



AGENDA

Policy & Planning

Tuesday 8 June 2021, 10.30am

Policy and Planning Committee

08 June 2021 10:30 AM

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Purpose of Policy and Planning Committee meeting

This committee attends to all matters of resource management, biosecurity and related environment policy.

Responsibilities

Prepare and review regional policy statements, plans and strategies and convene as a Hearing Committee as and when required for the hearing of submissions.

Monitor plan and policy implementation.

Develop biosecurity policy.

Advocate, as appropriate, for the Taranaki region.

Other policy initiatives.

Endorse submissions prepared in response to the policy initiatives of organisations.

Membership of Policy and Planning Committee

Councillor C L Littlewood (Chairperson)	Councillor N W Walker (Deputy Chairperson)
Councillor M G Davey	Councillor M J McDonald
Councillor D H McIntyre	Councillor C S Williamson
Councillor E D Van Der Leden	Councillor D N MacLeod (ex officio)
Councillor M P Joyce (ex officio)	

Representative Members

Councillor C Young (STDC)	Councillor S Hitchcock (NPDC)
Councillor G Boyde (SDC)	Mr P Moeahu (Iwi Representative)
Ms B Bigham (Iwi Representative)	Ms L Tester (Iwi Representative)

Health and Safety Message

Emergency Procedure

In the event of an emergency, please exit through the emergency door in the committee room by the kitchen.

If you require assistance to exit please see a staff member.

Once you reach the bottom of the stairs make your way to the assembly point at the birdcage. Staff will guide you to an alternative route if necessary.

Earthquake

If there is an earthquake - drop, cover and hold where possible.

Please remain where you are until further instruction is given.



Date 8 June 2021

Subject: **Confirmation of Minutes - 27 April 2021**

Approved by: A D McLay, Director - Resource Management
S J Ruru, Chief Executive

Document: 2785494

Recommendations

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

- a) takes as read and confirms the minutes and resolutions of the Policy and Planning Committee of the Taranaki Regional Council held in the Taranaki Regional Council chambers, 47 Cloten Road, Stratford on 27 April 2021 at 10.30am
- b) notes the recommendations therein were adopted by the Taranaki Regional Council on 18 May 2021.

Matters arising

Appendices/Attachments

Document 2760753: Minutes Policy and Planning Committee - 27 April 2021

Late Items Councillor E Van Der Leden requested a discussion on penguin monitoring.

Mr G Bedford introduced Abby Matthews, Director – Environment Quality, who started today with the Council. He noted this was his last meeting and thanked the Committee.

1. Confirmation of Minutes – 15 March 2021

Resolved

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

- a) takes as read and confirms the minutes and resolutions of the Policy and Planning Committee of the Taranaki Regional Council held in the Taranaki Regional Council chambers, 47 Cloten Road, Stratford on 16 March 2021 at 10.30am
- b) notes the recommendations therein were adopted by the Taranaki Regional Council on 6 April 2021.

MacLeod/Williamson

Matters Arising

- 1.1 The Council received comments from one other Council regarding its Climate Change submission. A few minor changes were made and extra comments from Port Taranaki Limited and Venture Taranaki were received and incorporated. The submissions from Taranaki were more aligned as a result of the Council's and others' efforts. Thanks was given to Mr C Wadsworth, Strategy Lead, for his work on the submission and associated processes.

2. MfE Proposals to Impose National Regulatory Control on Fossil Fuels in Industry

- 2.1 Mr G K Bedford, Director – Environment Quality, spoke to the memorandum informing the Committee of a consultation document that has been released by the Ministry for the Environment (MfE), '*Phasing out fossil fuels in process heat*' (MfE 8 April 2020), and to introduce the recommendations of officers for the content of a submission by the Council. Officers had not had the time between receipt of the consultation document and preparation of the Committee agenda to prepare a full draft submission for the consideration of the Committee.
- 2.2 The Council's view is that they would prefer an NES that is clearly worded as it is direct and immediate, rather than an NPS open to further interpretation.
- 2.3 It was noted that the submission needs to focus on why it is important for NZ to maintain energy security using gas as opposed to relying fully on future but currently undeveloped energy sources.

Recommended

That the Taranaki Regional Council:

- a) receives the memorandum '*MfE Proposals to impose national regulatory control on fossil fuels in industry*'
- b) notes the recommendations of officers concerning suggested content of a future submission

- c) directs officers to prepare a submission as amended by the Committee, for further consideration at the Ordinary Meeting of 18 May 2021
- d) determines that this decision be recognised as not significant in terms of section 76 of the *Local Government Act 2002*
- e) determines that it has complied with the decision-making provisions of the *Local Government Act 2002* to the extent necessary in relation to this decision; and in accordance with section 79 of the Act, determines that it does not require further information, further assessment of options or further analysis of costs and benefits, or advantages and disadvantages prior to making a decision on this matter.

Joyce/Boyde

3. Making of the Amended Regional Pest Management Plan for Taranaki

- 3.1 Mr D R Harrison, Director – Operations, spoke to the memorandum seeking Members' agreement to make and adopt the revised *Regional Pest Management Plan for Taranaki 2018* (RPMP) to include mustelids.

Recommended

That the Taranaki Regional Council:

- a) receives this memorandum titled *Making of the amended Regional Pest Management Plan for Taranaki*
- b) notes that the Council prepared its Decision Report, publicly notified its decisions, and provided a copy to each submitter and to the public in February 2021
- c) notes that no applications were lodged in the Environment Court by the deadline which ended on 19 March 2021
- d) agrees that the Common Seal be affixed to the Plan and that Council make and adopt the amended *Regional Pest Management Plan for Taranaki*.
- e) determines that this decision be recognised as not significant in terms of section 76 of the *Local Government Act 2002*
- f) determines that it has complied with the decision-making provisions of the *Local Government Act 2002* to the extent necessary in relation to this decision; and in accordance with section 79 of the Act, determines that it does not require further information, further assessment of options or further analysis of costs and benefits, or advantages and disadvantages prior to making a decision on this matter.

MacLeod/McIntyre

4. Intensive Winter Grazing Update

- 4.1 Mr A D McLay, Director – Resource Management, spoke to the memorandum updating members on changes to the Government's intensive winter grazing regulations.

Recommended

That the Taranaki Regional Council:

- a) receives this memo *Intensive Winter Grazing Update*
- b) notes the amended timeframes for intensive winter grazing regulation and additional monitoring and reporting responsibilities for the Taranaki Regional Council.

McIntyre/Boyde

5. SEM Periphyton Monitoring Programme Report for 2018-2020

- 5.1 Mr G K Bedford, Director – Environment Quality, spoke to the memorandum presenting to the Committee the latest report on the ecological health and state of streams and rivers in the Taranaki region, as measured by assessing periphyton during the 2018-2020 years. The programme is reported in *Freshwater Periphyton Monitoring Programme (Periphyton monitoring in relation to amenity values) State of Environment Monitoring Report 2018-2020*.

Recommended

That the Taranaki Regional Council:

- a) receives this memorandum on the results of the Council’s SEM programme monitoring periphyton, and the accompanying report *Freshwater Periphyton Monitoring Programme (Periphyton monitoring in relation to amenity values) State of Environment Monitoring Report 2018-2020 Technical Report 2020-24*.
- b) adopts the specific report recommendations contained therein.

Van Der Leden/Williamson

6. Regional Freshwater Recreational Bathing Water Quality Report for 2019-2020

- 6.1 Mr G K Bedford, Director – Environment Quality, spoke to the memorandum presenting the Committee on the 2019-2020 bathing season results from the ‘state of the environment’ programme that monitors freshwater contact recreational water quality. The full report (*Freshwater contact recreational water quality at selected Taranaki sites State of the Environment Monitoring Report 2019-2020, Technical Report 2020-01, April 2021*) is available upon request, and will be published on the Council’s website following this meeting. The memorandum summarised the report’s data and results, and the Executive Summary and recommendations from the report were attached.

Recommended

That the Taranaki Regional Council:

- a) receives the memorandum noting the preparation of the report *Freshwater Contact Recreational Water Quality at selected Taranaki sites SEM Monitoring Report 2019-2020, Technical Report 2020-01*; and
- b) adopts the specific recommendations presented in Technical Report 2020-01.

Davey/Williamson

7. Bathing Beach Recreational Water Quality SEM Report 2019-2020

- 7.1 Mr G K Bedford, Director – Environment Quality, spoke to the memorandum presenting to the Committee the report on the quality of coastal bathing waters in the Taranaki region during the 2019-2020 bathing season, as set out in the report *Bathing Beach Water Quality State of the Environment Monitoring Report Summer 2019-2020, Technical Report 2020-82*. The Executive summary and recommendations from the report were attached to this memorandum. The full report is available upon request, and will be published on the Council’s website following this meeting.

Recommended

That the Taranaki Regional Council:

- a) receives the memorandum noting the preparation of the report *Bathing Beach Water Quality State of the Environment Monitoring Report Summer 2019-2020 Technical Report 2020-82*
- b) adopts the specific recommendations presented in Technical Report 2020-82.
Williamson/Walker

8. Regional LiDAR PGF/LINZ project

- 8.1 Mr S Latheef, Project Co-ordinator – Compliance Monitoring gave a presentation informing the Committee of the progress of the Regional LiDAR capture project that is presently underway in Taranaki.

Recommended

That the Taranaki Regional Council:

- a) receives this agenda memorandum *Regional LiDAR PGF/LINZ Project*
Littlewood/MacLeod

9. General Business

9.1 Pampas

Councillor N W Walker requested that Officers bring back a report to Council regarding pampas, explaining the history and options for pampas to be included as a pest plant. An overview will be provided at the next meeting.

9.2 Penguins

A discussion was held around the responsibility for the management and monitoring of Little Blue Penguins. It was noted any information obtained by the Council would be shared amongst those responsible and the Council’s coastal permit consent process did address effects on penguins.

Mr P Moeahu thanked the Council for approving the option for representative members to be provided with electronic devices.

There being no further business the Committee Chairman, Councillor C L Littlewood, declared the meeting of the Policy and Planning Committee closed at 12.06pm. The meeting closed with a karakia.

Confirmed

Policy and Planning

Chairperson: _____

C L Littlewood

8 June 2021



Date 8 June 2021

Subject: **Freshwater Implementation Project Overview**

Approved by: A D McLay, Director - Resource Management
S J Ruru, Chief Executive

Document: 2743855

Purpose

1. The purpose of this memorandum is to seek Council approval of the project plan for Essential Freshwater project and to introduce Members to the regular report that is proposed for this Committee. Both items are part of the overall management of the implementation of the *National Policy Statement for Freshwater Management* (NPS-FM) and related policy and instruments across the Council.

Executive summary

2. Implementing the government's *Essential Freshwater* package is one of the key tasks that is facing the Council over the next two to three years. With multiple requirements coming into effect at different dates across the implementation window and the desire to notify a proposed plan by December 2023, there is a high level of complexity and a need for coordination.
3. As a result of this complexity, Council is introducing a higher level of project management discipline than has been seen on some other recent projects. That discipline will focus on developing and managing a project plan and regular reporting to key oversight bodies – including to this Committee. This Memorandum and the associated attachments introduce the project plan and proposed report template to the Committee for information and review.

Recommendations

That the Taranaki Regional Council:

- a) receives the *Freshwater Implementation Project Review* memo
- b) approves the project plan, including the scope of the project function teams, the risks and proposal for managing them and notes the comments about resourcing strategies
- c) receives the proposed Freshwater Project Implementation Report template and approves both the template and the proposed reporting cycle.

- d) determines that this decision be recognised as not significant in terms of section 76 of the *Local Government Act 2002*
- e) determines that it has complied with the decision-making provisions of the *Local Government Act 2002* to the extent necessary in relation to this decision; and in accordance with section 79 of the Act, determines that it does not require further information, further assessment of options or further analysis of costs and benefits, or advantages and disadvantages prior to making a decision on this matter.

Background

4. Freshwater Management (“FW”) policy reform started in 2006 when a National Policy Statement (“NPS”) was issued for discussion and review. The NPS-FW was adopted in 2011 and amended in 2014 and 2017, before another review in 2017 saw the *Action for Healthy Waterways* discussion document released in September 2019.
5. That document set out Government proposals for new and additional requirements intended to “...stop further degradation of New Zealand’s freshwater resources and improve water quality within five years” and “reverse past damage and bring New Zealand’s freshwater resources, waterways and ecosystems to a healthy state within a generation.”
6. Following an extensive consultation process, the Government released its *Action for Healthy Waterways* policy and regulatory package (“FW Package”) in August 2020, comprising:
 - *Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F)*;
 - *National Policy Statement for Freshwater Management 2020 (NPS-FM)*;
 - *Resource Management (Stock Exclusion) Regulations 2020*; and
 - *Resource Management (Measurement and Reporting of Water Takes) Amendment Regulations 2020*.

Discussion

Business Requirements

7. FW Package Implementation (“FW Implementation”) is one of the more complex and significant projects implemented by Council due to a combination of:
 - 7.1. The nature of the FW Implementation itself – which impacts or involves practically every team in Council;
 - 7.2. The desire to notify a FW Plan (as part of an overall Natural Resources Plan) by December 2023;
 - 7.3. The fact that different parts of the FW Package come into effect at various dates over the next 3 years; and
 - 7.4. The Council’s current and predicted operating environment (e.g. local government reform, RMA reform).
8. Dealing effectively with these factors and maintaining the overall project timelines will require a structured project management approach. The two key elements of that approach, which are discussed in this memo, are:

- 8.1. An overall Project Implementation Plan (“the Plan”); and
- 8.2. Effective reporting and communication with key over-sight committees.

Overall Project Implementation Plan

9. Council’s Policy and Planning Team began drafting a FW Implementation Plan late in 2020. Following establishment of the FW Implementation project earlier this year, the initial document was expanded to create the Plan.
10. The Plan identifies implementation tasks and assigns deliverables for each of those tasks to one or more of seven functional groups. Those groups each own part of both the implementation during the project window and the longer term accountability for FW Package service delivery.
11. The tasks described in each workstream have been sequenced and timed to build a FW Package implementation project schedule. Following standard project management practice, that schedule has been developed into Gantt charts for both the individual workstreams and the project overall. Those Gantt charts form Appendix 2 to the Plan.
12. A high level swimlane diagram that summarises the main activities from the Gantt charts is also included in the Plan. It is intended to give an overview of the Plan for readers who don’t need the additional detail contained in the schedules.
13. The Plan and its component schedule information will be an important management tool for Officers as they manage FW Implementation. Along with the specific governance processes described in the Plan, it will provide the visibility on key activities that enable effective and efficient delivery of tasks against the agreed implementation timelines.

Regular update reporting to strategic governance bodies

14. Part of supporting the governance is the reporting framework used to both inform and engage the Executive Lead Team (“ELT”) and this Committee of the strategic issues where they can support FW Implementation delivery. To that end, Officers are recommending a Freshwater Project Implementation Report (“the Report”).
15. An example of the proposed Report to be presented to this Committee, prepared using current project status information, is attached to this Memo. The sections currently marked “To Be Completed” will be populated as soon as the necessary data becomes available.
16. This Report focuses attention on progress, upcoming milestones, resource use and priority risks. It will also be used to raise higher importance and more strategic (risk or opportunity) matters for attention and guidance from the ELT and/or this Committee.
17. The expectation is that this Report will support the type of strategic level conversation needed to give overall direction and context to the FW Implementation. Tactical issues and matters that are part of normal day to day project implementation will not be raised. This type of approach is a very standard pillar of good project management practice.
18. An example of the types of issues that Officers expect to raise to this Committee is the Freshwater Vision. This vision is a requirement under the NPS-FW and must be included in the updated Regional Policy Statement. As Members can see from the Plan swimlane, it is one of the earlier steps in the FW Implementation process. Once the consultation round and drafting is complete, Officers would raise the draft to this Committee for review, prior to formal notification.
19. Other possible report contents include:

- 19.1. Feedback on developing the required partnerships with tangata whenua;
- 19.2. Revisions to monitoring programmes in light of FW Package requirements;
- 19.3. Feedback on developing the required partnerships with tangata whenua;
- 19.4. Updates on implementing the requirements for farm plans; and
- 19.5. Implementing synthetic nitrogen fertiliser record keeping.

These issues would be raised alongside the regular progress updates that are contained in the Report.

20. The Report will be presented to the ELT monthly and to this Committee at each meeting. The shorter ELT reporting cycle allows any highly urgent escalated issues to be addressed as promptly as possible. It also allows for a preliminary review of strategic issues before they presentation to this Committee.
21. Subject to feedback on the items contained here, we would propose that reporting start from the next Committee meeting.

Financial considerations—LTP/Annual Plan

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

Policy considerations

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

Iwi considerations

24. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum.

Community considerations

25. This memorandum and the associated recommendations have considered the views of the community, interested and affected parties and those views have been recognised in the preparation of this memorandum.

Legal considerations

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

Appendices/Attachments

Document 2755117: Essential Freshwater Implementation Plan

Document 2786508: FW Implementation June Report



Taranaki Regional Council Implementation Plan

Essential Freshwater

Version 4
Date: 26 May 2021

Document number: 2755117

DRAFT

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1. Introduction to the Plan

1.1 Plan Purpose

This Implementation Plan describes how the Taranaki Regional Council will give effect to the requirements of the 'Essential Freshwater' package.¹

This Plan guides the Council's delivery of the new and existing programmes and activities needed for *Essential Freshwater* package implementation.

This Plan sets out in some detail that timing and those activities. It also describes the interrelationship between the different deliverables of the Council teams involved in this implementation. In doing so, it provides the guidance and framework to ensure that the Objective of giving effect to *Essential Freshwater* is achieved in a timely, efficient and effective manner.

1.2 Plan Format

The Plan is organised on the following basis:

- Introduction and Context - describes the background that the plan is developed against. That background includes the specific nature of freshwater resources in Taranaki, the planning and regulatory context and specific requirements for our partnership with tangata whenua
- Strategic Framework – a discussion of the principles that have guided the development of the Plan
- Implementation Framework – a more detailed description of the six work activity areas that will be undertaken as part of the Plan implementation. The section on each of those work activities contains:
 - An overall objective for that work activity

- A discussion of the key implementation components; and
- A summary implementation schedule.

