, while at the same time delivering on council and government objectives.

Control of inputs vs control of outcomes

'When a measure becomes a target, it ceases to be a good measure' – Charles Goodhart, economist[41]

For river systems comprising broad, shallow rivers, with slow flows, lack of shading, warm air temperatures, infrequent floods or freshes (especially over summer), lack of upstream colonising sources, and meanders, within-flow lakes, and/or impoundments (natural or artificial), then it is logical that the only drivers left that can easily be manipulated to promote better in-stream ecological health are those of nutrients. Otherwise- otherwise. In particular, where there are fast-flowing short-run rivers, that are narrow, already well-shaded and with riparian protection, with demonstrably good ecological condition (eg good quality macroinvertebrate communities and low levels of periphyton), then a blinkered focus on controlling nutrients in the belief that doing so is both necessary and the only option to manage ecological condition becomes one-dimensional (and therefore lacks resilience) and sub-optimal (because other options may be more effective and more cost-efficient), as well as reliant on selective science (and therefore at risk of loss of credibility).

Accordingly, the NPS-FM should not have Tables 5 and 6 (DIN and DRP) as compulsory values to be enforced at all sites under all circumstances, but as targets for a progressive approach, requiring the preparation of regional action plans that will provide a trajectory of travel.

The Council supports the inclusion of MCI as an attribute within the proposed NPS-FM. However, notwithstanding that the region's monitoring sites fall with only few exceptions into the A and B bands, the Council does not believe that the proposed universally applicable MCI attribute bands are suitable for adoption within an NPS-FM, even as an 'Appendix 2B ' attribute (action plan, not absolute limit). This is a matter of basic science. A single A-B-C (bottomline)-D system as proposed cannot be applied fairly and meaningfully to all wadeable streams and rivers across all geologies, hydrologies, and meteorologies countrywide. For a system like that to work for macroinvertebrates you would need multiple tables (in the style of Table 18, where there are 12 reference classes of river typology), with different MCI attribute scores for different river types - maybe based on REC). It could be quite complex and confusing to work out what attribute state should be applied in a given situation. On the other hand, trends testing answers the question "Is river health improving, staying the same, or getting worse?" The MCI can identify the comparatively worst sites within a region or sub-region (which can then be given a top priority for intervention) and the trends testing will reveal whether improvement results.

Trends in nutrients vs trends in stream health

Examination of the biological and physico-chemical monitoring data gathered over 25 years in Taranaki demonstrates plainly a lack of correlation between ecological health and nutrient concentrations, in either state or in trends. Data are set out in Appendix 4, attached. In summary, only two of the 11 sites in the Taranaki region for which both chl-a and nutrient data are available, meet both of the proposed DIN and DRP bottom lines. Yet every site lies in the 'A' band for the effect being controlled, that of chl-a in periphyton as a measure of trophic state.

[41] https://en.wikipedia.org/wiki/Goodhart%27s_law

This suggests a significant mis-alignment between the nutrient concentrations that have been set within the NPS-FM in order to control chl-a, against the concentrations of nutrients in the real world that are shown to not have an unacceptable effect upon periphyton.

The nutrient limits are overly conservative.

Moreover, this is borne out by the commentary in MfE's own experts' report[42].

> It is generally recognised that nutrient concentration criteria are highly site specific (Biggs, 2000; Snelder, 2018). A recent analysis suggests that total nitrogen concentrations that are consistent with the periphyton bottom line vary spatially between approximately1 0.2 to 3.5 mg L-1 (Snelder, 2018)…..
>
> A key assumption in this analysis was that periphyton bottom lines would be achieved purely by managing instream nutrient concentrations. This is a conservative assumption (ie, it maximises the impact of the current NPS-FM requirements) because measures other than nutrient concentration management can contribute to achieving periphyton objectives. Stream shading may be a more effective measure for achieving the periphyton bottom lines in many, particularly small, streams and rivers. Stream shading may reduce the need partially or wholly to reduce instream nitrogen. In some situations it may be possible to manage periphyton biomass by managing river flows, for example where additional flushing flows can be provided from hydro power facilities. However, it is expected that nitrogen load reductions are the most generally applicable method of managing periphyton biomass.

Compulsory monitoring regimes- methodology and programming

From a technical perspective, it is noted that the proposed DIN and DRP attributes are to be calculated on the basis of results from monthly sampling undertaken year-round under all flow conditions. However, this protocol is not relevant within all waterways if the consideration is for biological consequences of nutrient enrichment, which occur primarily within periods of low flows and elevated temperatures. Where a catchment consists of fast-flowing, frequently flushed, short-run rivers, with no in-stream reservoirs or likelihood of stagnant ponding along reaches of waterway, then nutrient concentrations during peak flows or in winter will have no meaningful association with potential ecological outcomes. The specified protocol actually has no bearing on the desired outcome, which should surely be the assessment of drivers of degraded stream health at times and conditions that are critical.

In Clause 3.13, the proposed NPS-FM states that '*monitoring methods must recognise the …relationship between results and their contribution to evaluating the environmental outcomes set under clause 3.7(2)*'. Clause 3.7(2) refers to the environmental outcomes that a council wants to achieve for the value Ecosystem Health and each of its components. These statements are supported. But the results of a year-round programme monitoring nutrients do not have a

[42] *Essential Freshwater: Impact of existing periphyton and proposed dissolved inorganic nitrogen bottom lines,* September 2019 Ministry for the Environment

direct and meaningful contribution to the outcomes required by the NPS-FM, and given this inconsistency, then at the very least should not be compulsory.

I propose that for catchments within REC wet and/or cool classes, measures of potential contribution to eutrophication from dissolved nutrients should be based on the median concentrations measured in monthly sampling undertaken in summer only, under below-median flow conditions, rather than year-round data collected regardless of prevailing hydrology.

OVERSEER: Land use controls or water quality outcomes

The designation of Overseer as the obligatory tool, either explicitly (NES Schedule 1 catchments) or implicitly (elsewhere in the NES) by which farmers must calculate their diffuse losses of *E coli*, nutrient, and sediment to the wider environment, and by which councils must determine the magnitude of drivers of offsite effects and must regulate farmer practice, is opposed in full as it is a measure that will impose high additional individual costs but with uncertain benefit for receiving waters, creation of a sense of inequity and frustration, and bringing the credibility and integrity of the proposed NPS-FM into disrepute. The Council's concerns, and those of many other authorities and experts, are set out in Appendix 3. It defies logic that at the same time as the government has announced major funding to review the Overseer model, it is simultaneously making its use compulsory in short order.

The Environment Court has recently released a decision that finds that Overseer is not fit for and should not be used as a regulatory tool in the absence of fundamental re-development, and cannot be meaningfully applied at farm level to determine off-site effects without comprehensive (and thus very expensive) site-specific calibration and validation. This material is set out verbatim in Appendix 3C The status of Overseer in the Environment Court.

The finding of the Court that '*It is important to note that Overseer is a long-term prediction model of nitrogen outputs and cannot be used to predict short-term management outcomes or changes that may be required to day-to-day farm operations*' must be given full weight.

There are alternatives to Overseer for farmers to demonstrate commitment to improved farm practices that have the outcome of reducing offsite discharges (eg recording changes in good farm practice).

A NIWA study specifically investigated sources and flows of nitrogen in a catchment on the southern ringplain[43]. In terms of the use of OVERSEER model, the study found that calculated rates of nitrogen leaching were very sensitive to rainfall, far more than to actual farm practice. The figure below is reproduced from the study.

[43] *Source and specific yields of nitrogen and phosphorus in the Waiokura catchment*, NIWA Client report HAM2015-124, October 2015.

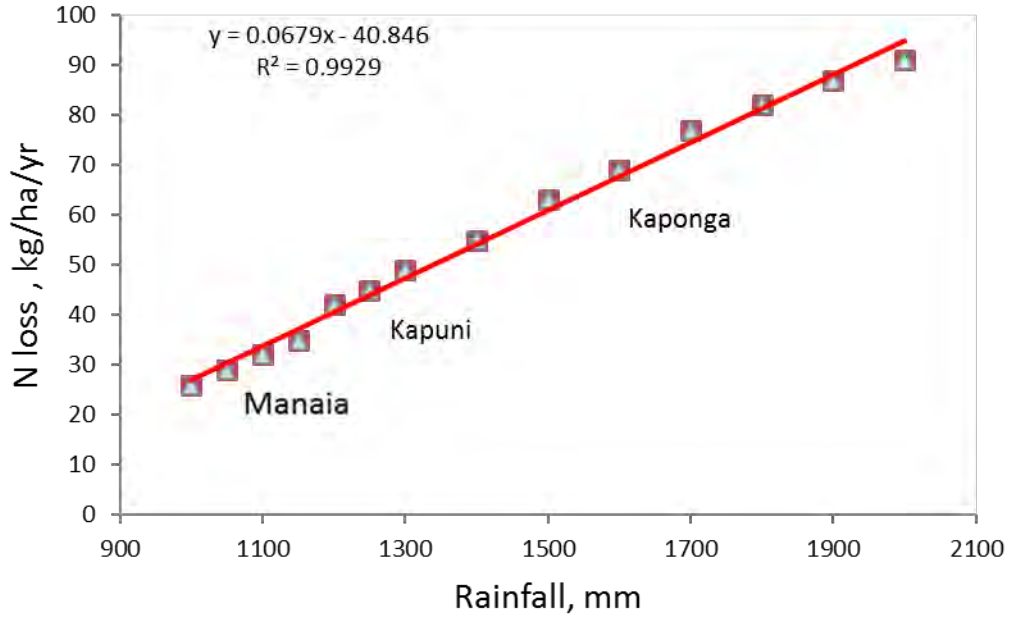

Figure 2: Effect of rainfall on predicted N losses from dairy farms in the Waiokura catchment.

The data showed that the primary driver of high N loss as measured by OVERSEER was not farm practice, but rainfall. The catchments of Taranaki encompass rainfall that varies from below 1200 mm per year at the coast, to close to 7,000 mm at the Park boundary. The farms in higher rainfall zones inevitably have higher leaching loss estimates.

While the proposal's intent is to target farms with poor environmental practices, its design does not appear to distinguish farms in high rainfall zones versus those in lower rainfall zones. The farms impacted are just as likely to be those with best current management practices, as the lowest adoption.

Finally, there is a real issue of resource availability for the Council to implement the NES N-limitation requirements. Especially within the Waingongoro catchment, but equally across the ringplain, the Council's current policy direction of stock exclusion on all waterways together with diversion of essentially all remaining dairy effluent discharges to land irrigation instead of to surface water, requires the full attention of current policy, land management, consenting, and compliance staff. The NES addition of OVERSEER-based farm plan considerations and an associated second layer of consenting imposes an imminent burden beyond current capacity.

Other matters

Exemptions from bottom lines for naturally occurring processes

Section 3.23 of Subpart 4 of the proposed NPS-FM allows for exemptions from having to meet national bottom lines when a council is setting target attribute states for a water body or part thereof, and the effect of naturally occurring processes is to make even the national bottom line unattainable. The onus is placed on a council to prove that the bottom line is

unattainable. '**Naturally occurring processes'** are defined within the NPS-FM text as those that could have occurred before the arrival of humans in New Zealand.

The principle of the exemption is supported, but there is detail to work through, as set out below.

E coli

The Council notes that there is an ever-increasing body of evidence for naturalised *E coli* to be found in waterways across New Zealand. The option of identifying such colonisation where it is occurring, and applying the exemption provision, is a commonsense approach. The Council further notes that the worst bacteriological contamination of recreational waters in Taranaki is associated with large populations of waterfowl, both introduced and native-seagulls, ducks, and pukekos, for example. The interpretation of '*could have occurred before the arrival of humans in New Zealand*' becomes problematic in the case of non-native ducks, for instance.

But in any case it should be argued that there is a case for provision of further exemptions in the case of introduced species such as ducks. There is Government support in legislation and in financial provisions for the proliferation of aquatic game birds across New Zealand. This is in direct and obvious conflict with the Government's stated intention of requiring improvement of the recreational qualities of fresh water. Why should regional councils and communities have to bear the cost of the consequences of Government support for pollution of waterways by introduced aquatic species?

Sediment (deposited or suspended)

The Council notes that the waterways of Taranaki are subject to significant and frequent erosion-driven sedimentation loads, originating either from the collapsing of the volcanic cone of Mt Taranaki, or through landslips and slumping of the mudstone sedimentary rock and riverbanks of the eastern hill country of the region. In the case of the latter, this encompasses land where previous governments have driven hillside clearances of protective vegetation and conversion into pasture or cropping, on land that is poor for production, is inherently prone to slope movement, and is subject to high and intensive rainfall episodes including cyclonic weather patterns. For the past 3 decades or more, the Council and its predecessors have been working to restore sustainable land management practices across this landscape. Clarification that natural processes that have been exacerbated by past Government policies and incentives are included in the NPS-FM definition of 'naturally occurring processes' is urged.

The Council's data shows very clearly that catchments fed from the eastern hill country fail the fine suspended solids attribute. The degree of failure is up to 3 times above the national bottom line for the particular land class as defined in Schedule 2B and 2C of the proposed NPS-FM attribute tables. The land use in the eastern hill country is a mixture of sheep and beef pastoral farming, forestry, and planned reversion in private ownership (74%), together with regenerating DoC estate (26%). Of the private land, 87% is already in sustainable land management already.

Across the ring plain (intensive dairying together with urban land uses), most sites are in the 'A' band for turbidity.

DRP:

The Council notes that the volcanic soils of Mt Taranaki and the surrounding ringplain have naturally high concentrations of phosphate, which by virtue of natural cycling of forms of phosphate will continually release DRP into interstitial (pore) water within the soil structure, and by subsequent transport into waterways. Even in very close proximity to the boundary of the Egmont National Park, DRP concentrations are close to or above the national bottom line for DRP. Therefore it is eminently sensible to apply an exemption.

The issue that comes to mind for DRP is that as riparian shading and cooling of a waterway increases, then for a given pre-existing load of or rate of discharge of phosphate within the catchment, DRP concentrations could **increase**, because the rate of uptake by periphyton and phytoplankton will reduce through slower metabolic assimilation. This is certainly a naturally occurring process, although the technical difficulties around quantifying the effects in water quality accounting will be substantial.

Appendix 1: DIN and DRP attribute tables (Tables 5 and 6 in Appendix 2A of proposed NPS-FM)

Table 5 – Dissolved inorganic nitrogen

Value (and component)	Ecosystem health (water quality)	
Freshwater Body Type	Rivers	
Attribute Unit	DIN mg/L (milligrams per litre)	
Attribute band and description	Numeric Attribute State	
	Median	95th percentile
A Ecological communities and ecosystem processes are similar to those of natural reference conditions. No adverse effects attributable to DIN enrichment are expected.	≤ 0.24	≤ 0.56
B Ecological communities are slightly impacted by minor DIN elevation above natural reference conditions. If other conditions also favour eutrophication, sensitive ecosystems may experience additional algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.	> 0.24 and ≤0.50	> 0.56 and ≤01.10
C Ecological communities are impacted by moderate DIN elevation above natural reference conditions, but sensitive species are not experiencing nitrate toxicity. If other conditions also favour eutrophication, DIN enrichment may cause increased algal and plant growth, loss of sensitive macroinvertebrate & fish taxa, and high rates of respiration and decay.	> 0.5 and ≤ 1.0	> 1.10 and ≤ 2.05
National Bottom Line	1.0	2.05
D Ecological communities impacted by substantial DIN elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DIN enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia and nitrate toxicity are lost.	>1.0	>2.05
Groundwater concentrations also need to be managed to ensure resurgence via springs and seepage does not degrade rivers through DIN enrichment. Numeric attribute state must be derived from the rolling median of monthly monitoring over five years.		

Table 6 – Dissolved reactive phosphorus

Value (and component)	Ecosystem health (water quality)	
Freshwater Body Type	Rivers	
Attribute Unit	DRP mg/L (milligrams per litre)	
Attribute band and description	Numeric Attribute State[1]	
	Median	95th percentile
A Ecological communities and ecosystem processes are similar to those of natural reference conditions. No adverse effects attributable to DRP enrichment are expected.	≤ 0.006	≤ 0.021
B Ecological communities are slightly impacted by minor DRP elevation above natural reference conditions. If other conditions also favour eutrophication, sensitive ecosystems may experience additional algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.	> 0.006 and ≤0.010	> 0.021 and ≤0.030
C Ecological communities are impacted by moderate DRP elevation above natural reference conditions. If other conditions also favour eutrophication, DRP enrichment may cause increased algal and plant growth, loss of sensitive macro-invertebrate & fish taxa, and high rates of respiration and decay.	> 0.010 and ≤ 0.018	> 0.030 and ≤ 0.054
National Bottom Line	0.018	0.054
D Ecological communities impacted by substantial DRP elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DRP enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia are lost.	>0.018	>0.054
Numeric attribute state must be derived from the rolling median of monthly monitoring over five years.		

Appendix 2: ANZECC tables for DIN and DRP

ANZECC (2000) provided what are deemed 'trigger values' for New Zealand. ANZECC states that the purpose of the trigger values is to assess the risk of adverse effects due to nutrients (and other stressors) in various ecosystem types. ANZECC notes that regional guideline trigger values should be developed and used in preference to the generic (default) values given.