NOTE: For activities which have immediate deliverables, a more detailed schedule is included. For the remaining activities, a higher level summary is included here. Detailed schedules will be developed as that particular work stream evolves.

The Plan represents Council's current best assessment of the works required and the timing for those works. As with any large scale and long duration project, both of those elements are likely to change as more the project is implemented.

To manage that change and ensure that the *Essential Freshwater* implementation objective is delivered in a timely manner, Council has implemented an internal project governance structure that includes:

- Appointing a Project Sponsor and Project Lead
- Regular progress monitoring meetings of the work area functional leads
- Oversight by an in-house Steering Team
- Use of risk management tools – including a risk register and regular updating of the project schedules

Council believes that the detail in the Plan and these internal governance measures will enable it to meet the overall Objective stated above.

¹ For the purposes of this Plan, the *Essential Freshwater* package means any or all of the measures released by government in August 2020. For details of those components, see section 2.2 "Planning Context".

2. Introduction and Context

2.1 The Taranaki context

The Council is firmly focused on improving the health of waterways in our region. Taranaki has over 20,000 kilometres of waterways and no less than 530 named rivers and streams. Taranaki also has 19 large lakes (with an area greater than eight hectares) and approximately 3,000 wetlands.

Over 300 rivers flow from the flanks of Mount Taranaki in a distinctive radial pattern across the ring plain. Typically ring plain rivers are short, small and fast-flowing. Te Papakura o Taranaki (the National Park) acts as a huge reservoir, supplying a steady flow of water to ring plain rivers even during prolonged dry periods.

By contrast, hill country rivers display a branch-like ('dendritic') pattern of drainage. Hill country rivers typically are much longer, have short tributaries and are contained by narrow valleys that carry relatively high sediment loads as a result of accelerated erosion.

Taranaki's waterbodies are a taonga for tangata whenua and have significant cultural value. Maintaining the health of our waterways is central to upholding Te Mana o te Wai. Taking care of the region's land and water is also vital for sustaining the regional economy and providing for a range of aesthetic, social and cultural outcomes.

Protecting and enhancing the quality and health of the region's fresh water remains excellent is of paramount importance. In Taranaki, the headwaters of many of our waterways lie within Te Papakura o Taranaki (National Park) or in largely unmodified stretches of the eastern hill country. The freshwater quality of headwaters is generally very good. However, freshwater quality in our rivers progressively declines downstream due to the influences of adjacent urban and rural land uses. Surface run-off can carry soil, urban and industrial contaminants, excess fertiliser and/or dung and urine into waterways. Discharges to waterways from various effluent systems can impact stream health and freshwater quality, as can draining or diverting streams and wetlands to improve land production.

The management of waterways has considerably improved in the past 40 years. Up until the 1970s, untreated dairy farm effluent was routinely discharged directly into the nearest river or stream, turning waterways green. Many wastewater treatment systems were inadequate compared with today's standards and greatly affected freshwater quality.

Whilst vast improvements have been made in infrastructure and practices to improve freshwater quality around our region, further work is still required.

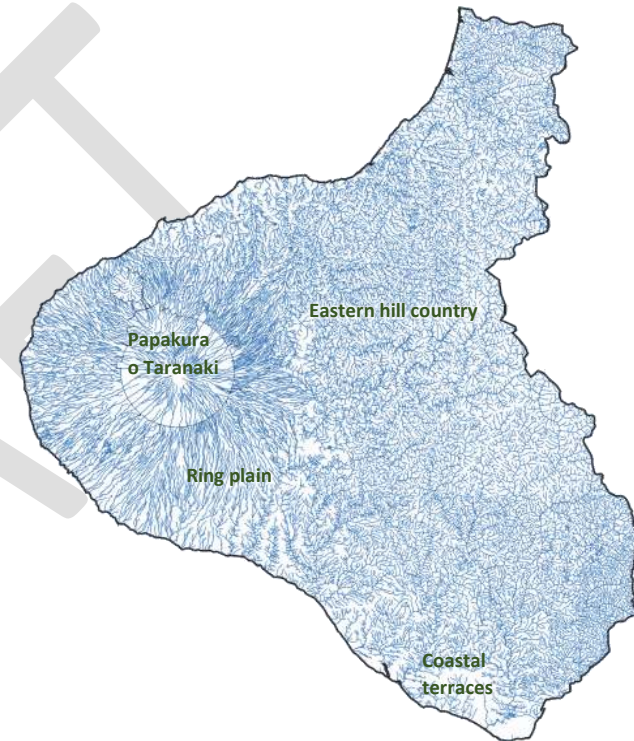


Figure 1: The Taranaki region and its waterways

Today, Taranaki's freshwater quality ranges from fair to excellent for a number of key measures of water quality. Current monitoring suggests that water quality is largely being maintained, and in some cases even improved. All farm effluent systems are now licensed

and monitored and long reaches of rivers and streams are fenced and planted. Most industrial waste treatment systems have been upgraded and almost all town wastewater discharges into rivers have been eliminated.

The latest Council monitoring shows the ecological health of rivers continues to remain at levels that are the best yet measured. However, at some sites, there are indications that the improvements that have been seen previously are starting to taper off.

Total nitrogen levels have either reduced or shown no significant change from 2005 (when trend analysis began) at 10 of 11 monitoring sites; however there has been a deterioration in nitrate and ammonia concentrations at more sites than have seen improvements. In recent years, dissolved and total phosphorus concentrations have remained relatively stable across monitoring sites.

Further monitoring and reporting will be required to understand these changes, and inform the implementation of Government’s Essential Freshwater package. While this work programme is rolled out, the Council continues to deliver and promote key policies and programmes designed to enhance water quality, alongside significant investment from the regional community.

2.2 Planning context

Since its inception in 1989, the Council has been managing the region’s freshwater resources to maintain and enhance the quality of water that is available for the varied needs of the region.

On 5 August 2020, the Government released its *Essential Freshwater* package, which contains:

- *National Policy Statement for Freshwater Management 2020* (NPS-FM),
- *National Environmental Standards for Freshwater 2020* (NES-F),
- *Resource Management (Stock Exclusion) Regulations 2020* (SER) and
- *Resource Management (Measurement and Reporting of Water Takes) Amendment Regulations 2020*.

Amendments to the *Resource Management Act 1991* (RMA) also form part of the package. These include introducing a streamlined freshwater planning process and setting a **31 December 2024** deadline for regional councils to notify plan changes giving effect to the NPS-FM.

The *Essential Freshwater* package imposes obligations on regional councils to be delivered on over the next 10 years. These obligations relate to topics such as stock exclusion from waterbodies, managing high-risk farming practices (eg., winter grazing), land use change and new limits for waterbodies.

These obligations will require significant new investment and changes to our current approach across many of our programmes, including:

- changes to existing planning documents² so as to give effect to NPS-FM and NES-F requirements (including Te Mana o te Wai – see discussion below);
- increased regulation for some activities (including new consenting requirements for activities previously allowed under the RMA or through regional rules);
- significantly increased investigations and monitoring; and
- major changes to our non-regulatory programmes (including the riparian management programme and sustainable land management programmes).

The *Essential Freshwater* package also requires Council to undertake the staged delivery of a variety of inter-dependant activities and tasks. Notable delivery deadlines are:

From 3 September 2020	New regulatory requirements relating to feedlots, wetlands, river reclamation, fish passage, agricultural intensification and stock exclusion for new pastoral systems
From 1 May 2021	Consent requirements for new and/or expanded intensive winter grazing
From 1 July 2021	New regulatory requirements relating to stock-holding areas other than feedlots and the application of synthetic nitrogen fertiliser to pastoral land

² Required changes to planning documents will be given effect to through a ‘Proposed Natural Resources Plan for Taranaki’ (which includes reviews of current freshwater, soil and air plans) and the review of the ‘Regional Policy Statement for Taranaki’.

From 1 May 2022	New regulatory requirements relating to all intensive winter grazing
November 2023	New regulatory requirements relating to natural inland wetlands, rivers
31 December 2024	Regional plans must be notified
1 July 2025	Stock exclusion regulations apply to dairy support cattle on any terrain and deer and beef on low slope land. Also all cattle, deer and pigs must be excluded from any natural wetlands that support a population of threatened species or are >0.05 hectares.

The overview diagram at the end of Section 2 shows this regulatory timeline and overlays key internal milestones that Council is looking to achieve.

2.3 Tangata whenua engagement

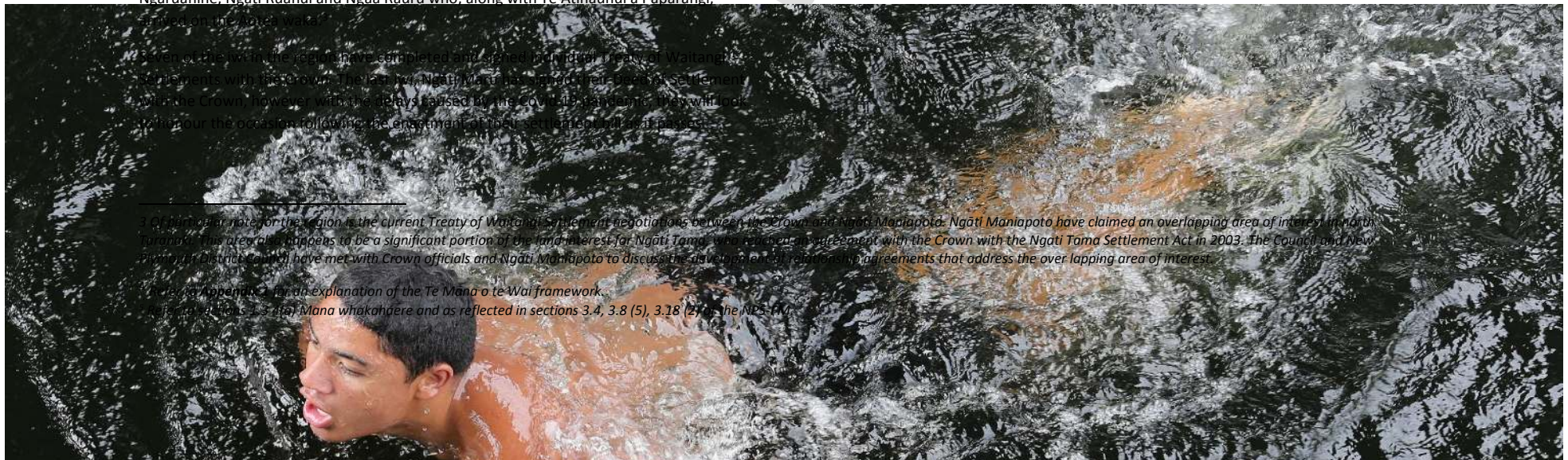
The Taranaki region has eight iwi. From north to south they are, Ngāti Tama, Ngāti Mutunga, Ngāti Maru and Te Atiawa who arrived on the Tokomaru waka. This waka landed on the Mohakatino River in north Taranaki. Taranaki Tūturu, the western most iwi, who arrived in the region on the Kurahaupo waka. Lastly, the southern collective iwi of Ngāruahine, Ngāti Ruanui and Ngāa Rauru who, along with Te Atihaunui a Paparangi,

through the house later in 2021. Combined and across the region there are over 58 named hapū and 41 marae.

The successful implementation of the Proposed Natural Resources Plan and improving freshwater outcomes in this region will depend, to a large part, on working in partnership with tangata whenua to build an understanding of Te Mana o te Wai in Taranaki.

Te Mana o te Wai is the central concept underpinning the new national directions for freshwater management. The concept refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment and of people.⁴

The NPS-FM provisions,⁵ increases the opportunity for tangata whenua involvement in both NPS implementation and subsequent decision making. Some Taranaki iwi have already signalled that their capacity to play all of the roles anticipated in NPS-FM may be beyond their current capacities. National discussions underway seeking substantial resourcing support from central government to address this issue. At a regional level, Council will work with iwi and hapū o Taranaki to formalise arrangements for engagement, relationship building and joint decision making opportunities as part of giving effect to the NPS-FM.



⁴ Even on the water, the iwi have completed and signed individual Treaty of Waitangi Settlements with the Crown. The last iwi, Ngāti Maru, has signed their Deeds of Settlement with the Crown, however, with the delays caused by the COVID-19 pandemic, they will lack time for the occasion following the enactment of their settlement deal in 2025.

⁵ Of particular note for the region is the current Treaty of Waitangi Settlement negotiations between the Crown and Ngāti Maniapoto. Ngāti Maniapoto have claimed an overlapping area of interest in north Taranaki. This overlap happens to be a significant portion of the land interest for Ngāti Tama, who reached an agreement with the Crown with the Ngāti Tama Settlement Act in 2003. The Council and New Plymouth District Council have met with Crown officials and Ngāti Maniapoto to discuss the development of relationship agreements that address the overlapping area of interest.

⁶ See Appendix 2 for an explanation of the Te Mana o te Wai framework.

⁷ Provisions 3.3 (a) Mana whakohere and as reflected in sections 3.4, 3.8 (5), 3.18 (2) of the NPS-FM.

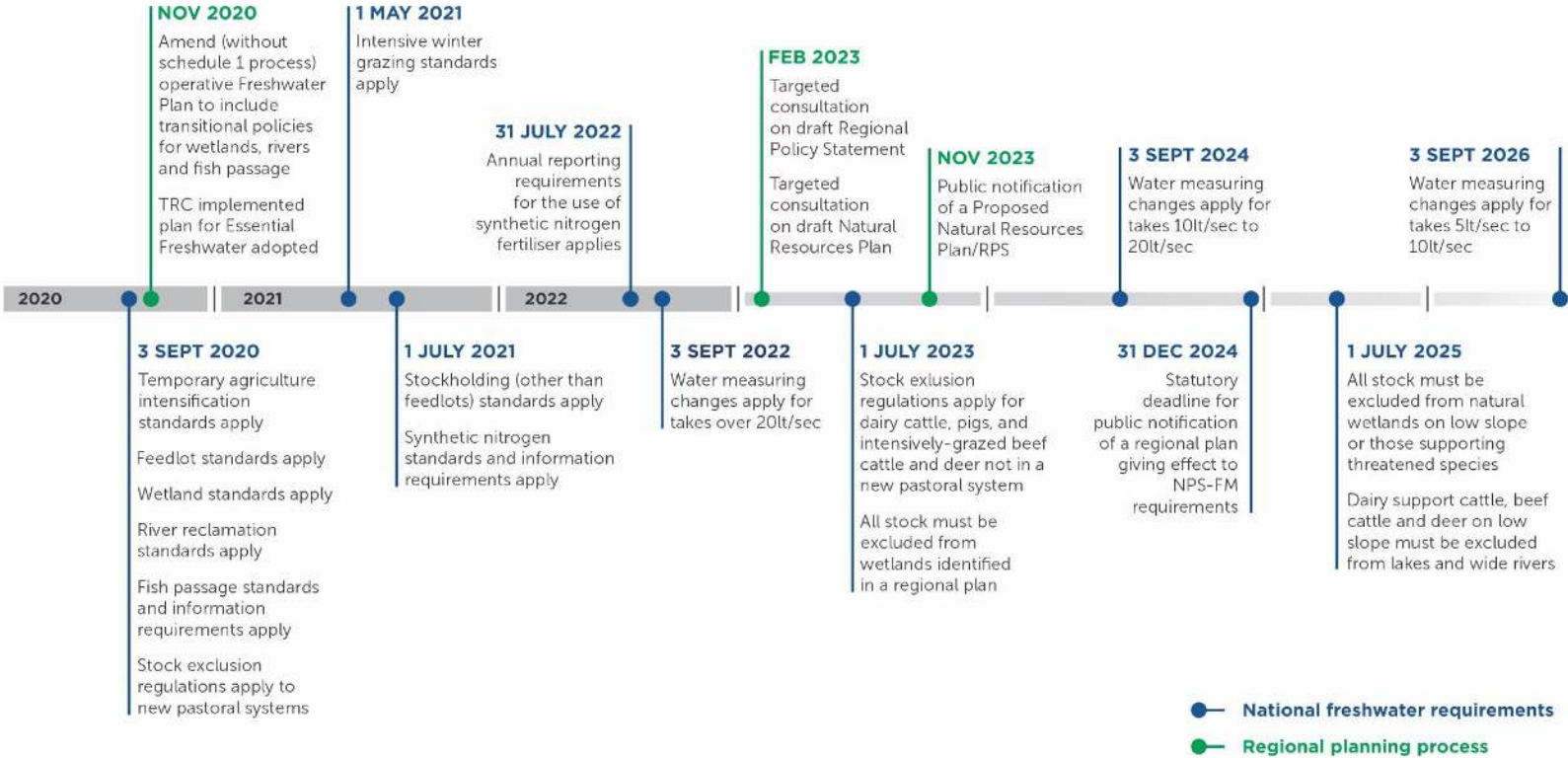


Figure 2: – Overview of key Essential Freshwater regulatory and implementation milestones

3. Strategic framework

3.1 Vision

The Council will manage the freshwater resources of the Taranaki region to give effect to the concept of Te Mana o te Wai.

Te Mana o te Wai is the recognition of the intrinsic importance of water, as well as its fundamental contribution to the health and well-being of the wider environment, and of the community. It requires Council (and the wider community) to recognise and protect the mauri of the water by prioritising (in this order):

- the health and well-being of water bodies and freshwater eco-systems;
- the health needs of people; and
- the ability of people and communities to provide for their social, economic and cultural well-being, now and in the future

A more detailed depiction of the concept of Te Mana o te Wai and the six principles that describe the roles of key stakeholders is contained in Appendix 1, below.

3.2 Implementation principles

The Council is committed to implementing this Plan in an effective, pragmatic way for the benefit of our region. As part of that commitment, the Council's deliberations when developing both the contents of the plan and the implementation timeline have been guided by the following inter-dependent principles:⁶

- **Subsidiarity:** *Decisions are made closest to community of interest for the issue.*
Difficult values-based choices in policy design and implementation are best made by the community of interest and within a structure where decision-makers are accountable to the community.

- **Evidence-based policy:** *Design and adoption of interventions is evidence-based.*

That evidence may be western-science based or based on Mātauranga Māori.

The problems to be addressed and the effectiveness of solutions proposed must be understood and assessed with reference to reliable and robust data or information.

- **Fit for purpose:** *Policy responses are flexible and tailored to local circumstances.*

'One size fits all' policy solutions will often not be appropriate. What applies in one part of the region may not be effective or necessary in another.