The ANZECC trigger values for nutrients[44] are as follows:-

DRP (denoted FRP= filterable reactive phosphorus)

upland rivers (above 150 m)	0.009 mg/L
lowland rivers	0.010 mg/L

DIN (NOX + NH4)

upland rivers (above 150 m)	0.177 mg/L
lowland rivers	0.465 mg/L

[44] Median values from at least 2 years' data. ANZECC 3.3-19

Appendix 3: Overseer

Appendix 3A

On-farm management vs off-farm effects estimation

Summary: The imposition of an OVERSEER-based N loss limit on selected farms within the catchment will impose high additional individual costs without certainty of any benefit for receiving waters, creating a sense of inequity and frustration, and bringing the credibility and integrity of the proposed NPS-FM into disrepute.

- Section 32 imposes tests for criteria for policies and for consent conditions/rules in a regional plan, of relevance, certainty, clarity, necessity, effectiveness, and efficiency.

- Overseer does not enable a farmer to see any connection between day to day management choices, and long term environmental outcomes. It is seen as a hindrance and interference rather than as an advantage and assistance. Overseer is being seen as the tool/model to ascertain and set a nutrient loss limit/number, rather than a mechanism to assist consideration of whether nutrient management practices adopted are achieving or could achieve the overall objectives sought.

- A regulatory regime that is based on a whole of catchment approach must of necessity take a starting point of regarding all farms as having an equal contribution and having to meet the same allocation imposition if target water quality is to be attained, when this does not reflect reality.

- The use of Overseer by itself as a tool to set limits in receiving waters is outside the scope of the purpose and function and capability of the model.

- Any link between cumulative nutrient losses (as modelled by Overseer) and instream standards/guidelines/targets is missing and is simply unattainable. It might in theory be possible to look for indirect and tenuous relationships between cumulative long-term Overseer N and P losses in a catchment, and ecosystem health measures like MCI score and/or algal biomass/cover, but there is also a need to consider many other confounding and important factors, and such an approach would be very demanding and intensive. In a region like Taranaki's, with over 230 catchments, the complexity of the task would be multiplied. For example, environmental monitoring has already demonstrated no discernible connection between trends in nutrients and trends in ecological health in the region's waterways. The authors of the report believe there are not yet strong scientific links between long term average nutrient losses from farms (Overseer) or nutrient fluxes in streams (CLUES), and periphyton biomass or MCI index. Those links are the subject of ongoing research which is not yet mature. This also leads to a more immediate question: is there anywhere in Taranaki that such an effort could be justified?

- Rather, deteriorations in instream ecology occur only at very limited times for limited durations and only in particular circumstances. This in turn means that use of models that deal in annual average scenarios lack any relevance to effective management of water quality in the region.

- Overseer N loss estimates have been validated against farmlet system N losses but most of these studies occur where annual average rainfall is no greater than 1200mm. The model extrapolates its algorithms to higher rainfall based on first principles and the

known interactions between rainfall and soil properties. Many of the catchments in the Taranaki ring plain, which have their source in the Egmont National Park, have an annual rainfall of between 1100mm to 7178mm (at 900m above sea level). These rates of precipitation are much higher than those at which Overseer has been validated. Overseer remains unproven in the Taranaki context of highly variegated soils, meteorology, and climate.

Appendix 3B

Overseer as a regulatory tool

Summary: alongside the Parliamentary Commissioner for the Environment and a number of mathematicians and scientists, the Council stands against the use of OVERSEER within any sort of regulatory framework. For reasons of uncertainty in results, unreliability in its modelling, lack of transparency, reliance upon unknown and unknowable inputs, lack of calibration in high rainfall zones such as the Taranaki ringplain, failure to recognise critical source areas vs 'whole of farm' leakage, and lack of connection between N loss modelled from a farm and N transportation to a waterway, OVERSEER remains indefensible.

From the outset it should be acknowledged that Overseer was never designed or intended to be used as a regulatory tool controlling off-farm effects. Rather, Overseer was designed and intended to support decision making around options for managing nutrient use and losses at a farm level. But inherently the regulatory setting requires certainty and accuracy to ensure environmental effects are identified and assessed and justified. Just as there is an onus on the resource user to demonstrate or prove what the effects of their activities will or will not be, the regulatory authority has to be able to demonstrate or prove where non-compliance with plan provisions or resource consent conditions has occurred, and what the consequences of this are, with certainty and accuracy ('beyond reasonable doubt').

On 12 December 2018, the Parliamentary Commissioner for the Environment (PCE) released his report *'Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways'*. The report was the PCE's response to a growing debate nationally about the application of a model designed initially to help farmers with their nutrient budgets but which was increasingly used by regulators (regional councils) to set nutrient limits and to enforce compliance with those limits in an effort to address diffuse water quality impacts from farming practices (with tacit support at the time from the Ministry for the Environment for its use within a regulatory approach). MfE have now decided to rely on OVERSEER as a regulatory intervention at national scale.

MfE's dependence on OVERSEER does nothing to diminish the strength of the PCE's critique. The report's main finding was that there were important gaps and shortcomings in Overseer that undermine confidence in its use as a regulatory tool and in its applicability in assessing environmental effects. It recommends that if the Government wants to see Overseer used as a regulatory tool, it needs to address these limitations as well as deal with issues concerning its transparency, ownership, governance and funding. The report acknowledges that this would be an expensive exercise that would take some time to complete and would not be sufficient on its own to validate OVERSEER's use within regulatory management of water quality. Despite the PCE's findings and that MfE have implicitly acknowledged the failings and shortcomings of Overseer by making a budget investment to improve Overseer in the future, the proposed NPS-FM and NES nevertheless require the regulatory use of Overseer with virtually immediate effect.
The PCE's main findings were:-
-attempting to calculate the scale of, much less the environmental consequences of, nutrient losses from an individual farm within a much wider catchment (and to a standard of assignment of cause and degree that would be acceptable for legal compliance and enforcement) is problematic in the extreme;
-Overseer is a model; it doesn't actually measure nutrient levels or losses. It simplifies highly complex processes and standardises equally complex local variability by applying a series of

algorithms designed to represent real-world but generalised conditions. All models operate with a level of uncertainty and the critical question for the PCE has been whether the level of uncertainty and accuracy in the information used in Overseer is acceptable in the context of regulation where compliance needs to satisfy a pass/fail test and those being regulated need to feel confident in the results. The test in law for compliance is and remains proof beyond reasonable doubt;
- Overseer models nutrients lost from the farming system, but not what happens to the nutrients after that, nor what happens in the surrounding and receiving environments;
- even for types of farming systems within models that have been calibrated, calculated results for losses of nitrogen can be up to 25 to 30% inaccurate, and outside of these calibrated ranges can be more than 50% inaccurate. Some parts of New Zealand, including Taranaki, have not had Overseer calibrated to regional conditions.
-the report notes that the widely quoted 'uncertainty' in the model of plus or minus 30% '*did not include errors associated with measurements, or uncertainty from data inputs, providing only part of the full picture of quantifying uncertainty.'*[45] …Instead, the PCE suggests *'uncertainty is likely to exceed 50%, but could be much higher still'*[46]. The PCE notes that on well-studied soils in Canterbury, estimates of leaching rates derived from Overseer '*could be anywhere from nearly 40% below to 60 per cent above the actual leaching rate*'[47]. In other words, a farm with an overall leaching rate of 30 kg N/hectare/year could be accused of leaching 50 kg N/hectare /year on the basis of Overseer modelling, even if the latter has been calculated using good field data for that specific farm and not just generic default values. In one case the PCE reports, experts came to the consensus that they were 90% confident the nitrogen loading rate on one particular catchment was somewhere between 400 and 910 tonnes/year[48] - a range of well over 100% of the lower figure, and even then the experts could not exclude the possibility they were well off the mark.
The PCE's report makes a number of specific recommendations, which call for:

- the commissioning of a comprehensive evaluation to ensure the Overseer model is independently reviewed, and is subject to sensitivity and uncertainty analysis;
- greater transparency about how the model works;
- aligning Overseer's ownership, governance and funding arrangements with the transparency required for it to be used as a regulatory tool; and
- setting up a working group to provide guidance on how Overseer can be used by regional and unitary councils.

None of these recommendations have been delivered. The Government has announced funding to 'improve' OVERSEER over the next 3 years. Yet we see OVERSEER already being incorporated into proposed regulatory instruments.
Expert reaction to the PCE's report was consistent in raising concerns with the use of Overseer for regulatory purposes. For example, Dr Julie Everett-Hincks, Legal and Scientific Researcher at the University of Otago in commenting on the PCE's report stated that:

> *'Overseer would not likely withstand legal challenge, but more importantly, is it right to burden farmers with regulatory compliance when the tool used cannot reasonably measure nutrient losses? In its current form and governance structure, Overseer is not fit to be a regulatory tool'.*

[45] Pg36

[46] Pg37

[47] *ibid*

[48] Pg 38

Professor Troy Baisden, BOPRC Chair in Lake and Freshwater Science at the University of Waikato when commenting on the PCE's report noted that:

> *'On the upside, Overseer is well used and reflects some of our farming systems well. That would be perfect if Overseer was still mainly a calculator to improve farm nutrient management. But, when used to enforce regulation, Overseer lacks the openness and transparency needed for scientists to review model results or develop improvements'.*

Professor Richard McDowell, former Chief Scientist, Our Land and Water National Science Challenge commented that:

> *… an uncertainty and sensitivity analysis of many of the model's components would be helpful'.*

Former IPCC working group director Martin Manning, Massey University Professor Emeritus of Industrial Mathematics Graeme Wake, Massey agricultural senior scientist Tony Pleasants and a retired associate professor of mathematics, John Gamlen, jointly stated that proposals to spend millions fixing Overseer's problems will not be enough unless the underlying mathematical model is ditched and replaced by more sophisticated modelling that can reflect interactions between different biological processes. They asked to be allowed to see inside the tool, and any moves to improve it.

In their critique, Wake and the others said MPI "lacked understanding" about what other countries were doing to model river pollution and other environmental effects, and called for a 'proper' peer review. One of their key concerns is that the model simply adds together the effects of various biological processes, without taking into account the complicated interactions between them. They said New Zealand had good research showing what happens to fertiliser on various soil types and in certain weather, for example, but that information needed to be fed into a better underlying model to get more accurate answers out the other end.

They noted: 'New Zealand is at serious risk of losing its credibility in agricultural and environmental management with the public and from our international colleagues….the science does not stand up to peer scrutiny'.

Appendix 3C

The status of Overseer in the Environment Court

Environment Court Decision [2019] NZEnvC 136 Interim Decision
Federated Farmers and others vs Bay of Plenty Regional Council (with Section 274 parties)

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35. We received expert evidence that Overseer is the most appropriate model to use for this purpose. While this approach has become common practice in many areas of New Zealand, it has notable limitations and presents both procedural and substantive risks when used in regulatory processes. We return to this later in our decision.

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Method for assessing nitrogen loads in the catchment using Overseer

107 Both nitrogen allocation methods incorporate the use of Overseer software to calculate long-term average losses of nitrogen from below the root zone of rural land uses on an individual property and, in the case of the sector range method, on a sector basis.

108 The Overseer software is jointly owned in equal shares by the Ministry for Primary Industries, AgResearch Limited and the Fertiliser Association of New Zealand. Use of it requires payment for user licences. The software models nutrient flows on a farm using farm information and scientific knowledge to produce, among other things, predictions of nutrient losses based on farm management practices. By modelling different scenarios, farmers can make decisions about their management approaches. The model's algorithms are not available for inspection and testing by either users or the Court. The Overseer software has gone through many versions since first being published as Overseer 2 in 2000. The current version is Overseer 6.3.0. The version used in PC10 is Overseer 6.2.0. Apparently, no library of earlier versions is publicly available.

109 It is important to note that Overseer is a long-term prediction model of nitrogen outputs and cannot be used to predict short-term management outcomes or changes that may be required to day-to-day farm operations.

110 The Regional Council's position is that"... the Integrated Framework when shown in PC10 should remain as shown in Overseer 5.4 as that is the base position from which all other computations in succeeding versions of Overseer occur." Counsel explained that the data "is a post-attenuation statement" provided in PC 10 for information only. Whatever the reason for its inclusion, the different ways that Overseer information was presented did not assist our understanding and introduces an unnecessary level of confusion.

111 Overseer has notable limitations in a regulatory context. One of the main limitations is that different versions of Overseer may give materially different predicted nitrogen losses. By way of example, Version 5.4 (as used initially in PC10) and Version 6.2.0 (as now proposed) differ in their nitrogen loss predictions by approximately 88%, the later version giving the higher figure. [30] The evidence before us included reference to five different versions of Overseer. PC10 includes predictions based on both versions 5.4

and 6.2.0, even though the sustainable lake load to be achieved remains unchanged and is determined independent of Overseer.[31] We consider the uncertainty caused by referencing the Overseer versions 5.4, 6.2.0 and future versions in the same plan makes understanding of plan requirements more complex than necessary and potentially confusing for some users of the plan. We sought clarification on this matter from the Council and return to it later.

112 A further notable limitation of the Overseer model is that the overall level of uncertainty associated with modelled outputs is difficult to ascertain. The only attempt to quantify this in evidence before the Court is in the First JWS on Water Quality, which referred to a degree of uncertainty of 30 - 50%.[32] In response to a question from the Court, Dr J C Rutherford, a specialist in water and nutrient management through catchments and engaged by the Regional Council confirmed "*... for the period 2003 and 2011, I think that uncertainty of 30% in my opinion is consistent with what the owners of Overseer believe. Prior to that, some of the historic land use ... is a little bit less well defined and .... ascribed a higher uncertainty.*"

113 In December 2018 the Parliamentary Commissioner for the Environment published a report on Overseer[33] which identified the need for greater transparency and for a comprehensive and well-resourced review of the model, including an independent peer review. We were particularly interested in the section of the PCE's report on model uncertainty, which indicates uncertainty associated with Overseer Version 6 could be in the range 25 to 30% for farms within "the calibration range." It is unclear to us whether this includes errors associated with measurements and uncertainties arising from data inputs. The report goes on to note that for farms outside the calibration range, higher levels of uncertainty of 50% or greater are possible. For the avoidance of doubt, while lysimeter testing is being undertaken in the Lake Rotorua catchment which will increase certainty in the predicted nitrogen losses, overseer has not yet been calibrated for conditions prevailing in the Lake Rotorua catchment, which means uncertainty could exceed ± 30%.

114 This assessment of uncertainty is consistent with the Court's own experience and understanding gained from evidence presented in a number of other cases over several years, including this one, and we are satisfied that it represents the current state of knowledge. It is important to note that if a nitrogen loss below the root zone was predicted (hypothetically) by Overseer to be 4,000 kg a year for a particular property, the actual loss at an uncertainty of± 30% could be anywhere between 2,800 and 5,200 kg a year, which is substantial and makes sound resource management planning problematic.

115 Notwithstanding those concerns, we have no evidence that there is any realistic alternative method presently available to the Regional Council or to farmers to obtain the necessary information about nitrogen loads in order to manage them. We note that Policy LR P14 recognises the possibility that there may be alternatives to Overseer for nitrogen budgeting purposes, but requires any alternative to be authorised by the Regional Council.

116 We are also particularly concerned to ensure that, as far as reasonably practicable, resources should be used for environmental improvements on-farm, not for unnecessarily high regulatory and monitoring costs.

117 In summary, it is the Court's view that a range of specific requirements need to be met when using Overseer in a regulatory context, including:

(a) A consistent approach to model input data and maximising the accuracy of that data;

(b) The use of best management practices appropriate for the local environment conditions such as soil types and weather patterns;

(c) Using the model to predict trends and relative changes in farm management systems, rather than absolute values;

(d) Calibrating the model outputs with field measurements for environments where conditions differ significantly from those where an acceptable level of calibration has been achieved;

(e) Using only appropriately qualified and experienced experts to run the model for compliance purposes;

(f) Establishing a clear, efficient and reliable process to review and update model outputs and management practices at appropriate intervals;

(g) Appropriate on-site verification that modelled inputs and outputs are being complied with, in addition to independent peer review of performance; and

(h) A compliance mechanism that is certain, reasonable, practical and legally enforceable

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126 The extent of attenuation that can be relied on in the catchment is fundamentally critical to understanding future nitrogen loads reaching the lake, and the limits that will need to be placed on nitrogen discharges from land within the catchment in the future. This is a highly complex subject where reliable information is not available to quantify overall attenuation and variability across the catchment. On the other hand, we have difficulty in placing significant reliance on model predictions of attenuation that move up or down to facilitate calibration of the model.

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368 On the other hand, the Regional Council has clearly recognised the inherent difficulties when using Overseer in a regulatory setting and has put considerable effort into understanding and managing those difficulties, for which the Council is to be commended. We consider the use of benchmarking, reference files, and five-yearly Nutrient Management Plan reviews designed as an integral part of PC10 as deserving of particular mention for their likely contribution to simplifying the use of Overseer, making it a more efficient management tool and providing greater certainty for farm managers and the regulator. Overall, we consider the proposed use of Overseer as included in PC10 is acceptable given our current state of knowledge. However, this will need to be confirmed through working experience and, in our view, should be considered as a "work in progress", which is likely to require modification over time.

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Appendix 4

Monitoring data for ecosystem health and for nutrients in Taranaki

Notes: these sites are not identical to those used by the Council for its longstanding monthly physico-chemical monitoring undertaken for state of the environment purposes, but have been instigated by the Council following the 2014 NPS-FM, for the purpose of monitoring streambed periphyton at representative sites in wadeable rivers as specified in the NPS-FM. A suite of nutrient analyses is undertaken simultaneously.

Data below has been analysed according to the NOF tables 2, 5, and 6 in the Draft National Policy Statement for Freshwater Management, 22 August 2019.