- **Socially durable:** *Policy design and implementation solutions are robust and capable of community support over a sustained period.*

The burdens imposed are fair and proportionate. The pace of change demanded reflects the scale of the task and the (at times) intergenerational origins of the issues addressed.

- **Effective and practical:** *Adopted interventions most effectively achieve the outcomes sought.*

Elements of the Government's package will impose significant costs on the Council and community. The Council will seek to find and realise value wherever possible. Interventions must also avoid perverse outcomes and unintended consequences.

- **Efficient:** *Deliver interventions in a timely and pragmatic manner.*

⁶ Adapted from the guiding principles set out in 'Regional Sector Commentary on Essential Freshwater Proposals He Pito Kōrero e pa ana ki Ngā Tūtuhu Mō te Waimāori'. Prepared by the Regional Sector Water Subgroup, September 2019.

The choice of interventions need to be affordable, benefits must outweigh the costs (monetary or non-monetary), including the imposition of unnecessary compliance costs and must avoid duplication of roles and responsibilities.

- **Tangata whenua partnership:** *Council works with tangata whenua in freshwater management, including decision making processes.*

Section 3.4 of the NPS-FM sets out requirements for tangata whenua involvement in freshwater management, including but not limited to identifying the local approach to giving effect to Te Mana o te Wai, making or changing regional policy statements or regional plans as they relate to freshwater, implementing NOF⁷ and developing and implementing mātauranga Māori.

- **Outcomes focus:** *Interventions achieve the best environmental outcomes sought.*

Management responses need to keep a focus on outcomes and trends. Key questions will be “are we seeing what we want in our waterways? Are we heading in the right direction?”

- **A systems approach:** *Considering both the interventions and the supporting systems needed – including assessing the merits (or otherwise) of regulatory versus non-regulatory actions.*

Because of the complex nature of the problem, when we think about possible interventions, we need to also think about the changes needed to support the intervention and make it work in practice. This includes rules and enforcement, education and advocacy, IT and information management systems, science and technology, institutional structures and capacity.

The Council regards the eight principles above as some of the key considerations for effective and efficient resource management solutions.

⁷ NOF refers to standards required under the Government’s National Objectives Framework for freshwater quality.



4. Implementation Activities

4.1 Introduction

This part of the Plan describes in detail:

- what has to be done,
- when it must be done; and
- who is responsible for doing it

for each of the six focused work streams that make up the Plan.

As noted previously, this plan represents the current best estimates of those tasks and relationships. Council will manage any changes required through the Council's project governance process describes in section 1.2.

The swimlane diagram in section 4.3 below depicts the interactions and sequence of events that are described for each of the work streams. Note that, for readability, there is no timeline on that diagram. Timing is provided in more detail in the schedule for each work stream.

4.2 Work Stream Objectives and Focus

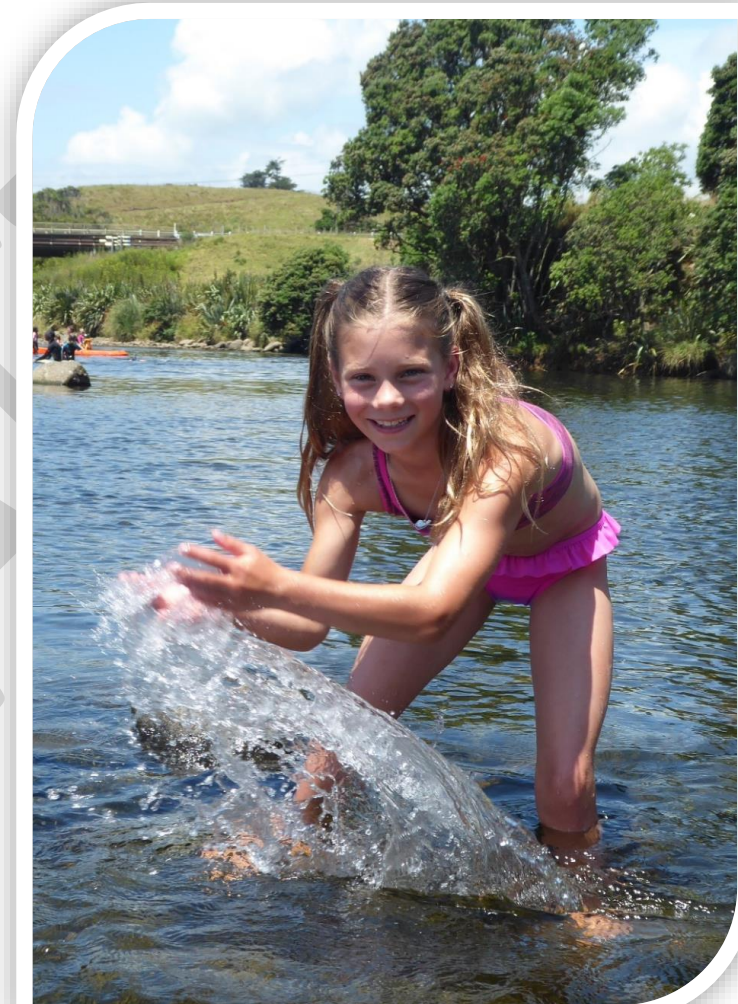
To give effect to the Plan's goal, the Council will undertake the following activities:

Work stream 1: Tangata whenua collaboration⁸

Taranaki Regional Council will work in partnership to involve tangata whenua in freshwater management and to integrate *Essential Freshwater* requirements and kaupapa Māori concepts into a revised planning framework.

Work stream 2: Policy development and review

Taranaki Regional Council will integrate *Essential Freshwater* requirements into a revised local planning framework to be established through the reviews of the



⁸ Tangata whenua engagement specific to policy review and development and monitoring and investigations are also addressed in section 3.2.2 and 3.2.5 below, respectively.

Regional Policy Statement for Taranaki, the Regional Freshwater Plan for Taranaki and the Regional Soil Plan for Taranaki.

In particular, by 31 December 2023, the Council will publicly notify a *Proposed Natural Resources Plan* that gives effect to the NPS-FM.

Work stream 3: Consenting and enforcement

Taranaki Regional Council will efficiently and effectively regulate existing regional rules plus any additional requirements arising from the *Essential Freshwater* package.

In particular, the Council will process resource consents and enforce new national requirements set out in the NPS-FM, NES-F and SER.

Work stream 4: Operations

Taranaki Regional Council will work with people to assist them to meet their *Essential Freshwater* requirements.

As necessary, Council will adapt and transition existing non-regulatory riparian and hill country programmes to a compliance regime to meet, as a minimum, *Essential Freshwater* requirements for intensive winter grazing, wetlands, fish passage and riparian management.

Work stream 5: Monitoring and investigations

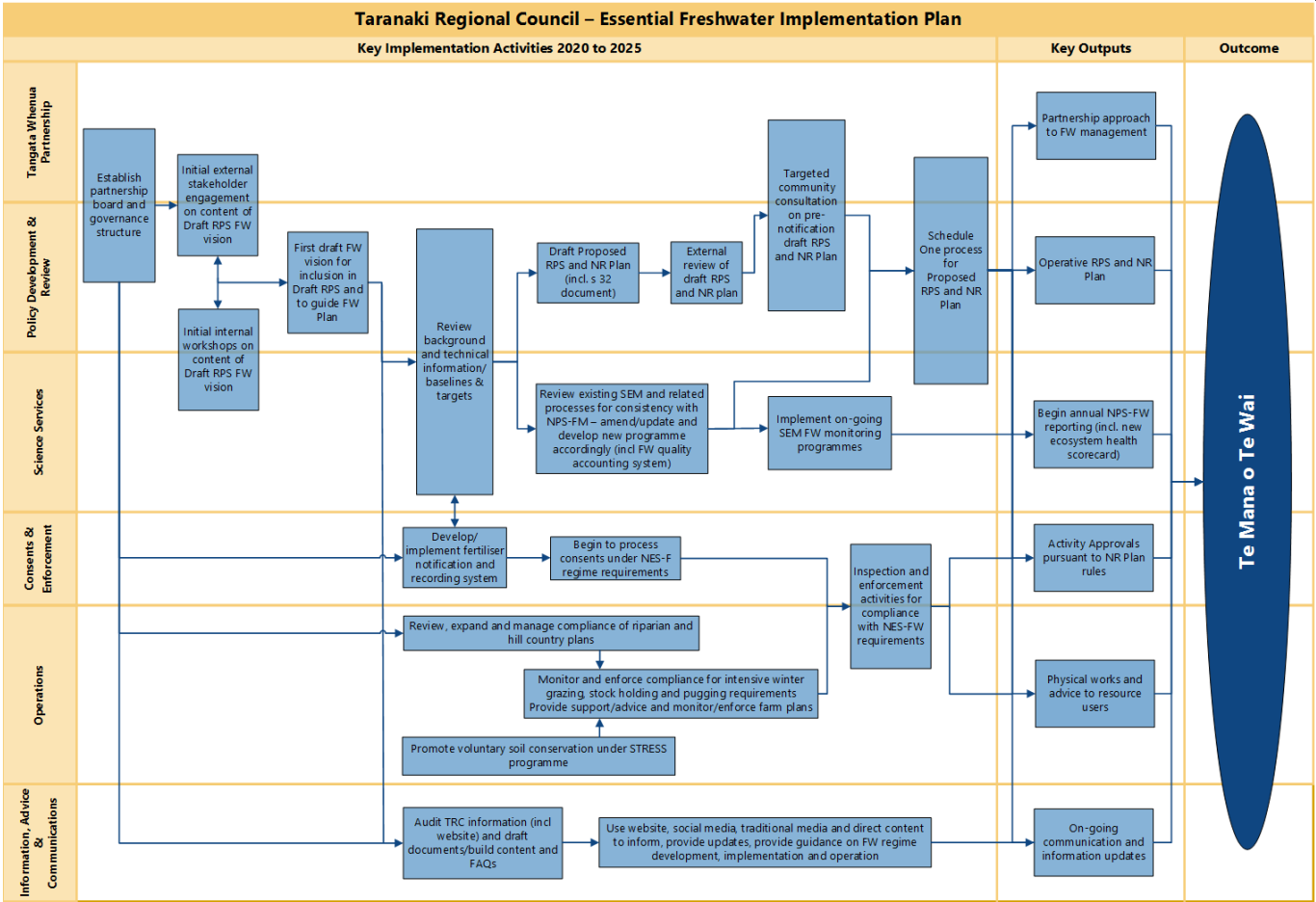
Taranaki Regional Council will undertake monitoring, investigations and research to inform policy development and monitoring requirements set out in the *Essential Freshwater* package. This work will help inform the setting of baselines and targets for various attributes required under the NPS-FM, as well as action plans to improve freshwater quality where necessary.

Work stream 6: Information, advice and communications

Taranaki Regional Council will inform, educate and consult with the community and stakeholders to increase awareness and understanding of *Essential Freshwater* requirements, building engagement and actions to deliver the freshwater outcomes being sought.



4.3 Essential Freshwater Implementation - Key Tasks Summary



4.3.1 Tangata whenua engagement

Lead responsibility: Iwi Communication Officer

The NPS FM also includes a stronger direction for Council to involve iwi and hapū in decision making and to better integrate Māori knowledge and practices (Mātauranga Māori) into regional freshwater planning, monitoring and reporting.

In recent years the Council has been working more closely with iwi and hapū o Taranaki, however the NPS-FM has formalised the requirement for engagement, relationship building and exploring joint decision making opportunities.

Accordingly, as part of the implementation of this Plan, the Council will work with tangata whenua to incorporate kaupapa Māori concepts into a new *Regional Policy Statement for Taranaki* (RPS) and a *Proposed Natural Resources Plan* (see section 4.3.2 below) plus monitoring systems and processes (see section 4.3.5 below).

For the RPS review, the Council will collaborate with tangata whenua (and other stakeholders) to develop and incorporate a vision statement/Whakatauki on what our waterbodies should look like in the future.

For the *Proposed Natural Resources Plan*, the Council will collaborate with tangata whenua to:

- identify how the Council/Plan will give effect to Te Mana o te Wai
- incorporate He kaupapa Māori (collective visions and aspirations of Māori) concepts and mātauranga Māori into Plan provisions
- identify freshwater outcomes in the Plan, including mahinga kai (a NOF compulsory value) and other values of significance to Māori.

In relation to other matters supporting or underpinning freshwater management, the Council will further collaborate with tangata whenua to identify how to integrate the above into its wider monitoring and operational processes.

Tangata whenua engagement and collaboration will require different levels and sources of input from individual hapū and iwi, through the Wai Maori group, to the tangata whenua representatives sitting on the Council committees and, ultimately, to the Maori

commissioner on the RMA planning documents hearings panel. Issues around Māori capacity to contribute effectively to this process will inevitably be raised.

To assist this process, the Council will develop a tangata whenua engagement strategy for freshwater implementation. This strategy will set out the Council's commitment and processes for enhancing the Council's relationships with tangata whenua in relation to its functions, powers and responsibilities.

Council will also develop with interested iwi, mana whakahono a rohe agreements and/or other mechanisms⁹ that set out agreed iwi input into planning, consenting and monitoring processes. That process also needs to recognise and address wider issues around governance and iwi capacity building .

The Table below sets out the key tangata whenua engagement activities and work streams to be coordinated by the Iwi Communication Officer with support from the Public Information, Policy and Planning and Science Services sections of the Council.



⁹ Section 3.4(3) [Tangata whenua involvement] of the NPS-FM requires Council to work with tangata whenua to investigate mechanisms such as section 33 transfer or delegations of power or joint management agreements under section 36B of the RMA to involve tangata whenua in freshwater management.

Work stream 1: Tangata whenua collaboration¹⁰

Taranaki Regional Council will work in partnership to involve tangata whenua in freshwater management and to integrate Essential Freshwater requirements and kaupapa Māori concepts into a revised planning framework.

Milestone	Completion Date

The above milestones are the best estimate of the tasks required and necessary timing in order to achieve the Council’s Essential Freshwater implementation objectives as at the date of preparing this Plan. They mirror the more detailed tasks and timing contained in the overall project schedules in Appendix 2 of the Plan.

Every effort will be made to manage the project to meet or better these milestones, with progress and any barriers being regularly reviewed under the project governance system

There are no known barriers or concerns on achieving the Tangata whenua collaboration milestones at this stage.

¹⁰ *Tangata whenua engagement specific to policy review and development and monitoring and investigations are also addressed in section 3.2.2 and 3.2.5 below, respectively.*

4.3.2 Policy development and review

Lead responsibility: Policy and Planning

The *Essential Freshwater* package (particularly in relation to the implementation of the NPS-FM, NES-F and the SER) requires significant policy development work, including the review and amendments to the current RPS and regional plans. The policy development work stream ensures that the outputs of that review deliver efficient and effective management of the Council's freshwater functions under the RMA.

The Council will undertake the RPS review in conjunction with the review of its regional freshwater, soil and air plans.

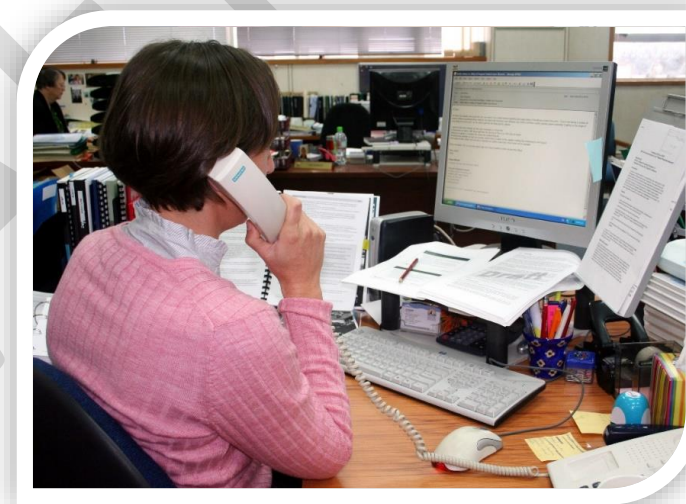
The Council is aiming to incorporate these documents into a combined RPS and Natural Resources Plan. The Council's target is to publicly notify a *Proposed RPS and Natural Resources Plan* by **31 December 2023** – one year ahead of the statutory deadline for plans to be notified. Meeting this target will be contingent upon the timely delivery of advice from Science Services and the outcome of tangata whenua and targeted stakeholders engagement processes.

In terms of key RMA and LTP considerations, the following milestones are highlighted for Policy and Planning:

<i>April 2021</i>	Public consultation on long term vision for freshwater values (for inclusion in a Proposed RPS), alongside the LTP process
<i>Pre 31 December 2022</i>	Draft RPS and plan development. Includes internal development of provisions and supporting investigations, engagement and collaborative processes that contribute to the development of a combined draft <i>Proposed RPS and Natural Resources Plan</i> , ready for targeted consultation in accordance with clauses 3 and 4A of schedule 1 of the RMA
<i>February 2023</i>	Targeted consultation on a <u>draft</u> <i>Proposed RPS and Natural Resources Plan</i>
<i>December 2023</i>	Public notification of a <i>Proposed RPS and Natural Resources Plan</i> that gives effect to NPS-FM and NES-F

requirements and in accordance with the Schedule 1 process.

Set out in the Table below are the key policy development activities to be delivered by the Policy and Planning Section as part of the Council giving full effect to *Essential Freshwater* requirements. They particularly pertain to the development and public notification of a *Proposed RPS and Natural Resources Plan* that gives effect to NPS-FM and NES-F requirements.



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Work stream 2: Policy development and review:

Taranaki Regional Council will integrate Essential Freshwater requirements into a revised local planning framework to be established through the reviews of the Regional Policy Statement for Taranaki, the Regional Freshwater Plan for Taranaki and the Regional Soil Plan for Taranaki.

In particular, by 31 December 2023, the Council will publicly notify a Proposed Natural Resources Plan that gives effect to the NPS-FM.