Colour key

NPS –FM attribute band	blue = Attribute band A chl-a < 50; DIN<0.24 DRP< 0.006	green = Attribute band B chl-a < 50; DIN 0.24-0.50 DRP 0.006-0.010	yellow = Attribute band C chl-a < 50; DIN 0.50-1.0 DRP 0.010-0.018	pink = Attribute band D (below the national bottom line) chl-a > 50; DIN>1.0; DRP>0.018

Site no.	NIWA REC	DIN	DRP	Chl-a (mg/m2)
KPA000950	WW/L/VA/P/LO/MG	0.352	0.022	6.12
MGN000195	CX/H/VA/P/MO/LG	NA	NA	1.01
MKR000495	WW/L/SS/P/MO/LG	0.365	0.0048	44.23
MKW000300	CX/H/VA/P/MO/LG	0.341	0.032	20.155
MTA000068	CW/L/SS/P/MO/LG	0.186	0.004	25.04
PNH000200	CX/H/VA/IF/MO/MG	0.0845	0.01995	1.305
PNH000900	CW/L/VA/P/MO/LG	1.0165	0.035	3.85
STY000300	CX/H/VA/S/MO/MG	0.04025	0.0192	0
TWH000435	WD/L/VA/P/LO/MG	2.1185	0.022	31.59
WGG000500	CW/L/VA/P/MO/LG	1.14	0.03	10.8
WKH000500	CX/H/VA/P/MO/MG	0.092	0.031	23.6
WMR000100	WW/L/SS/P/LO/LG	0.576	0.0095	6.645

Only two of the 11 sites for which both chl-a and nutrient data are available, meet both of the proposed DIN and DRP bottom lines. Yet every site lies in the 'A' band for the effect being controlled, that of periphyton as a measure of trophic state. This suggests a significant mis-alignment between the nutrient concentrations that have been set within the NPS-FM in order to control chl-a, against the concentrations of nutrients in the real world that are shown to not have an unacceptable effect upon periphyton. The nutrient limits are overly conservative.

Appendix 3

Assessment of the dairying economic impacts of DIN limit proposal in Essential Freshwater package in Taranaki

Assessment of the agricultural economic impacts of DIN limit proposal in Essential Freshwater package in Taranaki

Report prepared for Taranaki Regional Council

October 2019

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Table of Contents

1. Background

In 2015 LWP ((Harris, 2015) undertook an analysis of the impacts of 3 policy options for nutrient management in the Taranaki region. These included assessments of changes to dairy effluent discharges including discharge to land, completion of the riparian fencing programme, and a cap on discharges of N to the environment.

MFE recently (September, 2019) released a consultation document on changes to the management of freshwater in New Zealand. This included an update of the National Policy Statement for Freshwater Management (NPS-FM) and the National Objectives Framework (NOF). As part of the proposed changes, there are intended to be a number of priority catchments which are designated as having high nitrate nitrogen where immediate action is required, and a limit of 1mg/L for Dissolved Inorganic Nitrogen (DIN). The Waingongoro catchments has been identified as being a high nitrate N catchment, and the proposals are for a cap on N losses at the 75th percentile of the catchment (or somewhere between 70th and 90th percentiles, and this would have to be implemented within 12 months.

Taranaki Regional Council (TRC) is concerned at the impacts that the DIN and high nitrate nitrogen catchment proposals would have on the agricultural sector and the economy. They have requested that LWP use the information from the 2015 report to provide an estimation of the costs of the Essential Freshwater package as it relates to nitrogen limits, specifically the DIN limit of 1mg/L and the requirement to reduce N losses to the catchment 75th percentile in the Waingongoro catchment.

2. Method

Because detailed data is not available on the exact reductions required and the locations where it is would be required, a broad approach has been adopted. TRC has indicated that the proposal will affect farms primarily in the southern ring plain. They estimate that there are approximately 1000 farms in the southern ring plain, and that ¾ of the catchments will exceed the DIN limits. TRC have estimated that the reduction required will be from approximately 1.8mg/L to 1mg/L (the proposed national bottom line for DIN set out in the draft NPS-FM), a reduction of 44%. They have requested the analysis consider two approaches to meeting the limit:

- A cap on N losses where all farms above the cap must reduce their losses to the cap, and all those below cannot increase their losses.
- A proportional reduction approach where all farms reduce by the same amount in order to achieve the required catchment reduction.
- A third method was added where areas of the land use was substituted by forestry to achieve the require reduction in N loss.

In addition the analysis tests the impact of a requirement for an immediate reduction of N losses to the 75th percentile of N losses for the Waingongoro catchment.

TRC supplied:

- Data on land use in three sample catchments, the Kaupokonui, Waingongoro, and Punehu catchment, which are considered typical of the southern ring plain area likely to be affected.
- Overseer estimates of N losses for 397 farms in the Taranaki region for which farm plans have been completed.
- Reports from Dairy NZ (DairyNZ, 2015) and Ogle Consulting (Ogle & Stantiall, 2015) on the costs of reducing N losses on dairy and sheep and beef/dairy support farms respectively. These reports are the same as those used as the basis for the Harris (2015) report, and no later data is available on which to base the costs of reducing N losses in Taranaki.

Land use data

The land use data for the three sample catchments are shown in *Table 1* below. They show that dairy at 67% - 78% of the catchment area is the main land use in all three sample catchments, with Other (which include conservation land, roads, reserves, urban areas, transport corridors etc) as the other main category. Sheep and beef and dairy support are minor land uses in all three sample catchments at generally less than 5% of the land area.

Table 1: Land use for sample catchments by rainfall band (ha)

	Rainfall			
Kaupokonui catchment	**<1500mm**	**1500-2500mm**	**>2500mm**	**Total**
Dairy (ha)	640	2,670	6,970	10,280
Dairy support (ha)	-	-	-	-
Sheep and beef (ha)	20	220	210	450
Other (ha)	-	-	-	3,720
Total (ha)	660	2,900	7,180	14,450
Waingongoro catchment	**<1500mm**	**1500-2500mm**	**>2500mm**	**Total**
Dairy (ha)	1,040	8,950	6,370	16,360
Dairy support (ha)	10	120	40	170
Sheep and beef (ha)	20	800	330	1,150
Other (ha)	-	-	-	3,210
Total (ha)	1,070	9,860	6,740	20,880
Punehu catchment	**<1500mm**	**1500-2500mm**	**>2500mm**	**Total**
Dairy (ha)	1,231	689	725	2,646
Dairy support (ha)	-	-	131	131
Sheep and beef (ha)	38	-	17	55
Other (ha)	-	-	-	1,112
Total (ha)	1,269	689	873	3,943

Estimated loads and N loss reductions required of the primary sector

The reductions in N losses can only be achieved through changes in the primary sector, although there may be some reductions that can be achieved by urban areas and residential properties, these are generally minor in the context of the overall N losses from productive land uses. The estimated loads for the catchment were calculated through a number of means,

including using the losses estimated by the DairyNZ and Ogle reports from 2015, and using the more recent overseer loss reductions supplied by TRC both for the region and for the specific catchments. A loss rate of 1.5kg/ha was assigned to Other land to cover background losses. The loads calculated using the different per ha loss rates from different sources were generally in close agreement (<10% difference), and the larger dataset from the whole of Taranaki was used thereafter to estimate mean loss rates and their distribution. The location of farms used for the regional dataset is shown in *Figure 3* below, and given the relative uniformity of soil types across the ring plain, and that rainfall has a significant influence on N loss rates, it does not appear that the regional dataset is substantially skewed relative to those farms occurring in a southern ring plain dataset.

The mean loss rate for the larger dataset was 49.6kgN/ha with a standard deviation of 19.3kgN/ha. The range in mean loss rates for the three sample catchments was 48.6 for the Punehu to 55kgN/ha for the Kaupokonui and 53.8 for the Waingongoro. The 75th percentile loss rate is 58kgN/ha across the whole dataset.