Milestone	Completion Date
Develop long term vision for freshwater values	December 2021
Review and incorporate background technical information, baselines and targets Task includes: <ul style="list-style-type: none"> • FMU definition • River and lakes attributes requiring limits • River and lakes attributes requiring action plans • Scheduled/identified sites • Taonga species and sites of significance to Maori 	December 2022
Complete drafting of Proposed NRP	June 2023
Complete drafting of s 32 Report	June 2023
External peer review and targeted consultation of draft RPS and draft NRP	June 2023
Public notification of Proposed RPS and Proposed NRP	December 2023
Complete Schedule 1 plan review process	July 2025

The above milestones are the best estimate of the tasks required and necessary timing in order to achieve the Council’s Essential Freshwater implementation objectives as at the date of preparing this Plan. They mirror the more detailed tasks and timing contained in the overall project schedules in Appendix 2 of the Plan.

Every effort will be made to manage the project to meet or better these milestones, with progress and any barriers being regularly reviewed under the project governance system

There are no known barriers or concerns on achieving the Policy development and review milestones at this stage.

Note however that the final milestone – “Complete Schedule 1 plan review process” - is tied to completing an externally managed, statutorily defined process. The process is led by the government’s appointed Freshwater Commissioners. Once the Council submits the Proposed NRP, it has no control over the timing or duration of this process.

4.3.3 Consenting and enforcement

Lead responsibility: Consents Section
Inspectorate Section

The Council has both resource consenting and enforcement responsibilities under the RMA. The *Essential Freshwater* package introduces new requirements for consenting and enforcement to those existing responsibilities. Those new consenting and regulatory requirements will come into effect according to the following timeline on the following activity types

3 September 2020	Feedlots, wetlands, river reclamation, fish passage, agricultural intensification and stock exclusion for new pastoral systems
1 May 2021	Consenting for new and/or expanded intensive winter grazing
1 July 2021	Stockholding areas (other than feedlots) and the application of synthetic nitrogen fertiliser (including requirements for dairy farmers to provide application information to the Council)
1 July 2021	Stock exclusion
1 May 2022	Intensive winter grazing
3 September 2022	Measuring water takes over 20 l/sec

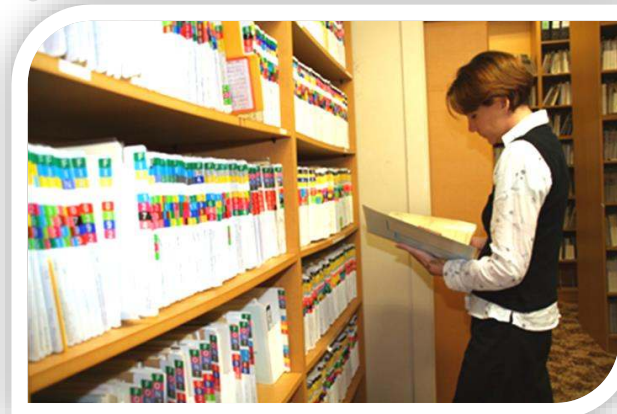
In addition, Council has an obligation to monitor intensive winter grazing and stockholding areas (other than feedlots) from May 2021 and December 2021, respectively. Current expectations are that a new regulatory regime will be in place for each measure from 2022. Farmers undertaking those activities will have to apply for consents under the new regime if they wish to continue them beyond that date.

Finally, following the timeline proposed in this implementation plan, notification of a *Proposed Natural Resources Plan* by the end of December 2023 will bring all remaining elements of *Essential Freshwater* into effect. The final tranche of new consenting and regulatory requirements will take effect at that stage.

All of these new requirements share a common need for Council to consider the changes and develop appropriate implementation measures to address those requirements. In particular, Consents and Inspectorate sections will:

- amend existing consent forms and/or develop new versions to apply to the new activities
- review field information against new baselines and the rules contained in the NES and undertaking enforcement activities as required. No new enforcement processes are anticipated, existing tools will meet all new activity needs.
- as required, obtain legal advice and clarification to enable accurate, clear and consistent application of consents and enforcement processes.
- undertake focused training for Consents and Inspectorate staff to ensure the new regulatory regime is correctly applied
- support Public Affairs' efforts to develop broader internal and external communications tools and processes.

Set out in the Table below are the key work streams to be delivered by the Consents and Inspectorate sections as part of giving effect to *Essential Freshwater* requirements. Note that, as the activities described above apply to each of the new *Essential Freshwater* requirements, the table below is organised in terms of the new requirements, rather than the specific activities.



Work stream 3: Consenting and enforcement	
<i>Taranaki Regional Council will efficiently and effectively regulate existing regional rules plus any additional requirements arising from the Essential Freshwater package. In particular, the Council will process resource consents and enforce new national requirements set out in the NPS-FM, NES-F and SER.</i>	
Milestone	Completion Date
Feedlots, wetlands, river reclamation, fish passage, agricultural intensification and stock exclusion for new pastoral systems	In place from September 2020
Begin consenting for new and/or expanded intensive winter grazing	May 2021
Begin consenting for stockholding areas (other than feedlots) and the application of synthetic nitrogen fertiliser	July 2021
Begin enforcing regulations for stock exclusion	July 2021
Begin consenting for all Intensive winter grazing	May 2022
Synthetic nitrogen application information collection requirements for dairy farms – first year reports due	July 2022
Begin measuring water takes over 20 l/sec	September 2022
Begin consenting and enforcing rules in notified version of Proposed NRP	December 2023

The above milestones are the best estimate of the tasks required and necessary timing in order to achieve the Council’s Essential Freshwater implementation objectives as at the date of preparing this Plan. They mirror the more detailed tasks and timing contained in the overall project schedules in Appendix 2 of the Plan.

Every effort will be made to manage the project to meet or better these milestones, with progress and any barriers being regularly reviewed under the project governance system

There are no known barriers or concerns on achieving the Consenting and enforcement milestones at this stage.

4.3.4 Operations

Lead responsibility: Land Management

The Council has significant non-regulatory programmes contributing to freshwater and soil conservation outcomes in the region. In particular:

- On the ring and coastal terraces, the Taranaki Riparian Management Programme has been successfully promoting the fencing and planting of riparian margins to exclude livestock from waterways and to intercept and filter the overland flow of nutrients and other contaminant from land to water.
- On erosion prone land in the eastern hill country, the Sustainable Hill Country Programme has been successfully promoting sustainable land use practices to address the impacts of accelerated soil erosion and its effect on water quality.

Both of the aforementioned programmes involve Council land management officers (LMOs) working with individual farmers to prepare property-specific plans (e.g. riparian plans or comprehensive farm plans), the provision of plants and/or pole material and ongoing advice, liaison and monitoring to support the implementation of these plans.¹¹

Over the life of the Implementation Plan, the Land Management section will continue to provide appropriate advice and support for land occupiers to encourage the voluntary adoption of sustainable land use practices to meet its soil conservation and wetland responsibilities under the RMA. However, there will also be a need to adapt and transition existing non-regulatory work programmes to give effect to new regulatory requirements set out in the *Essential Freshwater* package.

As noted in previous section, in the short term, LMOs will be providing monitoring and inspectorial support to the Inspectorate Section as part of enforcing *Essential Freshwater* requirements, particularly in relation to intensive winter grazing and stock exclusion. In the mid to long term, LMOs are likely to have a role in the certification or auditing of farm plans.

Set out in the Table below are the key activities and work streams to be delivered by the Land Management and Environment Services sections as part of giving effect to *Essential Freshwater* requirements.



¹¹ To date, 99.5% of dairy farms have a riparian plan while approximately 69% of the hill country in private ownership has a comprehensive or agroforestry plan. The NPS-FM requires the development of action plans to address the Appendix 2b attributes and any other attribute that is declining. Council riparian and hill country plans are the equivalent of NPS-FM "action plans" in all but name. To be formal action plans they do need to be consulted on as part of NPS-FM but there are no timeframes for preparing action plans.

Work stream 4: Operations	
Taranaki Regional Council will work with people to assist them to meet their <i>Essential Freshwater</i> requirements.	
As necessary, Council will adapt and transition existing non-regulatory riparian and hill country programmes to a compliance regime to meet, as a minimum, <i>Essential Freshwater</i> requirements for intensive winter grazing, wetlands, fish passage and riparian management.	
Milestone	Completion Date
Review, audit and enforce riparian plans	July 2025
Audit riparian plans, update recommendations and recording of wetlands, etc	December 2024
Amend existing hill country plans	July 2030
Expand hill country plan coverage – add 80,000ha of new plans	June 2026
Prepare and deliver advice to farmers	Start March 2021
Plan sediment level targets for catchments Task includes <ul style="list-style-type: none"> • Assessing Sednet results • Prioritising highest risk catchments • Plan to targets farmplans to highest risk catchments • Implementation 	July 2030

The above milestones are the best estimate of the tasks required and necessary timing in order to achieve the Council’s Essential Freshwater implementation objectives as at the date of preparing this Plan. They mirror the more detailed tasks and timing contained in the overall project schedules in Appendix 2 of the Plan.

Every effort will be made to manage the project to meet or better these milestones, with progress and any barriers being regularly reviewed under the project governance system

There are no known barriers or concerns on achieving the Operations milestones at this stage.

Note that the milestone dates given here exceed the Plan horizon because they reflect Operations’ programme milestones, not Plan implementation milestones.

The milestone to expand hill country plan coverage is broken into five annual milestones/target levels.

4.3.5 Monitoring and investigations

Lead responsibility: Science Services

The Council will be required to undertake significant additional monitoring, research and investigation work over the life of this Plan to implement *Essential Freshwater* requirements.

Over the life of the Implementation Plan, particularly in the first 2-3 years, Science Services will be undertaking/overseeing new research and investigations to inform the setting of limits (and incorporating the NOF). This work is crucial to informing the attributes, limits and targets that are incorporated into the targeted consultation drafts of the *Proposed RPS and NRP*. It will also be used for the section 32 analysis and the versions of those documents released for formal consultation in 2023.

In giving effect to the NPS-FM in particular, Science Services will also need to develop new monitoring programmes and adopt new methodology and reporting requirements over the life of the Implementation Plan.

In relation to developing new monitoring programmes, Science Services will be including new NOF measures for mātauranga Māori and mahinga kai and for threatened species and habitats. Programmes for monitoring compulsory and (yet to be defined) community attributes will also be required. As part of developing new monitoring programmes, Science Services (and the Council generally) will need to think about how to extract the maximum value to the Council and regional community, while optimising alignment of the various components for efficiency and cost-effectiveness.

In relation to existing monitoring programmes, Science Services will need to adapt those programmes to meet new data collection and monitoring requirements set out in the NPS-FM, NES-F and *Measurement and Reporting of Water Takes Regulations*. This will require Science Services establishing and monitoring additional sites, establishing baseline states and adopting new methodologies for a number of attributes.

Set out in the Table below are the key monitoring, research and investigation activities and work streams to be delivered by Science Services Section as part of the Council giving full effect to *Essential Freshwater* requirements. The following timelines are based upon the assumption that a draft Proposed Plan must be available for internal review/challenge: by December 2021, which allows for tangata whenua and targeted stakeholders consultation in 2022, with potential public notification occurring by 31 December 2023.



Work stream 5: Monitoring and investigations	
<i>Taranaki Regional Council will undertake monitoring, investigations and research to inform policy development and monitoring requirements set out in the Essential Freshwater package. This work will help inform the setting of baselines and targets for various attributes required under the NPS-FM, as well as action plans to improve freshwater quality where necessary.</i>	
Milestone	Completion Date
Complete FMU review and recommend FMU structure	June 2021
Develop Regional River Type classifications	June 2021
Develop river and lakes attributes technical information, baselines and targets	June 2023
Develop “other attributes” (eg., DIN, indigenous flora and fauna, mahinga kai)	June 2023
Develop other technical information Task includes <ul style="list-style-type: none"> • Inland wetland conditions • Fish passage • Freshwater quality and quantity accounting Naturally occurring processes	June 2023
All core scientific inputs developed and passed to Policy and Planning for drafting	June 2023

The above milestones are the best estimate of the tasks required and necessary timing in order to achieve the Council’s Essential Freshwater implementation objectives as at the date of preparing this Plan. They mirror the more detailed tasks and timing contained in the overall project schedules in Appendix 2 of the Plan.

Every effort will be made to manage the project to meet or better these milestones, with progress and any barriers being regularly reviewed under the project governance system

There are no known barriers or concerns on achieving the Monitoring and evaluation milestones at this stage.

The final milestone relates solely to the development input of initial baselines, trends and scientific information needed to draft the Proposed NRP. On-going monitoring and evaluation will still be required to ensure that the scientific values that underpin or are used in the NRP criteria are still appropriate. This monitoring will likely support and compliment the Council’s other scientific monitoring programmes (eg., State of the Environment).

4.3.6 Information, advice and communications

Lead responsibility: Public Information

The effects of the new rules and regulations arising from the *Essential Freshwater* package are far-reaching for the Council, its community and stakeholders.

The community will need to be kept apprised of progress through the regional planning process. It will also be encouraged to participate in the various collaborative and engagement processes underpinning that process. The community and resource users in particular, will also need to be aware of and comply with new obligations introduced by the NPS-FM and NES-F as they come into effect. A wider range of activities will require resource consents and conditions will be tightened for some existing consents.

Given the above, the Council has developed a communication plan to support the implementation of the *Essential Freshwater* package in the Taranaki region. Through activities set out in the communication plan, the Council will:

- **Inform and educate** our community on what the regulations mean, how the Council is implementing them and the practical implications for each sector of our community – i.e. what they need to know and changes they need to make.
- **Consult and collaborate** with stakeholders to ensure their aspirations and concerns around the region's freshwater are addressed.
- **Reassure** the community and stakeholders that the Council will implement the rules in a pragmatic and efficient way, as it recognises the challenges they present.
- Reaffirm and bring **awareness** to the good work being done by the Council and the community in farm and freshwater management, the outcomes this is achieving and how this is making Taranaki a better place for all.

Tangata whenua are identified as a partner and a separate communications plan for engaging with local iwi is a core part of the communications framework for delivering desired outcomes under NPS-FM and NES-F.

In particular, the Council will provide farmers, industry and ratepayers with clear, practical guidance as it works through the details. Other interest groups will also be targeted from, including current and potential consent holders, other waterways users (e.g. recreation),

key sector groups and businesses (e.g. Federated Farmers, district councils) and the wider Taranaki public.

Set out in the Table below are the key public information activities to be delivered by the Council arising from the promulgation of *Essential Freshwater* requirements. Activities to engage with tangata whenua engagement are captured separately and documented in section 3.2.1 of this report.



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Work stream 6: Information, advice and communications:	
<i>Taranaki Regional Council will inform, educate and consult with the community and stakeholders to increase awareness and understanding of Essential Freshwater requirements, building engagement and actions to deliver the freshwater outcomes being sought.</i>	
Milestone	Completion Date
Develop overall communications and engagement strategy for freshwater implementation project	May 2021
Develop iwi partnership communications and engagement plan	May 2021
Develop an internal communications plan for TRC staff	July 2021
Develop and implement focused communications and engagement plans on core freshwater implementation modules. Focus areas are: <ul style="list-style-type: none"> • Intensive winter grazing • Feedlots and stockholding areas • Rivers and lakes • Wetlands • Stock Exclusion • Synthetic nitrogen 	Develop by July 2021 Implement until May 2024
Develop a communications register to enable reporting on stakeholder engagement	August 2021
Develop and implement communications and engagement plan for Proposed RPS and NRP	Develop by July 2022 Implement until June 2023
Develop a communications resource database	July 2023

The above milestones are the best estimate of the tasks required and necessary timing in order to achieve the Council's Essential Freshwater implementation objectives as at the date of preparing this Plan. They mirror the more detailed tasks and timing contained in the overall project schedules in Appendix 2 of the Plan.

Every effort will be made to manage the project to meet or better these milestones, with progress and any barriers being regularly reviewed under the project governance system

There are no particular barriers or concerns on achieving the Information, advice and communications milestones that are known at this stage.

5. Administrative provisions

5.1 Funding

Implementing this Plan will involve the staged delivery of a variety of new and inter-dependant activities and tasks. This means increased funding will be required to undertake additional Council planning, monitoring and compliance activities. Changes in funding allocations and sources for previously non-regulatory programmes (including the riparian management programme and sustainable land management programmes) to new regulatory programmes are also likely to be required.

Funding by the Council for the implementation of this Plan and the implementation of *Essential Freshwater* will be undertaken in a manner consistent with its *Revenue and Financing Policy*.

Pursuant to its *Revenue and Financing Policy*, the Council's policy is to fully fund all operational expenditure from the sources allowed under section 103(2) of the *Local Government Act 2002* and in a manner that promotes the current and future interests of the regional community. In determining the sources of revenue and finance for each of the Plan's activities, the Council considers:

- the outcomes to which the activity primarily contributes
- the distribution of benefits between the community as a whole, any identifiable part of the community and individuals
- the period in or over which those benefits are expected to occur
- the extent to which the actions or inaction of particular individuals or a group contribute to the need to undertake the activity
- the costs and benefits, including consequences for transparency and accountability, of funding the activity distinctly from other activities
- the overall impact of any allocation of liability for revenue needs on the community.

The Council is entitled to finance its activities and functions from a number of sources, including user charges and general rates. User charges are used for services where there is a benefit to a party or a party that causes the Council to provide a service or incur expenditure. If it is possible to legally and efficiently impose a charge, the Council does so based on recovering the full cost of the service.

General rates is used to fund those services where the Council believes there is a public benefit even though it may not be to the whole community. It typically funds 'public goods' for which there is no practical method for charging individual users as the benefit is wider than just specific users. General rates fund a range of services which are used by individual ratepayers to varying extents.

5.2 Monitoring and review of the implementation plan

The Council's implementation plan is a living document.

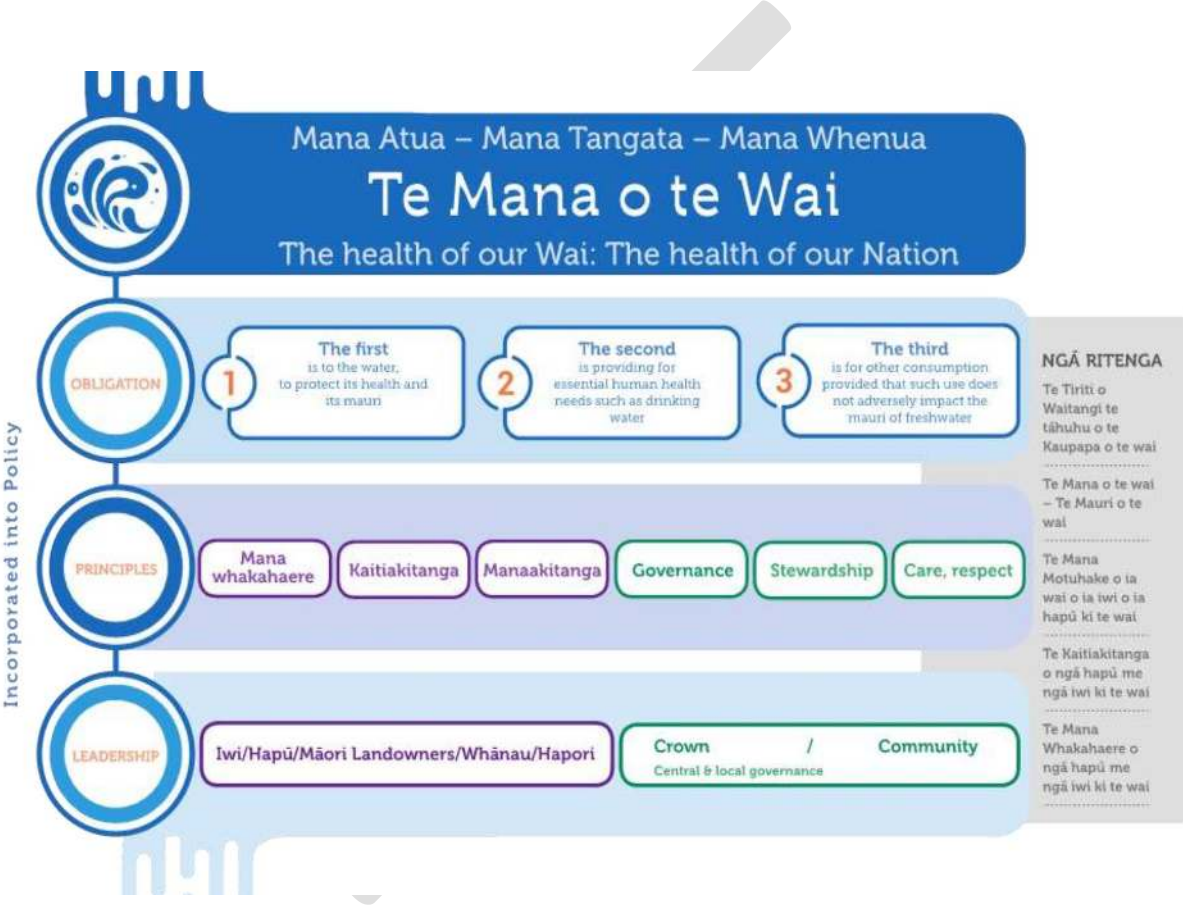
Progress will be reported regularly to Council's Policy and Planning Committee, who will operate as an overall steering team for the Plan's implementation. Priorities and implementation plans will be adjusted to respond to changes in the implementation environment (including regulatory and operational factors) to maximise the delivery of both the overall Vision and the objectives of this Plan.

The Plan will also be reviewed and amended as necessary to align with Long Term Plan priorities and funding limits. The LTP process will include reviews of the Council's Revenue and Financing Policy and a review of its section 36 RMA administrative charges.

Any changes to this Plan will respect the principles set out in section 3.2, above.



Appendix 1: Te mana o te wai



(as sourced by the Kahui Wai Maori Group)

Appendix 2: Freshwater Project Implementation Schedule

The schedules below have been prepared by the Implementation Lead for each of the six work streams described in Section 4, above. They represent the result of extensive work and collaboration to identify the required tasks to implement Essential Freshwater. They are the current best assessment of the works and timing required to meet the overall project implementation goals within the targeted timeline. The schedules will be

maintained and amended as necessary to reflect the impacts of external environment changes (eg., regulatory regime changes, revised government deadlines) and internal pressures (eg., staff changes). Implementation progress will be measured and reported regularly to the project steering team.








DRAFT



Freshwater Implementation Project Report to Policy & Planning Committee

8 June 2021

Executive Summary
<p>Current progress is tracking to schedule.</p> <p>Bedding in the processes and management tools that are needed to support this project. Initial indications are that the implementation team are taking to these processes well.</p> <p>Key activities at present are focusing on:</p> <ul style="list-style-type: none"> • developing Council engagement strategy with iwi • establishing science baselines for input to plan and monitoring programmes • developing communications strategy and supporting material (both internal and external use) <p>No significant risk management issues. Most significant risks at present relate to community/stakeholder communications (including tanagata whenua stakeholders) and some short term resource constraints.</p>
Project Programme
<p>Key project achievements during the last reporting period</p> <ul style="list-style-type: none"> • Bedding in internal governance structures – team, tools and meeting cycle • All teams have developed overall implementation project schedules – which are now used to manage progress during implementation team meetings • Specific implementation activities: <ul style="list-style-type: none"> ○ Kicked off science work programme and baselines ○ Communications strategy developed – and began drafting core internal and external communications materials ○ Identifying priority catchments for first tranche of hill country farm plan roll outs
<p>Key upcoming activities and milestones in the next reporting period</p> <ul style="list-style-type: none"> • Full roll out of iwi engagement activities – including looking to accelerate engagement with Iwi Chairs on high level engagement processes. • Continue science services baselining and monitoring programmes – including analysing current data reliability and working with P&P to assess how this relates to drafting needs/timetable • Progress recruiting processes in teams with identified resource needs. • Continue engagement with sector and central government working groups – including on FW Farm Plans. • Continue development of synthetic nitrogen recording structure with industry stakeholders.
HSE Updates
<p>Nothing significant to report</p>

Workstream Status Summary		
Workstream	Tracking	Comments/Clarifications
Tangata whenau partnerships		<ul style="list-style-type: none"> Developed Iwi Engagement Strategy (with Comms) and have successfully “test run” in recent meetings with iwi prior to full roll out Still waiting for feedback from Iwi Chairs on proposal to meet NPS-FW engagement requirements Matauranga Maori Science Advisor appointed and will support this work in FW Implementation
Policy and Planning		<ul style="list-style-type: none"> Maintaining strong engagement with MfE and other RC’s on implementation issues and opportunities – including part of the core group developing the FW Farm Plan module. Successful community workshop on FW Vision – key input to RPS. Developed project implementation plan and aligned project deliverables and schedules with Science Services. Some concern that required focus on <i>Essential Freshwater</i> package tasks is affecting drafting progress.
Science Services		<ul style="list-style-type: none"> Prepared detailed project implementation plan – including aligning with key P&P deliverables. Briefed the broader Science Services team and they are now working to that across the 12 key work-fronts. Developing the data and baseline information needed for FMU development and Rec classifications. Behind schedule at present – due to greater level of work needed in reviewing information – but expect to catch up with no overall impact on deliverables.
Consents		<ul style="list-style-type: none"> No noticeable increase in consent applications related to FW Implementation. Intensive winter grazing requirements postponement gives longer window to develop new consents processes.
Inspections		<ul style="list-style-type: none"> Good progress on implementing requirements for feedpads (starts from 1 July) Possible concern regarding training needs for Inspectorate and other team staff on FW Package needs (see Communications item about fact sheets for staff)
Operations		<ul style="list-style-type: none"> Progressing recruiting key roles for expanded hill country programme Reviewed Sednet data and have begun identifying priority hill country catchments for first tranche of plans. Specialist advice obtained on illegal piping of wetlands – developing protocols to address.
Communications		<ul style="list-style-type: none"> Overall Comms Strategy developed – and specific Iwi Engagement Strategy (in consultation with Iwi Liaison) Developing fact sheets and other materials to support field staff stakeholder communication. Investigating opportunities for CRM and developing fact sheets to aid field staff

Project Risk/Opportunity Management

The Project Implementation Leads maintain a full project Risk and Opportunity Register.

The following are issues in that Register that Leads believe, due to significance or the types of actions required, should be communicated to this Committee.

Description	Effect	Mitigation Strategy	Risk Rating (unmitigated)	Actions being taken
Effective interaction with tangata whenua	<p>Demands from increased consultation on a number of fronts are placing limits on iwi ability to engage with TRC.</p> <p>Variable levels of understanding and familiarity with Essential Freshwater needs across iwi.</p>	<p>Maximise opportunities for both formal and informal iwi engagement.</p> <p>Where possible give sufficient notice and make allowances to work within their time limits.</p> <p>Use existing liaison processes and groups to the extent possible – don't increase iwi workloads.</p>	High	<p>Meet with iwi operational teams to initiate discussion on the NPS.FW (initial views/comments) and to draft timeline for engagement.</p> <p>The trigger for this will be the introduction to each entity of the appointed Maturanga Maori Science Advisor.</p>
Lack of clarity and guidance due to gaps in key Government advice or changes in the policy/legal framework	<p>Runs the risk of a set of "moving goal posts" across implementation.</p> <p>Some FW Implementation elements need to be developed without clear guidance – which may result in changes later if Government position changes.</p>	<p>Recognise that some level of risk is unavoidable.</p> <p>Maintain strong presence on Government (especially MfE) and sector working groups.</p> <p>Maintain contacts with other regional council <i>Essential Freshwater</i> teams.</p> <p>Develop tools and processes that based on established or determined best practice.</p>	High	<p>Working with MfE, MPI and other RC's to develop FW-Farm Plan discussion documents.</p> <p>Working with industry to develop synthetic nitrogen register based on their information and best practice. Unclear signals from MfE (including of potential "reinterpretation of regulations) may need additional actions.</p> <p>Participating in regional Essential Freshwater working groups, including SIG.</p>

Description	Effect	Mitigation Strategy	Risk Rating (unmitigated)	Actions being taken
Ensuring effective community/stakeholder engagement	<p>Risk of multiple interactions with stakeholders causing “consultation fatigue” or leaving unfilled gaps in communication.</p> <p>FW Package knowledge gaps amongst field staff.</p> <p>Community understanding of <i>Essential Freshwater</i> is limited – but FW becoming more significant as parts of package come into effect.</p>	<p>Develop communications plans and supporting materials to ensure consistent and complete messaging.</p> <p>Use a CRM to minimise over/under communication and provide records.</p> <p>Prepare training materials for in-house teams.</p>	High	<p>Detailed communications plan developed. Will form basis of Council’s approach with stakeholders (including for field contacts).</p> <p>Developing CRM database capacity to help record, align and manage communications.</p> <p>Planned (and started delivering) project updates to Council teams.</p> <p>Developing more comprehensive customer services protocols (eg., “rules” about directing calls, develop background information materials to guide customer response).</p>



Date: 8 June 2021

Subject: **Sediment load reductions for freshwater planning and soil conservation in Taranaki**

Approved by: AJ Matthews, Director - Environment Quality
S J Ruru, Chief Executive

Document: 2785926

Purpose

1. The purpose of this memorandum is to provide the Committee with an overview of the findings of a recent report commissioned by Taranaki Regional Council (TRC) '*Planning soil conservation for sediment load reduction in Taranaki*' by Manaaki Whenua - Landcare Research (MWLR).

Executive summary

2. Hill country erosion remains one of the most significant management challenges for the region. It is estimated that extreme storm events resulting in flooding and slips are likely to occur somewhere in Taranaki about once every five to six years. These events strip valuable soils from hill country farms, and lead to sedimentation of the regions freshwater and marine environments.
3. Council has recognised that taking preventative measures to minimise the effects of soil loss is key to reducing the impacts of erosion and sedimentation. This has resulted in significant investment in the development of comprehensive farm plans, and the implementation of soil conservation projects through the South Taranaki and Regional Erosion Support Scheme (STRESS) with support from the Ministry for Primary Industries (MPI) Sustainable Land Management Hill Country Erosion Fund.
4. New requirements, introduced by Government through the National Policy Statement for Freshwater Management 2020 (NPS-FM), require councils and communities to set limits and establish action plans to maintain and improve freshwater quality above minimum standards known as 'national bottom lines'. These requirements apply to a range of indicators (referred to as attributes).
5. The NPS-FM 2020 introduced a new requirement whereby targets must be set for visual clarity or turbidity as a measure of the suspended fine sediment (SFS) attribute. Bands for SFS range from Band A (best) to Band D (worst, below the national bottom line). To achieve the minimum standard (Band C), action is required to reduce erosion, improve sediment control and/or adapt landuse practices. Councils and communities may also

seek improvements in those catchments that are currently achieving the national bottom line.

6. Council recently contracted MWLR to assess the impact of soil conservation works on sediment loads across the region, and the reductions in load required to meet the SFS attribute states (visual clarity) in the NPS-FM. Key findings are summarised below and set out in further detail in the discussion section of this memorandum.
7. Modelling was carried out by MWLR using the SedNetNZ model, which has been utilised by a number of other regional councils for similar analyses. The modelling suggests that soil conservation works implemented over the last ~25 years have resulted in a 29% net reduction in mean annual suspended sediment load across the region. Assuming there is no change in landcover, further reduction of around 15% may be expected as existing soil conservation works mature and additional riparian fencing is completed. Further gains are also expected when remaining landowners (approximately 30%) have comprehensive farm plans completed.
8. Monthly water quality data from 14 sites collected over the past five years showed that seven of the 14 sites presently sit in the A band for suspended sediment in the NPS-FM 2020 (the highest achievable attribute state). Of the remaining seven sites, only the Mangaehu is predicted to see an improvement in attribute state under the future scenario, moving from band C to band B. Four of these sites are currently above the national bottom line, while three further sites presently fall below the national bottom line for visual clarity in the NPS-FM 2020.
9. As with any model, there are several limitations in the SedNetNZ modelling undertaken. These limitations are largely related to the availability of input data associated with erosion processes and their occurrence, and limited spatial coverage of water quality monitoring data for hill country river catchments. Available datasets can be improved upon, and the report makes a number of suggestions as to how this information can be improved for future SedNetNZ modelling.
10. A number of these recommendations (for example, increasing soil mapping and regional LiDAR coverage) are already underway, while other recommendations will require further consideration and planning. For example, further work will be necessary to establish the possible impacts of climate change on sediment loads in the region. Additionally, there will be a need to establish whether 'naturally occurring processes', as defined within the NPS-FM, are a significant barrier to achieving national bottom lines for suspended fine sediment.

Recommendations

That the Taranaki Regional Council:

- a) receives the memorandum '*Sediment load reductions for freshwater planning and soil conservation in Taranaki*'
- b) notes the recommendations of the authors and officers regarding future work.

Background

11. Hill country erosion is a significant and on-going challenge for the Taranaki region. Erosion of soils leads to loss of soil productivity, capability and versatility, reductions in water quality and degradation of aquatic habitats from increased siltation, and downstream flooding from aggradation of riverbeds. An assessment of the region's

estuaries (Robertson Environmental, 2020) showed that seven Taranaki river mouth estuaries are vulnerable to sediment and nutrient loading, which can threaten marine life, lead to habitat loss, and impact recreational use.

12. The inland hill country and the coastal sand country are particularly susceptible to 'unsustainable' land use activities (activities that carry a severe or high risk of erosion in the long term). The geology, soil type, slope angle and aspect, climate and vegetation cover found in these areas make them more prone to erosion.
13. Key actions to address the risk of soil loss and environmental degradation resulting from erosion are set out in TRC's Regional Policy Statement (RPS) and Regional Soil Plan (RSP). In addition to regulatory activities, these actions also include implementing Council's Sustainable Land Management Programme, and providing advice and guidance to land owners.
14. Much work has been undertaken to date to support soil conservation projects that will reduce the risk of accelerated erosion in the eastern hill country and the subsequent sediment that ends up in our waterways and marine environment. Council recently secured a further \$3.9 million over the four years to June 2023 for STRESS through the MPI's Sustainable Land Management Hill Country Erosion Fund.
15. In 2020, Government released a suite of freshwater policy changes that include a new NPS-FM. A key requirement of the NPS-FM is that councils and communities must set limits and establish action plans to address freshwater quality degradation. This includes addressing the effects of sediment in rivers and lakes. Councils must notify new regional policy statements and regional plans that give effect to the NPS-FM, including proposed limits, no later than December 2024.
16. To inform NPS-FM implementation and future decision-making around land management, it is imperative that Council has a sound understanding of both the progress made to date, and future reductions that can be made through the implementation of soil conservation works. To advance this understanding, MWLR were contracted to undertake sediment modelling for the region, applying the SedNetNZ model.