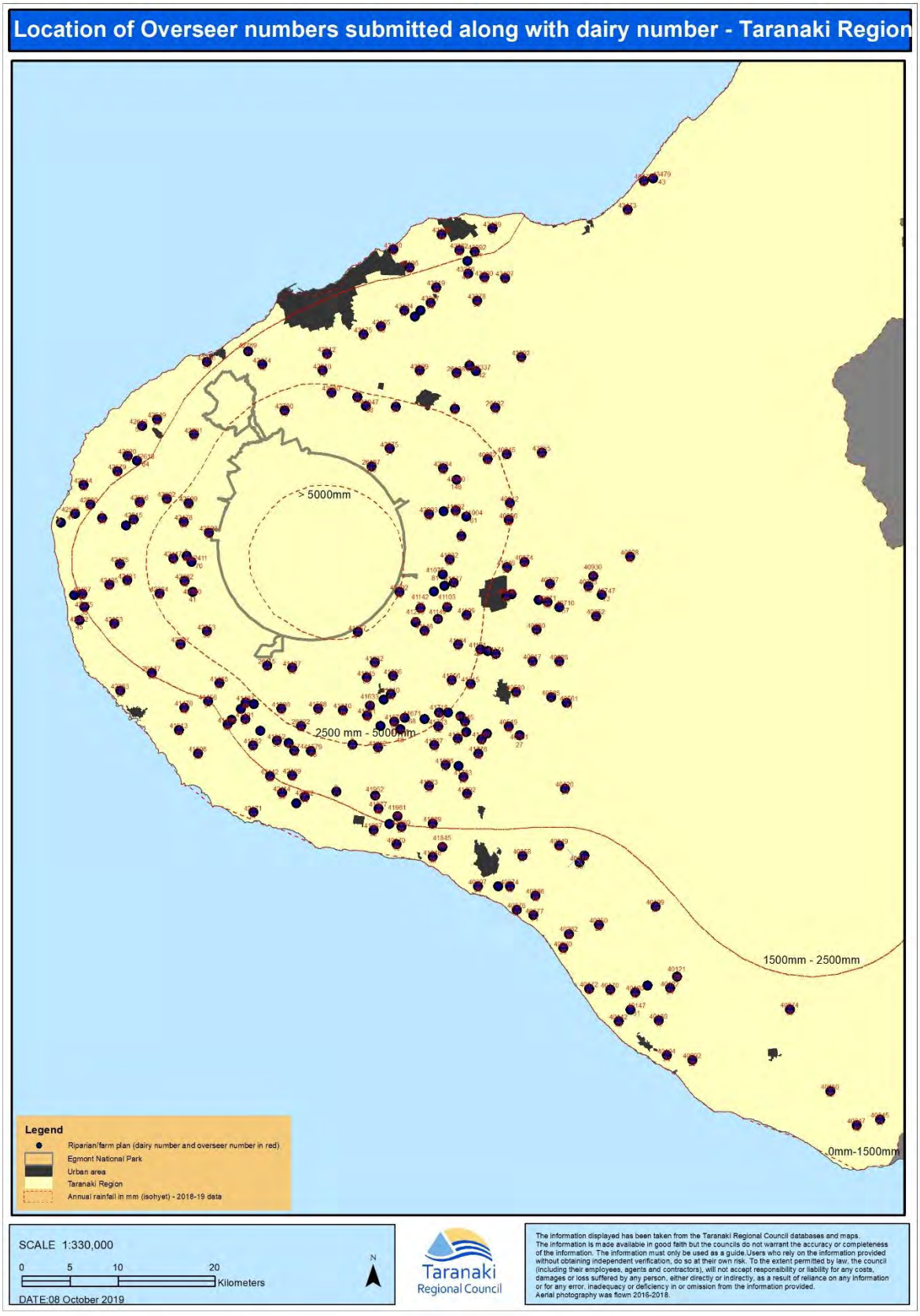

Figure 3: Location of farms supplying N loss rates for regional dataset (Source:TRC)

Required reduction

Because not all land uses are able to reduce their N loss rates any required reduction must be achieved from the remaining 'manageable' load. For example neither production forestry nor conservation forestry is able to reduce its load, yet they contribute at low levels to the total catchment loads. In the case of the sample catchments, most of the load is manageable, and only 3% of the load is unmanageable. In order to achieve the required 44% reduction, the manageable land uses must reduce by 46%.

N cap

The cap approach requires that all land uses above the cap must reduce their N losses down to the cap. Because the N losses from dairy farms were 97% of the total N losses for the sample catchments, the cap that would achieve a 46% reduction in manageable N losses was calculated from distribution of N losses in the TRC supplied regional dataset of N losses for dairy farms. This figure was 27.2kgN/ha, which is a 40% reduction for the median property in the dataset.

For the immediate reduction requirement in the Waingongoro catchment the 75th percentile of N losses is 58kgN/ha (again calculated from the full N loss dataset, not the catchment specific subset).

Mitigation costs

The costs of mitigation were estimated from information supplied by DairyNZ and Ogle Consulting. For dairy a regression analysis was used to estimate a curve of mitigation costs based on the sample of 18 mitigation examples from DairyNZ. This gave a curve as shown in *Figure 4* below.

The costs of mitigation in dairy support was based on the cost per kgN removed in the Ogle report, which was $10.07/kgN for moderate rainfall (<1500mm/annum) and $5.66/kgN for high rainfall (>1500mm/annum). For sheep and beef no costs were estimated in the Ogle report, and it was assumed that the reduction in N loss was linearly related to reduction in stocking rate (or equivalently the proportional retirement of land from production). A model of production was based on the Beef and Lamb NZ Class 5 per stock unit returns, linear reductions in revenue and operating profit with reduced stocking rate, and no change in fixed expenses. The resulting curve of mitigation cost is shown in *Figure 5* below.

Forestry replacement

The third method of achieving a reduction in N loss involved replacing the highest leaching land with forestry such that the desired reduction target was achieved, allowing for a leaching loss of 1.5kgN/ha from forestry land. This calculation relies on the distribution of N losses in the affected areas matching that for the region overall, and results in 40% of the dairy land use being replaced with forestry in order to achieve the desired 46% reduction in catchment N loss. This calculation may not be exactly correct, because the replacement with forestry may also affect the water yield, which in turn would affect the concentrations resulting from a given load loss. However the approach adopted is likely to be sufficiently accurate for the purposes of this analysis.

The costs associated with the replacement by forestry were estimated as the change in operating profit for each land use. A figure of $130/ha for forestry plus $266 for carbon[49], $2017/ha for dairy based on DairyNZ Economic Survey regional data for Taranaki, and $520 for sheep and beef and dairy support based on Beef and Lamb NZ farm survey data NI Intensive Finishing model (Class 5). The operating profit for dairy and sheep and beef/dairy support was based on revenue minus working expenses (including insurance, ACC levies and rates) and minus depreciation.

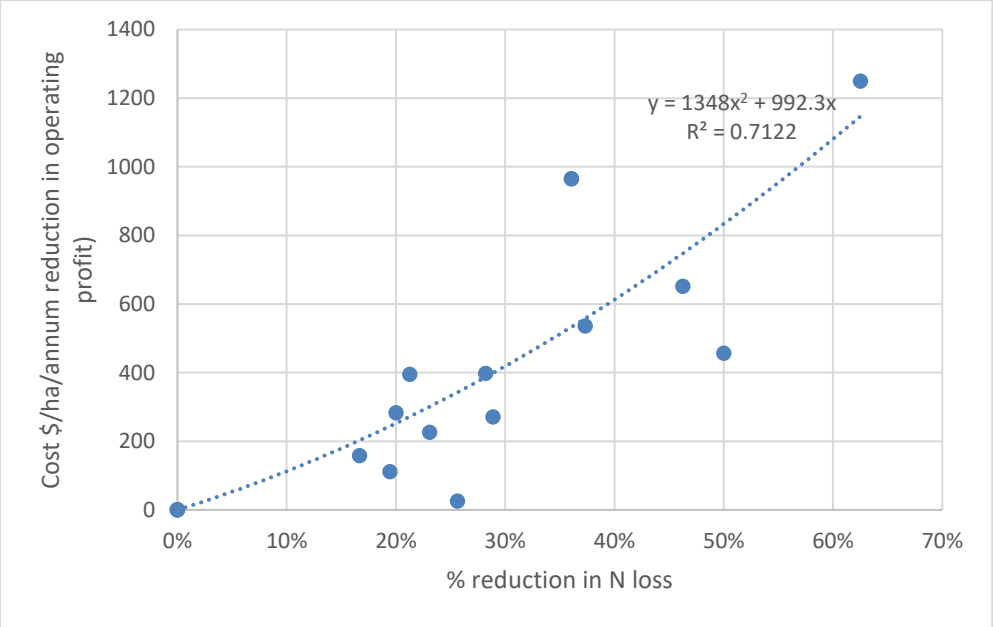

Figure 4: Cost of N mitigation for dairy land use

[49] Calculated based on MPI lookup tables for carbon absorption in the southern NI, converted into a NPV at 6% and then converted into an annuity in perpetuity at 6%. An averaging approach to the ETS was assumed, with a rotation length of 24 years – ie carbon was claimed up to year 12.