Discussion

17. SedNetNZ is an erosion model that predicts the generation and transport of sediment through river networks. The model is based on a relatively simple physical representation of hillslope and channel processes at small sub-catchment scale, providing estimates of long-term average annual sediment load generated by different erosion processes (landslides, gullies, earthflows, surface, and bank erosion) and sediment deposition on floodplains.
18. The model enables improved targeting of erosion mitigation to the key contributing processes, and analysis of the linkages between upstream sediment generation and downstream sediment loading. It is also well-suited to scenario analysis of changes in land management and implementation of erosion mitigation practices. Several regional councils have recently commissioned SedNetNZ analyses of large catchments to support land and water policy development.
19. To provide greater understanding of the impact of erosion mitigation in the Taranaki region, modelling of mean annual suspended sediment loads using SedNetNZ was completed for:
 - a landcover scenario representing a pre-mitigation state (circa 1996);

- a landcover scenario representing the contemporary state (as at 2018); and
 - a landcover scenario representing a future state under best practice soil conservation works (circa 2035).
20. This was assessed by establishing baseline visual clarity at water quality monitoring sites across the region; assessing the sediment load reduction achieved by soil conservation works implemented to date; and modelling the reductions in contemporary mean annual suspended sediment loads required to achieve the national bottom line and A-C attribute states for fine suspended sediment in the NPS-FM 2020. The report also explored the feasibility of achieving the national bottom line and A-C attribute states under the best practice soil conservation scenario. An accompanying data file can be used to rank REC2 sub-catchments to identify areas for prioritising future soil conservation works.
 21. Modelling found that a significant reduction in mean annual suspended sediment loads has been achieved across the region since farm plans were established, with a 29% (698,000 tonnes per year) net reduction in modelled load between the initial and contemporary baseline scenarios. A further reduction of 249,000 (15%) t/yr is estimated to be achievable once existing soil conservation works reach full maturity, and riparian fencing is completed across the region, giving a total net reduction of 947,000 t/yr (40%) between the initial baseline and future mitigation scenario. Further gains are also expected when remaining landowners (approximately 30%) have comprehensive farm plans completed.
 22. Monthly water quality data from 14 sites collected over the past five years showed that seven of the 14 sites presently sit within the A band for suspended sediment in the NPS-FM 2020 (the highest achievable attribute state). Of the remaining seven sites, only the Mangaehu is predicted to see an improvement in attribute state under the future scenario, moving from band C to band B. Four of these sites are currently above the national bottom line, while three further sites presently fall below the national bottom line for visual clarity in the NPS-FM 2020. These sites include Whenuakura River at Nicholson Rd, Waitara River at Autawa Rd and Waiokura pumphouse.
 23. Contemporary reductions in suspended sediment load range from 6 to 45% at water quality monitoring sites since Whole Farm Plans (WFPs) were established. Lower reductions are projected between the contemporary baseline and future mitigation scenarios at all sites (0.2 – 20%) due to the estimated maturity of WFPs and extent of riparian fencing being high in the contemporary baseline, therefore leaving less room for improvement in the future.
 24. The inability to achieve the reductions required to meet the national bottom line may result from a combination of factors. These include overestimation of the contemporary effectiveness of soil conservation works in the model, limiting the room for future improvement; and/or the naturally occurring high rates of erosion in the catchments which could result in naturally highly-coloured streams, noting that there is provision within the NPS-FM to allow for the effects of naturally-occurring processes (such as naturally highly-coloured brown-water streams).
 25. As with any model, there are several limitations in the SedNetNZ modelling undertaken. These limitations are primarily related to the availability of input data. Further work is required to adequately inform future decision-making and the pending freshwater limit setting and development of actions plans required by the NPS-FM. As such, the report sets out a number of recommendations including:

- Further analysis of farm plan data around the maturity of implemented works to improve the model outputs;
 - Modelling the potential impacts of climate change on sediment loads in Taranaki region to inform NPS-FM limit setting and the development of action plans;
 - Increase the coverage of soil mapping using S-map to provide better representation of soil parameters such as surficial erosion;
 - Obtain regional LiDAR data to enable better representation of erosion processes within SedNetNZ; and
 - Building a regional multi-temporal shallow landslide database to improve calibration of the shallow landslide component of the model for the region.
26. Council is already making progress toward advancing this work, having recently invested in regional-scale LiDAR. Through the LTP 2021-31, further soil mapping will be completed to improve Council's data holdings and better inform land management and freshwater planning. Recommendations regarding the further analysis of farm plan data and compilation of a regional shallow landslide database will be further explored by council officers.
27. Climate change projections for the Taranaki region published by MfE suggest more frequent and intense heavy rainfall events, which are likely to increase the risk of erosion and landslides. Flooding is also likely to become more frequent and severe.
28. Consideration of the likely impact of climate change in increasing erosion rates and sediment loads will be necessary to informing the appropriate actions that can be taken to respond to risks arising from erosion and sedimentation. Modelling by Basher *et al.* (2020) explored the effect of erosion mitigation and climate change on sediment loads in the Manawatū-Whanganui region and suggested that the increase in sediment load resulting from climate change impacts may exceed the reductions achieved by land management by 2090. This may have significant implications for sediment management policy, including in the Taranaki region. TRC will need to consider these impacts as part of future planning, and when informing the implementation of new freshwater policy. A key action will be advancing a summary report on climate projections for the region to inform future modelling.

Financial considerations—LTP/Annual Plan

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

Policy considerations

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

Iwi considerations

31. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making

processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum.

Community considerations

32. This memorandum and the associated recommendations have considered the views of the community, interested and affected parties and those views have been recognised in the preparation of this memorandum.

Legal considerations

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

References

Basher L, Spiekermann R, Dymond J, Herzig, A, Hayman E, Ausseil AG. 2020. Modelling the effect of land management interventions and climate change on sediment loads in the Manawatu-Whanganui region. *New Zealand Journal of Marine and Freshwater Research* 2020 54: 490-511.

Robertso, B. 2019. *Taranaki Regional Estuaries Ecological Vulnerability Assessment for Taranaki Regional Council*. Robertson Environmental client report prepared for Taranaki Regional Council, July 2019.

Attachments

Document 2787658: *Planning soil conservation for sediment load reduction in Taranaki*, Manaaki Whenua Landcare Research client report for Taranaki Regional Council, March 2021.



Planning soil conservation for sediment load reduction in Taranaki

Prepared for: Taranaki Regional Council

March 2021



Planning soil conservation for sediment load reduction in Taranaki

Contract Report: LC3942

Andrew Neverman, Hugh Smith, Alexander Herzig

Manaaki Whenua – Landcare Research

Reviewed by:

Chris Phillips
Portfolio Leader – Managing Land & Water
Manaaki Whenua – Landcare Research

Approved for release by:

Chris Phillips
Portfolio Leader – Managing Land & Water
Manaaki Whenua – Landcare Research

Disclaimer

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Summary

Project and Client

- Taranaki Regional Council (TRC) contracted Manaaki Whenua – Landcare Research (MWLR) to model mean annual suspended sediment loads and the reductions in load required to meet the suspended fine sediment attribute states (visual clarity) in the National Policy Statement for Freshwater Management 2020 amendment (NPS-FM 2020). This modelling will contribute to soil conservation planning to meet future water quality targets in the Taranaki region.

Objectives

- Model mean annual suspended sediment loads using SedNetNZ for:
 - a landcover scenario representing a pre-mitigation state.
 - a landcover scenario representing the contemporary state.
 - a landcover scenario representing a future state under best practice soil conservation works.
- Assess the sediment load reduction achieved by soil conservation works implemented to date.
- Establish baseline visual clarity at water quality monitoring sites across the region.
- Model the reductions in contemporary mean annual suspended sediment loads required to achieve the national bottom line and A-C attribute states for fine suspended sediment in the NPS-FM 2020.
- Assess the feasibility of achieving the national bottom line and A-C attribute states under the best practice soil conservation scenario and provide a ranked list of priority REC2 sub-catchments to target for soil conservation works.

Methods

- Mean annual suspended sediment loads were modelled for a nominal year of 1996 to represent sediment loads before soil conservation works. Landcover for this period was represented by the New Zealand Landcover Database version 1 (LCDBv1), EcoSat Woody, and existing riparian fencing.
- A second scenario was modelled using LCDBv5, existing Whole Farm Plans and their contemporary maturity, and the contemporary extent of riparian fencing. This scenario represents contemporary mean annual suspended sediment loads, with a nominal year of 2018.
- A final scenario was modelled with WFPs fully matured, and a completed extent of riparian fencing. This scenario represents the load reductions achievable given full implementation and maturity of best practice soil conservation works in Taranaki, and can be used to assess the feasibility of achieving fine suspended sediment attribute states in the NPS-FM 2020. Full maturity could be achieved by 2035.
- Monthly visual clarity monitoring data were compiled for 14 water quality monitoring sites across the Taranaki region and used to calculate the median visual clarity for the

past 5 years to establish a baseline visual clarity. 5 years is the minimum period for baseline calculation in the NPS-FM 2020.

- The mean annual suspended sediment load reductions required to achieve higher visual clarity attribute states were calculated using national-scale empirical models of the relationship between SSC and visual clarity.

Results

- Modelled mean annual suspended sediment loads for the Taranaki region were 2.38 Mt yr⁻¹ for the initial baseline scenario, reducing to 1.68 Mt yr⁻¹ for the contemporary scenario. Future loads are expected to be 1.44 Mt yr⁻¹ for the region under current landcover with full implementation and maturity of soil conservation works.
- Despite some land cover change leading to local increases in soil erosion, SedNetNZ modelling for the Taranaki region suggests soil conservation works implemented since ~1996 have resulted in a 29% net reduction in mean annual suspended sediment loads across the region. As existing soil conservation works mature, and further riparian fencing is completed, a further 15% reduction is expected across the region under the current landcover configuration.
- The NPS-FM 2020 sets 5 classes for suspended sediment: bands A, B, and C which represent acceptable levels of fine sediment, with band A being the best, a national bottom line, which is the minimum acceptable standard, and band D which is below the minimum acceptable level. Based on the past 5 years of monthly water quality monitoring data from 14 sites across the region, seven of the 14 sites presently sit in band A for visual clarity in the NPS-FM 2020. This is the highest achievable attribute state for fine suspended sediment, and represents a state where suspended sediment has a minimal impact on instream biota, and ecological communities are similar to those observed in natural reference conditions.
- Of the remaining seven sites, four sites have a state better than the national bottom line, two of which achieve band B status, and two achieve band C. Eleven of the 14 sites are therefore above the national bottom line and require no further reductions in suspended sediment. Three sites presently fall below the national bottom line.

Conclusions and Recommendations

- Soil conservation works implemented since ~1996 have resulted in an estimated 29% net reduction in mean annual suspended sediment loads across the region. A further 15% reduction is expected across the region under the current landcover configuration as existing soil conservation works mature and riparian fencing is completed. This state would be achieved as early as 2035 under this SedNetNZ model configuration.
- Seven of the 14 sites analysed presently sit in band A for visual clarity in the NPS-FM 2020. This is the highest achievable attribute state. Two sites are in band B, and two in band C, totalling 11 sites sitting above the national bottom line, and therefore requiring no further reduction. Three sites presently sit below the national bottom line.
- Uncertainty about the present maturity of existing soil conservation works likely means the model has underestimated the sediment load reductions that can be

achieved in the future. This modelling could be improved with comprehensive data on the present level of completion of soil conservation in Whole Farm Plans, and their maturity.

- The availability of regional LiDAR data will enable better representation of erosion processes within SedNetNZ. Future work could update SedNetNZ modelling for the region when LiDAR data become available.
- Climate change is likely to have an adverse effect on suspended sediment loads and may offset the reductions achieved by soil conservation works by the end of the century. SedNetNZ modelling could be undertaken for the Taranaki region to explore the potential impact of climate change on mean annual suspended sediment loads.

1 Introduction

To achieve national freshwater targets, erosion and sediment control practices and/or land management change are required to reduce sediment loads and improve visual clarity (Neverman et al. 2019). Taranaki Regional Council (TRC) contracted Manaaki Whenua – Landcare Research (MWLR) to use spatial modelling to 1) identify monitoring catchments requiring reductions in suspended sediment loads to achieve the range of attribute states for suspended fine sediment in the NPS-FM 2020, and 2) identify and prioritise areas within these catchments for soil conservation and erosion control work.

SedNetNZ (Dymond et al. 2016) was identified as the most appropriate model for these objectives. SedNetNZ is a steady-state sediment budget model designed to represent the diversity of erosion processes that occur in the New Zealand landscape and predict mean annual suspended sediment yields (Dymond et al. 2016). Recent updates to the SedNetNZ model include improved representation of streambank erosion (Smith et al. 2019) as well as spatial variability in surface soil erodibility and lake trapping of suspended sediment (Neverman et al. 2020). SedNetNZ represents erosion processes individually, allowing direct targeting of erosion processes with appropriate mitigations during mitigation scenario modelling. This improves on the national-scale modelling framework employed by Neverman et al. (2019), which utilised the NZeem model (Dymond et al. 2010) that does not represent individual erosion processes.

2 Background

In 2020 the Ministry for the Environment (MfE) amended the National Policy Statement for Freshwater Management (NPS-FM) and National Objectives Framework (NOF). The NPS-FM and NOF require a minimum standard to be achieved (a national bottom line) for water quality attributes, along with a requirement for no further degradation for water bodies which already exceed the national bottom line. Councils are required to develop plans to achieve these standards.

Previous versions of the National Policy Statement for Freshwater Management (NPS-FM 2014 and 2017) did not include limits for fine suspended sediment. Following the 2017 amendment, MfE led work to develop a fine suspended sediment attribute (Franklin et al. 2019; Hicks et al. 2019; Neverman et al. 2019). This work resulted in the inclusion of a fine suspended sediment attribute in the 2020 amendment to the NPS-FM, with attribute states set using visual clarity targets.

Taranaki Regional Council engaged Manaaki Whenua – Landcare Research (MWLR) to provide modelled mean annual suspended sediment loads under a set of scenarios to explore the suspended sediment load reductions achieved by soil conservation works to date, and to assess the feasibility of achieving NPS-FM 2020 fine suspended sediment attribute states at water quality monitoring sites throughout the region through prioritised soil conservation works.

Dymond et al. (2017) identified relationships between suspended sediment concentration and visual clarity and turbidity. Hicks et al. (2019) used these relationships to develop

nationally fitted models to predict the reductions required in mean annual suspended sediment loads to achieve visual clarity and turbidity bottom lines. Following a similar approach to Neverman et al. (2019), these models have been applied to estimate the reductions in the SedNetNZ baseline mean annual suspended sediment loads required to achieve the NPS-FM 2020 fine suspended sediment attribute states at water quality monitoring sites across Taranaki.

3 Objectives

- Model mean annual suspended sediment loads using SedNetNZ for:
 - a landcover scenario representing a pre-mitigation state.
 - a landcover scenario representing the contemporary state.
 - a landcover scenario representing a future state under best practice soil conservation works.
- Assess the sediment load reduction achieved by soil conservation works implemented to date.
- Establish baseline visual clarity at water quality monitoring sites across the region.
- Model the reductions in contemporary mean annual suspended sediment loads required to achieve the national bottom line and A-C attribute states for fine suspended sediment in the NPS-FM 2020.
- Assess the feasibility of achieving the national bottom line and A-C attribute states under the best practice soil conservation scenario, and provide a ranked list of priority REC2 sub-catchments and farms to target for soil conservation works.

4 Methods

4.1 SedNetNZ Model Description

4.1.1 Surficial Erosion

Surficial erosion processes in SedNetNZ (Dymond et al. 2016) are represented by the NZUSLE (Dymond 2010) model:

$$ES = a P^2 KLSC \quad (1)$$

where ES denotes surficial erosion in $t \text{ km}^{-2} \text{ yr}^{-1}$; a is a constant ($t \text{ km}^{-2} \text{ yr}^{-1} \text{ mm}^{-2}$) calibrated against measurements (Dymond 2010) with a value of 1.2×10^{-3} ; P is mean annual rainfall (mm); K is the soil erodibility factor (dimensionless), L is the slope length factor, estimated as $\left(\frac{\lambda}{22}\right)^{0.5}$ with λ assumed globally = 200 m; S is the slope steepness factor, estimated by $0.065 + 4.56 \theta + 65.41 \theta^2$, where θ denotes the dimensionless slope gradient; and C represents the impact of vegetation cover (dimensionless) (1.0 for bare ground, 0.01 for pasture, and 0.005 for forest and scrub).

In this study, we use a revised representation of surficial erosion processes as part of the SedNetNZ model. Following Smith et al. (2019b), this includes replacing the uniform slope length factor (L) of the NZUSLE (Dymond 2010) with a factor that better represents the effect of topography on the size of convergent upslope areas contributing overland flow and surficial erosion, as described by Desmet and Govers (1996):

$$L = \frac{(A + D^2)^{m+1} - A^{m+1}}{D^{m+2} * x^m * 22.13^m} \quad (2)$$

where L is slope length factor for a given raster cell (pixel), A is the upstream catchment area (m^2) at the cell inlet, D is the raster cell width (m), m is the slope length exponent, $x = \sin a + \cos a$, with a being the slope aspect.

The slope length exponent m is calculated depending on the rill to inter-rill ratio β and the slope gradient θ (Foster et al. 1977 and McCool et al. 1989, cited in Renard et al. 1997):

$$\beta = \frac{\sin \theta}{3 * (\sin \theta)^{0.8} + 0.56} \quad (3)$$

$$m = \frac{\beta}{1 + \beta} \quad (4)$$

We also apply a revised slope factor, S , which is calculated according to a threshold in slope gradient sp (%) (Renard et al. 1997):

$$S = \begin{cases} 10.8 * \sin \theta + 0.03 & \text{with } sp < 9\% \\ 16.8 * \sin \theta - 0.5 & \text{with } sp \geq 9\% \end{cases} \quad (5)$$

Furthermore, we apply a revised, spatially-variable, K factor in the NZUSLE developed in Neverman et al. (2020) to better represent the spatial variability of soil erodibility, utilising the Fundamental Soils Layer (FSL) to represent soil parameters. We adapted the K factor equations in Wang et al. (2001) and Yang et al. (2018) to the NZUSLE:

$$K = \frac{2.1(12 - OM)M^{1.14}10^{-4} + 3.25(SS - 2) + 2.5(PP - 3)}{7.59 * 10} \quad (6)$$

where OM is the soil organic matter content, M is the particle size parameter, SS is the soil structure code, and PP is the soil profile permeability code. We use 6 PP classes, adapted from Rosewell & Loch (2002). The soil structure code was set at $SS = 2$ as the FSL has insufficient data on soil structure to relate to the SS classes used for calculating K . We found the magnitude of K was not sensitive to the choice of SS class value. M is calculated as a function of the proportion silt and clay:

$$M = Silt(100 - Clay) \quad (7)$$

where $Silt$ and $Clay$ are the percent of silt and clay in the soil, respectively.

$Silt$ was limited to a range of 15–70%, and OM was capped at 4% to fit the nomograph of Wischmeier et al. (1971) used to derive Equation 6 for organic soils.

4.1.2 Shallow Landslide Erosion

Shallow landslides are considered to be the most common form of erosion in New Zealand hill country (Eyles 1983). Typical landslides are seldom greater than 2 m deep, and individual failures are usually of small areal extent (50–100 m²) (Smith et al. 2021). They usually have a debris tail of deposited sediment below their source that often reaches a stream (for approximately half of debris tails – Dymond et al. 1999). Landslide occurrence is highly correlated with slope angle, with most failures occurring on slopes steeper than 26 degrees, but landslides can occur on slopes as low as 15 degrees (DeRose 2013; Smith et al. 2021). The expected mass of soil lost to landslide erosion per square kilometre per year, and the connection with a stream, is given by EL :

$$EL = \rho SDR d_l f(s) \quad (8)$$

where ρ is the bulk density of soil (t m⁻³), SDR is the sediment delivery ratio, d_l is the mean depth of landslide failure (m), and $f(s)$ is the expected area of landslide scars per square kilometre per year at slope angle s (m² km⁻² a⁻¹).

Landslide erosion is estimated for those Erosion Terrains¹ (see Dymond et al. 2010) identified as being susceptible to landslide erosion. ρ is set to 1.5 t m⁻³ (Dymond et al. 2016); SDR is set to 0.5 for hill country and 0.1 for mountainland (Dymond et al. 2016); d_l is set to 1 m (Page et al. 1994; Reid & Page 2003); and $f(s)$ is determined from previous calibration of SedNetNZ in the Manawatu (Dymond et al. 2016; Betts et al. 2017) and adjusted for the Taranaki region using information on storm rainfall magnitude–frequency (NIWA HIRDS v4) and estimated landslide triggering rainfall thresholds (Basher et al. 2020).

4.1.3 Earthflow erosion

Slow-moving earthflows (c. 1 m per year) are common in Erosion Terrains underlain by crushed mudstone and argillite (Dymond et al. 2010). The delivery of sediment to streams is via the undercutting of earthflow toes. The mass of soil delivered to streams by earthflows in t km⁻² a⁻¹ is denoted by EE and is estimated as:

$$EE = \rho d_e v ED \quad (9)$$

Where ρ is the bulk density of soil (t m⁻³), d_e is the mean depth of earthflows (m), v is the mean speed of earthflows (m a⁻¹), and ED is the mean length of stream intersecting earthflow toes in a square kilometre (m km⁻²).

ρ is set to 1.5 t m³ (Dymond et al. 2016); d_e is set to 3 m (through field observation (Dymond et al. 2016)); and v is set to 0.1 m a⁻¹ (average from published data — Guy 1977;

¹ An erosion terrain is a land type with a unique combination of erosion processes and rates leading to characteristic sediment generation and yields. Erosion terrains were derived from New Zealand Land Resource Inventory data and are based on combinations of rock type/parent material, topography, rainfall, and erosion process type and severity. Erosion terrain coefficients are listed in Dymond et al. (2010).

Zhang et al. 1991; Marden et al. 2008, 2014). ED is set to $1,024 \text{ m km}^{-2}$ (from digitising stream lengths on digitised aerial photographs – Dymond et al. 2016).

4.1.4 Gully erosion

Gullies commonly initiate at channel heads, usually as a result of excessive surface or subsurface water flow. Once initiated, a gully can continue to expand over long time periods (decades). The mass of soil delivered to streams by gullies, in $\text{t km}^{-2} \text{ a}^{-1}$, is denoted by EG and is estimated by:

$$EG = \rho A_g GDT \quad (10)$$

where ρ is the bulk density of soil (t m^{-3}), A_g is the mean cross-sectional area of gullies (m^2), GD is the length of gullies in a square kilometre (m km^{-2}), and T is the time since gully initiation (yr).

Using the methodology outlined in Dymond et al. (2016): ρ is set to 1.5 t m^{-3} ; A_g is set to 900 m^2 (from field observations); GD is set to 220 m (from digitising gully lengths on digitised aerial photographs); and T is set to 100 years.

4.1.5 Bank erosion

SedNetNZ represents bank erosion at the reach-scale where the river network is divided into stream links based on the River Environment Classification (REC). The total mass of material eroded from riverbanks each year is a function of bank height, reach length, and bank migration rate (Dymond et al. 2016):

$$B_j = \rho M_j H_j L_j \quad (11)$$

where B_j is the total eroded mass for the j th stream link (t y^{-1}), ρ is the bulk density of the bank material (t m^{-3}), M_j is the bank migration rate (m y^{-1}), H_j is the mean bank height (m) and L_j is the length (m) of the j th stream link. Bank height is derived from a regional relationship with mean annual discharge and bulk density is estimated at 1.5 t m^{-3} (Dymond et al. 2016).

The predicted mass of material eroded from riverbanks represents the gross contribution of sediment supplied to the river channel per year. This does not account for redeposition and storage of eroded bank material on banks, within the channel bed or the lateral accretion of material on bars with channel migration. Hence, net bank erosion in SedNetNZ is estimated as one-fifth of gross bank erosion based on results from the Waipaoa River catchment (De Rose & Basher 2011). Overbank vertical accretion of fine sediment on floodplains beyond the active channel is represented separately (Dymond et al. 2016).

Bank migration rate (M_j) in equation 11 is represented as a function of six factors as follows:

$$M_j = SP_j Sn_j T_j V_j (1 - PR_j) (1 - PW_j) \quad (12)$$

where M_j is the bank migration rate (m y^{-1}) of the j -th stream link, SP_j is the stream power of the mean annual flood for the j -th stream link, Sn_j is the channel sinuosity rate factor of the j -th link, T_j is the soil texture-based erodibility factor of the j -th link, V_j is the valley confinement factor of the j -th link, PR_j is the proportion of riparian woody vegetation of the j -th link, and PW_j is the fraction of bank protection works for the j -th link (Smith et al. 2019a).

Stream power (SP_j) for the mean annual flood (MAF_j , $\text{m}^3 \text{s}^{-1}$) is estimated for each stream link by the product of mean annual flood and channel slope (S_j). MAF is estimated from a fitted power relationship ($MAF = aq^b$) with mean annual discharge (q , $\text{m}^3 \text{s}^{-1}$) using data from long-term river flow gauging within the catchment or region of interest:

$$SP_j = MAF_j S_j = a q_j^b S_j \quad (13)$$

Various studies report increasing bank migration rates with increasing bankfull discharge and stream power (Hooke 1979; Nanson & Hickin 1986; Walker & Rutherford 1999; Alber & Piégay 2017). While MAF has been shown to relate to bank erosion rates (Dymond et al. 2016), other factors, such as channel sinuosity (Nanson & Hicken 1983), the cohesiveness of bank materials (Julian & Torres, 2006), valley confinement (Hall et al. 2007), and riparian woody vegetation (Abernethy & Rutherford 2000), are also important, resulting in high levels of spatial variability in bank erosion.

We use the log-normal probability density function to represent the relationship between channel sinuosity and migration rate, which we term the sinuosity rate factor. This function allows us to represent the positive-skew observed in the relationship between channel sinuosity and migration rate (Crosato 2009). The dimensionless channel sinuosity rate factor (Sn_j) is calculated as

$$Sn_j = \frac{1}{(Sinu_j - 1)\sigma\sqrt{2\pi}} e^{\left(-\frac{(\ln(Sinu_j - 1) - \mu)^2}{2\sigma^2}\right)} \quad (14)$$

where $Sinu_j$ is sinuosity of the j -th stream link of the REC2 network, and μ and σ are the mean and standard deviation parameters that determine the location and scale of the distribution. The μ and σ parameters are fitted using measurements of reach-scale bank migration rates.

The texture of bank material influences bank migration rates (Hickin & Nanson 1984; Julian & Torres 2006; Wynn & Mostaghini 2006). Our approach is based on an empirical relationship between percent silt + clay content (SC) and soil critical shear stress (τ_c) derived by Julian and Torres (2006) using data from Dunn (1959) as follows:

$$\tau_c = 0.1 + 0.1779SC + 0.0028SC^2 - 0.0000234SC^3 \quad (15)$$

SC is obtained from spatial data on soil textural classes compiled from the Fundamental Soil Layers (FSL) (Newsome et al. 2008), which provide national coverage. The soil texture-based erodibility factor (T_j) is represented by a power function to characterise the relationship between τ_c and bank erodibility for the j -th stream link:

$$T_j = c\tau_{c,j}^{-d} \quad (16)$$

where the c and d parameters are fitted using available bank migration rate data. The choice of a power function is based on experimental (Arulanandan et al. 1980) and field (Hanson & Simon 2001; Julian & Torres 2006) observations of the relationship between stream bank or bed critical shear stress and erodibility.

Floodplain extent and the level of valley confinement are factors that may limit lateral bank migration (Hall et al. 2007; De Rose & Basher 2011). The presence of steep valley sides and/or exposure of bedrock influence spatial patterns of erosion and deposition (Fryirs et al. 2016). Here, we adapt the Australian SedNet model approach to estimate a valley confinement factor (V_j) by using the mean slope (SB_j) in degrees of a buffer zone (4×15 m DEM pixel width) either side of the j -th stream link:

$$V_j = \left(1 - e^{\left(-15/SB_j\right)}\right)^{11} \quad (17)$$

Woody riparian vegetation typically increases bank stability via the effects of root reinforcement and root cohesion (Abernethy & Rutherford 2000; Hubble et al. 2010; Polvi et al. 2014; Konsoer et al. 2015). Woody vegetation can also increase roughness and flow resistance, thereby reducing the boundary shear stress acting on the bank surface (Thorne 1990). In addition, woody vegetation has hydrological effects on bank stability. For example, woody vegetation was found to be more effective than grass cover in lowering soil water content due to increased canopy interception and evapotranspiration, thus improving bank stability (Simon & Collinson 2002).

We represent the effect of riparian woody vegetation (PR_j) in reducing bank migration rates at the reach scale. Bank migration rates are reduced proportionally to the extent of woody riparian vegetation along the j -th stream link (equation 12). Stream links with complete riparian woody vegetation cover are assumed to erode at 0.05 of the migration rate with no woody cover (De Rose et al. 2003). Spatial information on woody vegetation is obtained from satellite imagery and intersected with the Land Information New Zealand (LINZ) digital stream network obtained from 1:50,000 topographic mapping. The mapped stream network was used in preference to the DEM-derived channel network because it tends to exhibit better planform accuracy which should improve spatial correspondence between channel position and riparian woody vegetation.

In some cases, the LINZ stream network provides poor representation of channel width for wider reaches with exposed gravel. To address this issue, the spatial union of the LINZ river polygons with LCDB v5 'river' and 'gravel and rock' land cover classes was used to produce revised river polygons. Mapped 'gravel and rock' areas located beyond the extent of the channel network were removed. The revised stream network layer improved alignment between channel banks and mapped woody vegetation when quantifying the reach-scale extent of riparian woody vegetation cover. The proportion of riparian woody vegetation is computed from the intersection of the revised stream network with a 15-m buffer and a classified map of 2002 woody vegetation cover (called EcoSat Woody) derived from Landsat TM at 15-m resolution (Dymond & Shepherd 2004).

We also include representation of channel protection works (PW_j) that are designed to reduce bank erosion (e.g. rock riprap, willow edge protection) as well as stopbanks employed for flood protection, where such data are available. We assume that over the multi-decadal model timescale, erosion mitigation would ultimately be targeted to where migrating riverbanks approach stopbanks, or that such interventions have already been implemented to protect stopbank integrity. The proportional length of bank erosion control measures (PEC_j) and stopbanks (PSB_j) is summed to give the proportion of channel works (PW_j) for the j -th stream link. PEC_j is computed as the length of erosion control measures within a stream link relative to the total length of that link. This assumes erosion control measures are targeted to the eroding bank side. Stopbanks may be located on either side of the channel irrespective of the direction of bank migration. Therefore, PSB_j is computed as the length of stopbanks in a link relative to $2 \times$ link length.

Inputs to the bank erosion model component of SedNetNZ were obtained from national-scale spatial datasets comprising the REC2 and LINZ stream networks, 15-m DEM, FSL for soil data, and EcoSat Woody for 2002 woody vegetation cover. LCDBv5 was not used, despite being more recent because it has a minimum mapping unit of 10,000 m² versus 225 m² for EcoSat. This makes LCDB less suitable for characterising narrow corridors of woody vegetation often found along channel banks.

Hydrological data were provided by TRC. This comprises flow data from 20 gauging stations with records > 10 years in length from across the region. These data were used to fit a relationship (Fig. 1) between mean annual discharge and mean annual flood ($MAF = 34q^{0.9}$, $R^2 = 0.83$) for use in calculating stream power for each REC2 link in the stream network. TRC also provided spatial data on stopbanks and channel protection works that have been included in the model simulations.

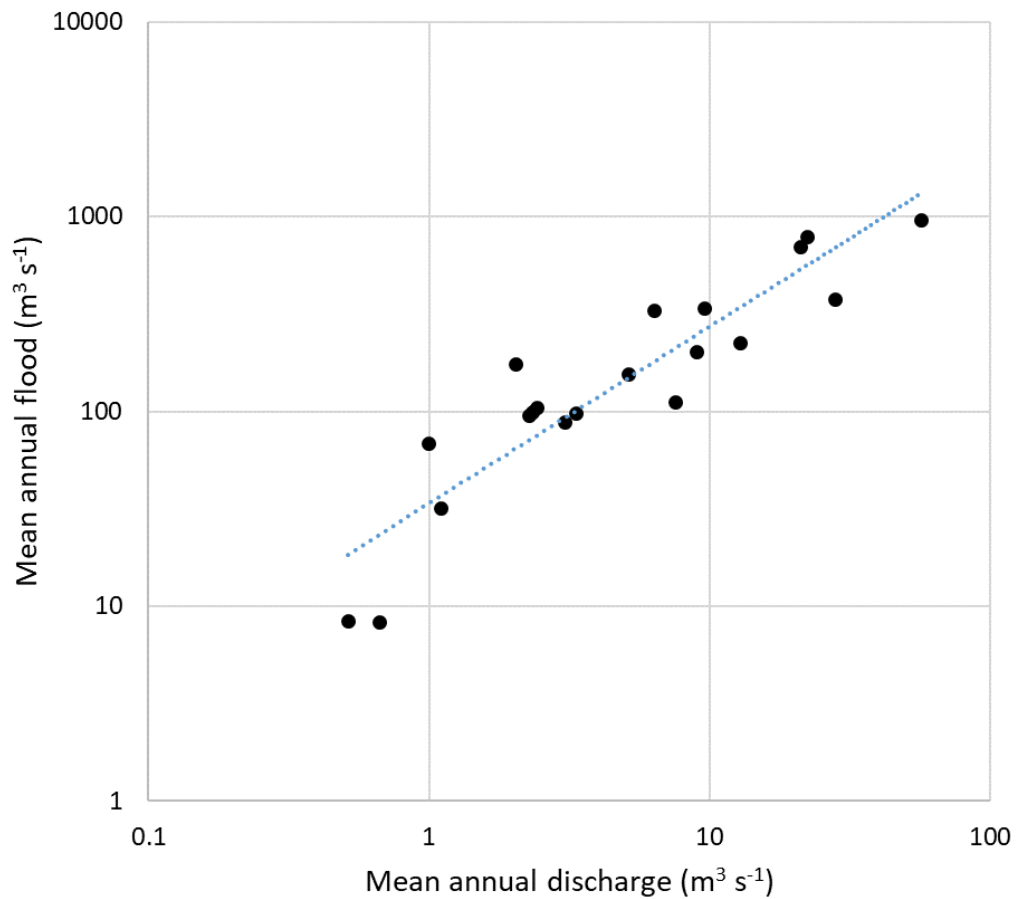


Figure 1. Fitted power relationship between mean annual discharge and mean annual flood (MAF) based on data from 20 gauging stations across Taranaki.

In the absence of mapped reach-scale channel changes within the Taranaki region, we used a combined dataset comprising measured bank migration rates from the Manawatu and Kaipara catchments to calibrate the bank erosion model (Spiekermann et al. 2017; Smith et al. 2019a). This calibration dataset has also been used in other recent applications of SedNetNZ in Hawke’s Bay (Smith et al. 2020) and Southland (Smith et al. 2019b; Neverman et al. 2020). Calibration of the bank migration model was performed by minimising the mean square error (MSE) between predicted and observed data by optimising parameter values for the sinuosity (μ and σ) and bank soil texture (c and d) factors in equations 13 and 15, respectively. This produced reasonable agreement between measured and observed bank migration rates (Smith et al. 2019a; Fig. 2).

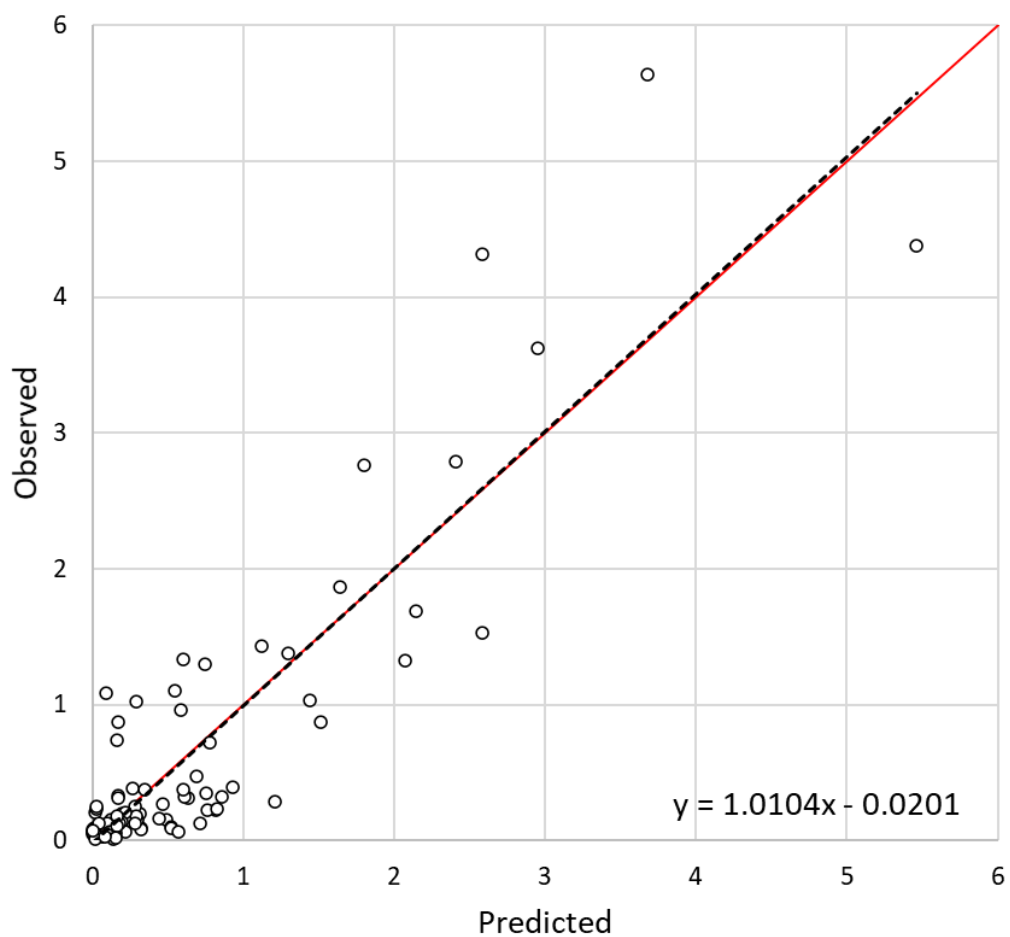


Figure 2. Plot comparing predicted versus observed bank migration rates (m y^{-1}) based on calibrated parameter values for the sinuosity and erodibility factors (Smith et al. 2019a). Fitted regression line (black dashed) and the 1:1 line (red) are also shown.