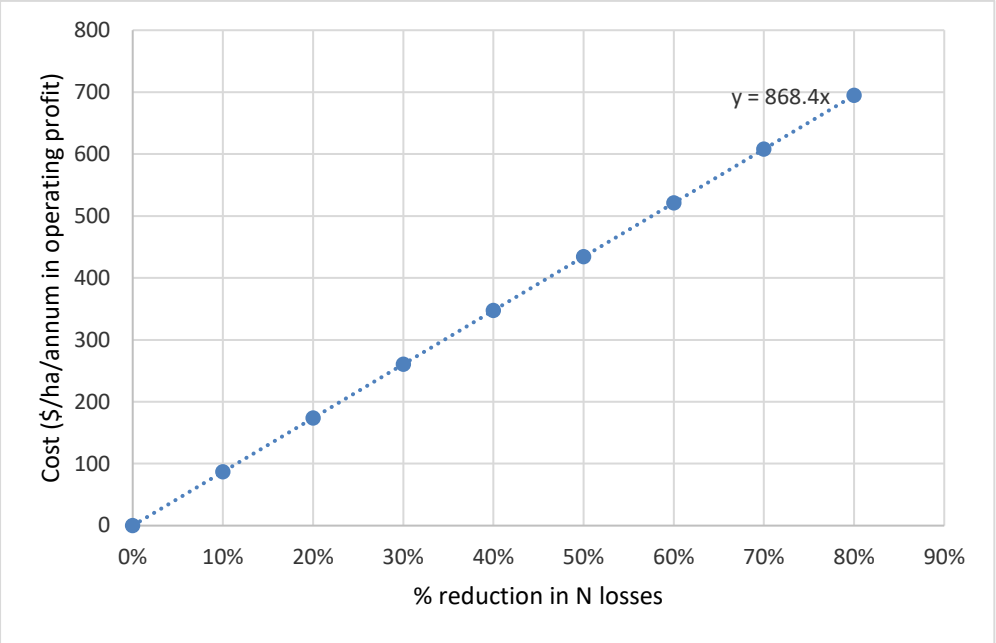

Figure 5: Cost of N mitigation in sheep and beef land use

3. Results

Caveats

The analysis relies on information from TRC on the reductions required to achieve the DIN limits, and on approximate values they have supplied for the extent of catchments likely to require reductions.

The data supplied on the distribution of N losses is regional for Taranaki, and may not apply directly to the southern ring plain area where the higher DIN concentrations largely occur. However, as it is based on Overseer model runs and contains a large number of sample farms, it is high quality data.

The work here has been undertaken in a relatively short time frame, and relies on mitigation costs that are several years old (2015), and which may over or underestimate the true cost of achieve reductions in N loss. We note that it is broadly similar to other exercises of this nature, although it may overestimate losses at lower levels of mitigation (0 – 20%). The costs of higher levels of reductions in N losses have generally been shown to have substantial impacts on operating profit.

The analysis has been undertaken in a relatively short time frame, and has not been as detailed or comprehensive as might be desirable when assessing changes of such a substantial nature as proposed in the Essential Freshwater package. In that sense it should not be considered as a comprehensive analysis.

Farm level results

The results of the analysis are shown on a per ha basis in *Table 2* and per farm basis in *Table 3*[50]. The results show that dairy and dairy support farms will need to reduce losses by close to 50%, and sheep and beef farms will on average only reduce their losses marginally.

Table 2: Per ha N losses and cost for DIN limit of 1mg/L

	Per ha average loss (kgN/ha)		Cost of mitigation		
Land use	**Current**	**Mitigated by N cap**	**Proportional – all farms reduce by 46% ($/ha/annum operating profit)**	**Cap of 27.2 kgN/ha ($/ha/annum operating profit)**	**Cost of forestry conversion ($/ha/annum operating profit)**
Dairy	50	27	$740	$700	$1,640
Dairy Grazing	55	27	$120	$170	$140
Sheep and beef	23	22	$400	$30	$140

Table 3: N losses and per farm cost for DIN limit of 1mg/L

	Per farm cost	
Land use	**Proportional – all farms reduce by 46% ($/farm/annum operating profit)**	**Cap of 27.2 kgN/ha ($/farm/annum operating profit)**
Dairy	$80,000	$70,000
Dairy Grazing	$23,000	$31,000
Sheep and beef	$79,000	$5,000

The distribution of costs at a farm level based on average farm size for Taranaki and the regional distribution of N losses is shown in *Figure 6*. These show that the costs for 33% of farms would exceed $100,000 per annum, and for 70% of farms would exceed $50,000 per annum.

[50] Uses an average farm size of 105 ha for dairy (DairyNZ/LIC Dairy Farm Statistics 2017/18) and 198 for other land uses based on the average farm size in Beef and Lamb NZ Class 5 for 2017/18.

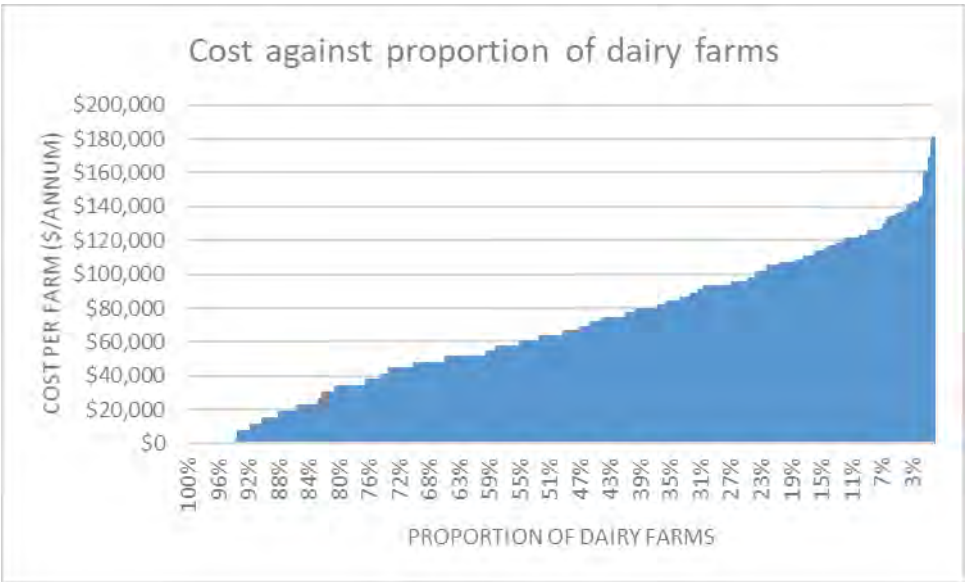

Figure 6: Distribution of estimated per farm costs based on average farm size and regional distribution of Overseer N losses, N Cap of 27.2 kgN/ha loss rate to achieve 1mg/L DIN

The likely impact of these measures is obviously difficult to predict, and it will depend substantially on the time scale over which the changes are implemented. However regardless of the approach adopted it is likely to involve large scale changes to the catchment, and substantial disruption to the existing structure of farming and the community. To achieve reductions in losses in the order of 50%, dairy farms are likely to have to make major changes to the farm system, such as moving to housing of stock and capture of all effluent. Even fewer options have been found for drystock systems which are typically lower input and with more marginal returns.

The changes outlined here will impact on the sustainability of farming businesses. The average dairy farm in Taranaki is small producing 103,000 kgMS average per farm compared with 167,000 kgMS/farm nationally. The average debt to equity ratio for Taranaki dairy farms in 2017/18 was 53%, with each farm carrying ~$34,000/ha in debt or $3.4 million per farm. In the 2017/18 season the average farm made a loss (i.e. the current operating profit is not sufficient to pay debt costs) and a return on equity of -8.4%. The small size and low profitability of dairy farms in Taranaki means that reducing intensity and profitability will also reduce the ability of the farm to support a family. In the practice this is likely to mean fewer labour units employed and the rationalisation and reorganisation of farms into fewer, larger units with an associated loss of population from the rural areas.

The Reserve Bank (Reserve Bank NZ, 2015) undertook national level stress testing of the potential impact of the (then) low farmgate milk price through to 2018/19. Under a base scenario with the milk price recovering[51] to $5.50/kgMS in 2016/17 and subsequently to $6.50 in 2018/19, non-performing loans (where cashflow is negative and equity is less than 10%) increase to 7.8% of debt. In a scenario where the milk price is $4/kgMS in 2015/16 and increases at 50c/kgMS annually through to 2018/19, 25% of farms and 44% of debt is in non-

[51] The payout for the 2014/15 year was $4.40/kg MS (excl dividend), and the Reserve Bank used prices of $4 to $4.15 in their scenarios of 2015/16 payout.

performing loans. This indicates that a small proportion of farms (<10%) are vulnerable to any decrease in operating profit, and a larger proportion (~25%) are vulnerable to a sustained decrease in operating profit.

Generally, the value of a productive asset reflects its ability to generate a profit, although this is not always true because some of the returns (e.g. capital value gains) may not be reflected in the annual operating profit. However, in a stable situation where demand for land and product are in equilibrium, and product prices are not increasing, there is a reasonable expectation of a relationship between operating profit and asset value. The changes required to achieve a DIN limit of 1mg/L will reduce operating profit substantially for most dairy farms, and depending on the way in which this achieved, the implications could be very significant for land values. For example a 33% reduction in operating profit, such as might occur with a proportional application of the 46% reduction (*i.e.* all farms reduce by 46%), would mean that land values would be expected to reduce by a similar amount, and given that no capital gains would be expected to occur in the immediate future, it may be that land values would decline further. Such a decrease in land values would result in a significant proportion of farms becoming insolvent because of the high debt to asset ratio in the Taranaki region.

Aggregate impacts

The results of the analysis for the three sample catchments are shown *Table 4*, and aggregated up to the full 750 dairy farms likely to be affected in *Table 5*.The overall cost of the DIN limit is estimated at $46 - $60 million per annum, and could involve large parts of the southern ring plain (up to 30,000 ha or 32% of the area) being converted to forestry.

The costs will depend on the method adopted to achieve the mitigation. The conversion of large parts of the area to forestry would be lowest cost when the returns from greenhouse gas emission absorption is included, but this would require co-ordinated action to purchase and convert the highest leaching properties. Furthermore this option depends on continued robust markets for forest products and NZUs[52], which is not guaranteed if large scale conversion to single species (radiata) forestry occurs.

The costs for proportional mitigation will be more evenly spread, and would result in higher costs for all farm types, but no extremely high costs for individual farms. The N cap approach would be a similar cost per ha on average for dairy and dairy support, but significantly lower cost for sheep and beef farms. The distributional impacts of these should be noted. In the cap approach, there are likely to be properties in high rainfall areas which will need to reduce losses by over 80% which could only be achieved by conversion to forestry or retirement of the land. Even the median property would need to reduce N losses by ~45%, which means that over 50% of dairy farms would have to reduce losses by more than this figure.

[52] NZ Units – 1 NZU = one tonne of CO_2 equivalent greenhouse gas emission.

Table 4: Results of analysis for three sample catchments for DIN limit of 1mg/L

	Cost of mitigation			
Land use	**Proportional reduction ($/annum operating profit)**	**Cap of 27.2 kgN/ha ($/annum operating profit)**	**Area converted to forestry (ha)**	**Cost of forestry conversion ($/annum operating profit)**
Dairy	$21,570,000	$19,020,000	10390	$17,050,000
Dairy Grazing	$35,000	$47,000	300	$43,000
Sheep and beef	$660,000	$45,000	1660	$238,000
Other	$0	$0	0	$0
Total	$22,260,000	$19,120,000	12350	$17,330,000

Table 5: Total cost of DIN limit of 1mg/L for 750 farms in South Taranaki

	Cost of mitigation			
Land use	**Proportional reduction ($/annum operating profit)**	**Cap of 27.2 kgN/ha ($/annum operating profit)**	**Area converted to forestry to achieve 46% reduction in N loss (ha)**	**Cost of forestry conversion to achieve 46% reduction in N loss ($/annum operating profit)**
Dairy	$58,000,000	$51,200,000	27960	$45,900,000
Dairy Grazing	$95,000	$127,000	800	$115,000
Sheep and beef	$1,775,000	$120,000	4470	$639,000
Other	$0	$0	0	$0
Total	$59,900,000	$51,400,000	33230	$46,600,000

Impact of high nitrate-nitrogen catchments requirements in Waingongoro

The requirement for all farmers to reduce N losses to the 75th percentile of all losses in the Waingongoro catchment will mean that all farms will have to be at or below 58 kgN/ha. The Waingongoro catchment is largely in dairy farms, with most of the land in higher rainfall areas (>1500mm), and there is a reasonably substantial area (15%) in other land uses.

Table 6: Land use in Waingongoro catchment

Area	Rainfall (mm)			
	<1500mm	1500-2500	>2500	Total
Dairy (ha)	1,000	8,900	6,400	16,400
Dairy support (ha)	-	100	-	200
Sheep and beef (ha)	-	800	300	1,200
Other (ha)	-	-	-	3,200
Total (ha)	1,100	9,900	6,700	20,900

Under the Option 1 proposal in the high nitrate N catchment proposal of the Essential Freshwater document, a maximum cap on N losses would be set at the 75th percentile of ranked losses for the catchment, presumably on a per ha basis and possibly with an area weighting. This analysis assumes that 25% of properties will be affected and based on the regional distribution of N losses it would result in an approximately 10% reduction in N losses for the catchment.

The cost of such a measure is shown in *Table 7* below. The impact will occur only for dairy farms, although there is limited data for dairy support and it may be that some dairy support in higher rainfall areas would also exceed the cap[53]. The total cost is estimated at $1.16 million per annum, and an average of $30,000 per property in the affected 25%. The distribution of the effects are shown in *Figure 7* and suggest that while ~10% of properties will experience costs in the order of less than $20,000 per annum, some properties will experience costs exceeding $100,000 per annum.

Table 7: Impact of 75th percentile cap in Waingongoro catchment

	Per ha average loss (kgN/ha)		Cost of mitigation	
Land use	Current	With 75th percentile cap	Total cost of 75th percentile cap ($/annum)	Per affected farm cost of 75th percentile cap ($/annum)
Dairy	50	46	$1,160,000	$30,000
Dairy Grazing	55	55	$0	$0
Sheep and beef	23	23	$0	$0

[53] There is only a small area of dairy support in the catchment, so this is not likely to make a serious difference to the results.

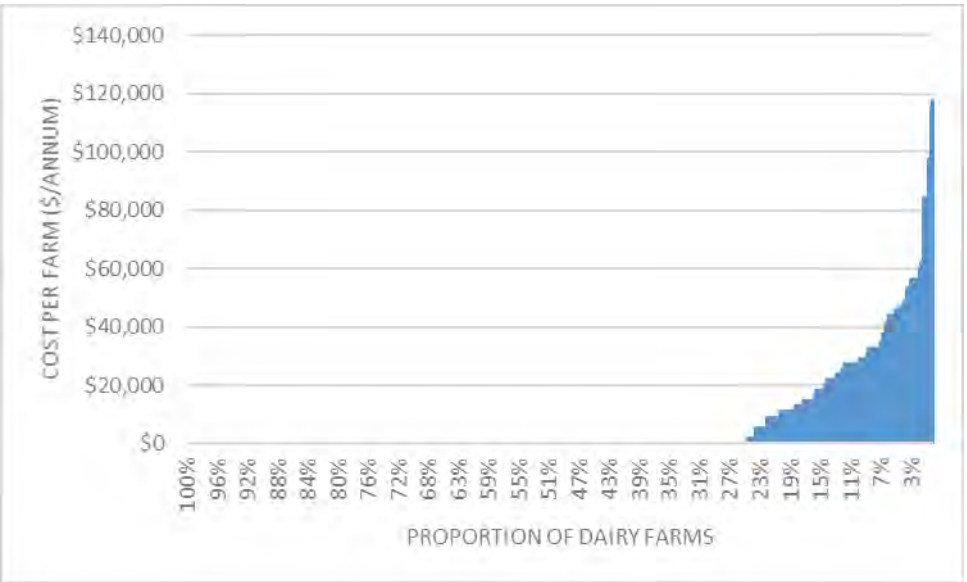

Figure 7: Cost of 75th percentile cap against the proportion of dairy farms affected

The scale of these changes, while impacting on a smaller proportion of the catchment than the DIN of 1mg/L, would result in significant impact for those properties. Quite apart from the practical difficulties of implementing these changes if they are required over a short time period, the reduction in profitability and associated reduction in land values would appear to have the possibility of rendering some farms insolvent.

Regional impacts

The analysis does not quantitatively consider the implications for the wider Taranaki economy, as the necessary information and time was not available to carry out this analysis. Given the scale of the changes, the impact would be expected to be reasonably substantial, particularly in the rural areas affected and for local businesses and communities that provide support services to dairy farms. We would typically expect restructuring of farming businesses into fewer larger farms and less employment, falling populations in affected areas, loss of scale for service providers, and flow on impacts into the regional towns of Stratford, Hawera and New Plymouth. Because household incomes of business owners and their employees will be affected, the impacts will extend into businesses that are not directly related to the agricultural sector. The option of conversion to forestry would appear to the be the lowest cost approach, but this would result in reduced local population and associated impacts on local businesses, schools, clubs and community organisations, and a resulting reduction in health and other community services.

However the exact nature of the changes required, their timing and how they are implemented will have a significant influence on the way in which the community is affected. Where changes occur over a longer time period, there is a greater capacity for the community to adapt and for new land uses to arise. Additional time can also help avoid large scale bankruptcies, which create additional social stresses for individuals and their community that can be hard to accommodate. In the last rural downturn that resulted from the 1980s reforms and sustained low commodity prices in the 1980s and 1990s, the government provided assistance packages to the rural sector and 20% of rural debt was written off (Ministry of Primary Industry, 2017). It is unclear whether the scale of changes indicated in the Essential Freshwater package would

be as widespread as they were during that period, but for specific areas and farmers they will be in the same order of magnitude.

4. Summary

The analysis undertaken here is limited in extent, relies on older data and should be read with the caveats in Section 0 in mind. The analysis suggests that the implications of DIN limit are potentially substantial, and will require major changes to land use in the southern ring plain area of Taranaki, and will result in high annual costs. The manner and time frame in which they are implemented will have a major bearing on the overall impacts, but they will have a more immediate impact on land values that needs to be considered alongside the profitability implications. For significant proportion of properties the changes will be too substantial to accommodate, and the business will not be able to continue operating.

If the changes were to occur, regardless of the manner in which it is accomplished, there will be associated impacts on the local and regional community, and particularly on those businesses that support and service dairy farms and the local community.

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