4.1.6 Sediment routing

SedNetNZ accounts for the deposition of sediment in lakes and on floodplains as the sediment is transported through the channel network.

To account for sediment trapping through lakes, we apply a revised SedNetNZ sediment routing algorithm. The revised routing algorithm applies a lake-specific sediment passing factor (*SPF*) to the net routed sediment load at the end of a REC2 sub-catchment draining to a lake. *SPF* was calculated using an adaptation of Gill's (1979) approximation of Brune's (1953) trap efficiency (the inverse of passing factor) curve for medium sediment:

$$SPF = 1 - \frac{V/I}{1.02(V/I) + 0.012} \quad (18)$$

where *V* is the lake volume and *I* is the annual inflow to the lake. This is similar to the approach of Hicks et al. (2019).

The mass of sediment deposited on the floodplain in a given reach is calculated as:

$$F_i = \left(\frac{pS_t}{\sum L_i S_i} \right) L_i S_i \quad (19)$$

where *F_i* is the total floodplain deposition ($t\ y^{-1}$) in the *i*th sub-catchment, *p* is the proportion of the catchment total sediment per sea-draining catchment that is deposited on floodplains in the catchment, set to 5% based on previous SedNetNZ parameterisation work carried out in the Manawatu (Dymond et al. 2016), *S_t* is the total sediment ($t\ y^{-1}$) per sea-draining catchment, *L_i* is the reach length (m) of floodplain per sub-catchment (as determined from Erosion Terrains), *S_i* is the total sediment ($t\ y^{-1}$) per sub-catchment.

4.2 Model simulations

The area modelled for this report comprises the REC2 sub-catchments within the four TRC Freshwater Management Units (FMUs). The FMUs were merged to create two aggregated FMUs for differential application of the modelling ruleset as outlined below: a hill country FMU defined as FMU D with inclusion of the Lake Rotokare Scenic Reserve, and a ringplain and coastal FMU comprised of FMU A, B, and C (Fig. 3). The difference in application of soil conservation between the aggregated FMUs was the limit of riparian fencing to third order and greater sub-catchments in the hill country FMU vs all sub-catchments in the ringplain and coastal FMU.

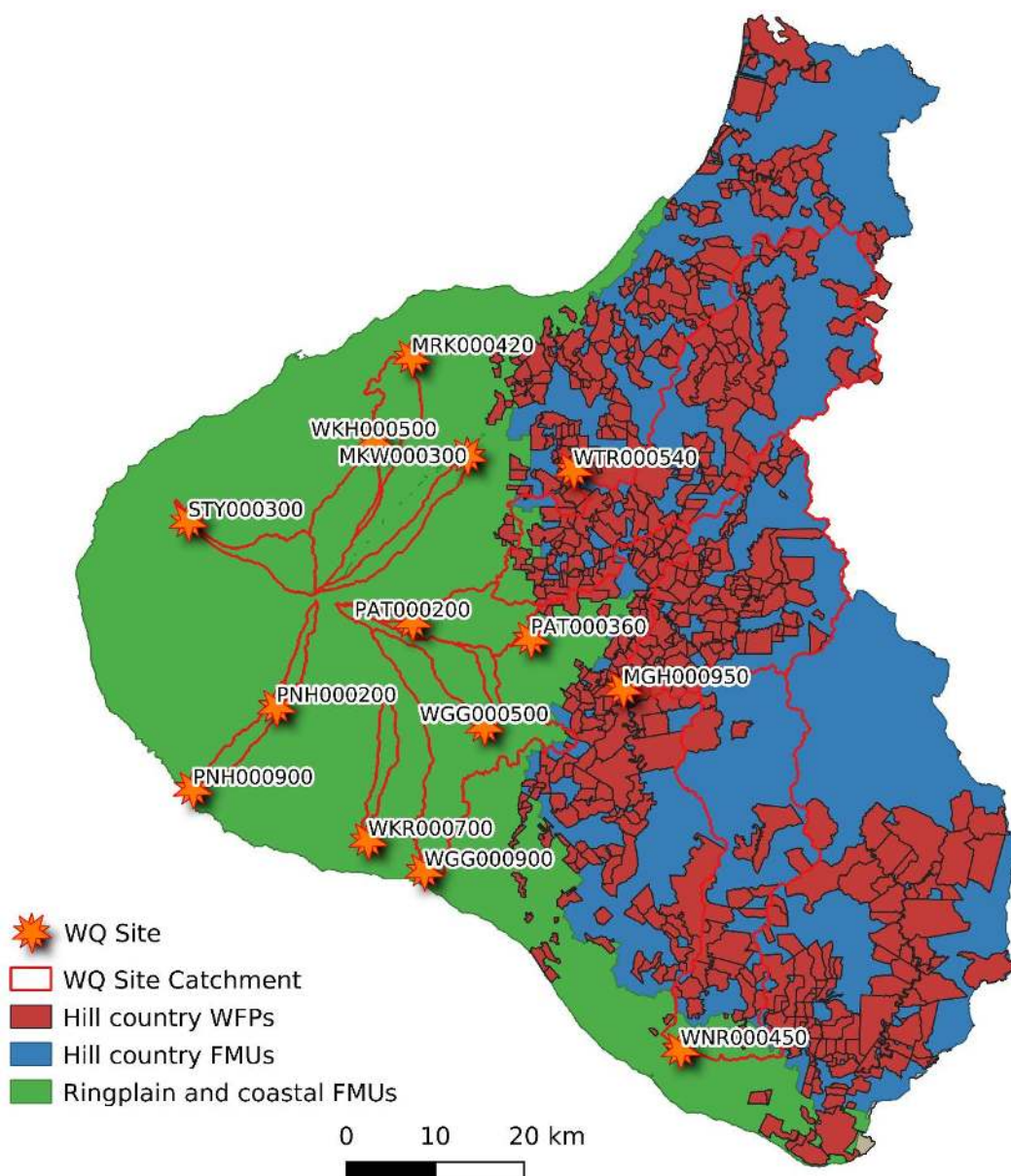


Figure 3. Distribution of hill country Whole Farm Plans and aggregated hill country and ringplain FMUs.

SedNetNZ model simulations were completed for the region as follows:

- a An initial baseline using 1996 land cover (LCDBv1) without specific representation of soil conservation works, representing a pre-mitigation state.
- b Contemporary baseline using 2018 land cover (LCDBv5) with representation of TRC conservation works completed to date and their estimated maturity, representing the contemporary state.

- c Future soil conservation scenario with fully matured and implemented conservation works comprising a) farm plans in hill country areas and b) riparian fencing in 3rd order and greater hill country channels, and all ring plain and coastal channels (see Fig. 3), representing a future state under best practice soil conservation works.

4.2.1 Hill country farm plans

Whole Farm Plans are represented spatially in the model using data provided by TRC. Hill country WFPs (Figure 3) have soil conservation works consisting of a combination of space-planted trees on non-G class slopes, and scrub reversion on G class slopes (identified from farm-scale LUC data provided by TRC) applied to appropriate pasture areas within the farm. It was assumed that WFPs were fully implemented in the year the plan was setup, as recorded in the dataset provided by TRC, following the method used by Basher et al (2020), McDowell et al (2020), Monaghan et al (2021), and Neverman et al (2019). This provided an age for the trees and scrub, calculated for 2018.

The erosion reduction effectiveness for fully matured space-planted trees (≥ 15 years old) is modelled as 70%, and for fully matured scrub reversion (≥ 10 years old) is modelled as 90%, and applied to mass-movement erosion processes, following Dymond et al. (2016).

As some WFPs were younger than 15 years in 2018, the contemporary baseline scenario modelled the erosion reduction effectiveness of trees and scrub as a function of their age using a maturity factor:

$$M_f = \frac{2018 - Y}{15} \quad (20)$$

where M_f is the maturity factor of the WFP in 2018, and Y is the year WFP mitigations were fully implemented (Basher et al 2020; McDowell et al 2020; Monaghan et al 2021; Neverman et al 2019).

4.2.2 Riparian fencing

Riparian fencing is represented spatially in the model using data supplied by TRC. Fencing data was classified by TRC as 'existing', 'completed' or 'proposed'. We applied the following ruleset to determine how the fencing data was used in each model simulation:

a. Initial baseline	<ul style="list-style-type: none"> • Only mapped fencing classed as 'existing' was included.
b. Contemporary baseline	<ul style="list-style-type: none"> • Mapped fencing classed as 'existing' and 'completed' were used. Comparison with the initial baseline simulation shows the reduction in bank erosion achieved by the riparian fencing completed to date.
c. Future conservation scenario	<ul style="list-style-type: none"> • Riparian fencing was applied to a) all stream orders within ring plain and coastal FMUs and b) $\geq 3^{\text{rd}}$ order streams within predominantly hill country FMUs in addition to mapped 'existing' and 'completed' fences included in the contemporary baseline simulation. • The additional fencing was applied to areas deemed 'mitigatable' (i.e. streams on agricultural land) and excluded from 'non-mitigatable' areas (e.g. native forest on conservation estate) for each REC2 stream link.

We applied a 60-m buffer to the REC2 stream network and used this to select those fences in the vicinity of channels. This buffer is designed to accommodate variations in channel width as well as positional error evident in REC2 stream segments relative to mapped fence lines. The length of selected fences was summed per REC2 stream link and used in determining the effect of fencing on bank erosion.

We estimate the fraction of stream link that has been fenced (FR_j) as the length of fence relative to 2 x stream link length, which approximates the maximum extent of fencing when present on both sides of a channel for a given REC2 reach. The reduced net suspended sediment load from bank erosion due to fencing and stock exclusion (B_{F_j}) is computed using equation 21, as follows:

$$B_{F_j} = B_j \times (1 - 0.8FR_j) \quad (21)$$

where B_j is the net suspended sediment load from bank erosion without the effect of fences reducing erosion. A reduction of 80% in net suspended sediment load from bank erosion may be attributable to riparian fencing and stock exclusion (Dymond et al. 2016). This reflects the effect of reduced stock trampling and foraging on banks (Trimble 1994) as well as the potential for riparian woody vegetation to become better established in the absence of livestock over the longer-term.

4.3 Contemporary and achievable attribute states

The 5-year median visual clarity was calculated for 14 water quality monitoring sites using the most recent black disc measurements ($n = 60$). This allows the contemporary fine suspended sediment attribute state to be identified for each site from the NPS-FM 2020 based on sediment class² and median visual clarity (Table 1).

² Suspended sediment classes for the REC2 network are available at <https://data.mfe.govt.nz/layer/103687-hydrological-modelling-to-support-proposed-sediment-attribute-impact-testing-2020/>

Table 1. Attribute bands and numeric attribute states for fine suspended sediment. Reproduced from Table 8 in the NPS-FM 2020

Attribute band and description	Numeric attribute state by suspended sediment class (visual clarity(m))			
	1	2	3	4
A Minimal impact of suspended sediment on instream biota. Ecological communities are similar to those observed in natural reference conditions.	≥1.78	≥0.93	≥2.95	≥1.38
B Low to moderate impact of suspended sediment on instream biota. Abundance of sensitive fish species may be reduced.	<1.78 and ≥1.55	<0.93 and ≥0.76	<2.95 and ≥2.57	<1.38 and ≥1.17
C Moderate to high impact of suspended sediment on instream biota. Sensitive fish species may be lost.	<1.55 and >1.34	<0.76 and >0.61	<2.57 and >2.22	<1.17 and >0.98
National bottom line	1.34	0.61	2.22	0.98
D High impact of suspended sediment on instream biota. Ecological communities are significantly altered, and sensitive fish and macroinvertebrate species are lost or at high risk of being lost.	<1.34	<0.61	<2.22	<0.98

The relationships between required reductions in median visual clarity and mean annual suspended sediment loads developed by Dymond et al. (2017) and simplified by Hicks et al. (2019) were used to calculate the reductions in mean annual suspended sediment loads required to achieve the NPS-FM 2020 attribute bands at each water quality monitoring site. The proportional reduction in load required to achieve each attribute band is calculated as a function of the difference between the baseline and minimum numeric attribute state for each band:

$$PR_v = 1 - (V_o/V_b)^{1/a} \tag{22}$$

where PR_v is the minimum proportional reduction in load required to achieve the attribute state, V_o is the minimum visual clarity for each band, V_b is the baseline median visual clarity, and a was assumed to take the national average reported by Hicks et al. (2019) as 0.76.

Given the national bottom-line threshold overlaps with the bottom of the range for band C, our analysis looks at reductions required to meet the national bottom line, band B, and band A. Achieving band C requires only a marginal increase in load reduction from that required to achieve the national bottom line.

To identify which attribute band a water quality monitoring site would fall in to after existing soil conservation works mature and riparian fencing is completed, the reduction in mean annual load between the contemporary baseline and future conservation scenarios was compared to the required load reduction to achieve each attribute band. Where the achieved reduction was higher than the required load reduction, the associated attribute band is considered achievable.

5 Results

5.1 Scenario mean annual suspended sediment loads

Mean annual suspended sediment loads are presented for the Taranaki region in Table 2 and visualised in Figure 1, and for the water quality monitoring sites in Table 3. To visualise the distribution of erosion rates, net specific sediment yield ($\text{t km}^2 \text{ yr}^{-1}$) is presented in Figure 2 by REC2 sub-catchment across the region for each scenario.

Table 2. Total mean annual suspended sediment loads for the Taranaki region under each modelled scenario

Scenario	Mean annual suspended sediment load (Mt yr^{-1})
Initial Baseline	2.38
Contemporary Baseline	1.68
Future conservation works	1.44

Table 3. Total mean annual suspended sediment loads at water quality monitoring sites under each modelled scenario, rounded to significant figures

Site Code	Location	Initial baseline suspended sediment load (t yr^{-1})	Contemporary baseline suspended sediment load (t yr^{-1})	Future scenario mean annual suspended sediment load (t yr^{-1})
MGH000950	Mangaehu River at Raupuha Rd Bridge	369,600	231,300	195,600
MKW000300	Maketawa Stream at Tarata Rd	1,200	670	650
MRK000420	Mangaoraka Stream at Corbett Rd	1,000	760	660
PAT000200	Patea River at Barclay Rd Bridge	170	150	150
PAT000360	Patea River at Skinner Rd Bridge	2,700	2,000	1,600
PNH000200	Punehu Stream at Wiremu Rd	750	560	550
PNH000900	Punehu Stream at SH45	1,700	1,000	960
STY000300	Hangatahua (Stony) River at Mangatete Rd	8,900	8,300	8,300
WGG000500	Waingongoro River at Eltham Rd Bridge	2,200	1,900	1,900
WGG000900	Waingongoro River at SH45	13,300	9,200	8,500
WKH000500	Waiwhakaihō River at SH3	4,300	3,700	3,500
WNR000450	Whenuakura River at Nicholson Rd	194,000	144,400	135,500
WTR000540	Waitara River at Autawa Rd	539,000	345,500	292,600
WKR000700	Waiokura pumphouse	130	100	90

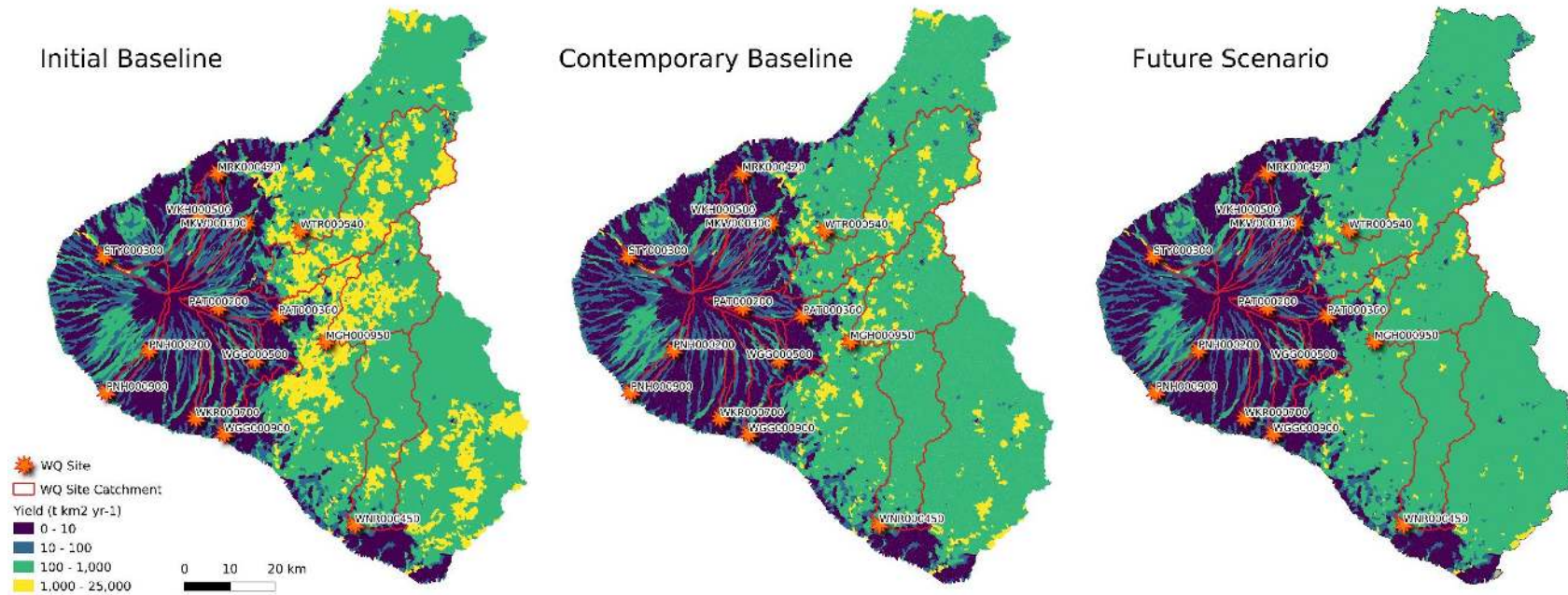


Figure 4. Net suspended sediment yield ($t\ km^2\ yr^{-1}$) for the REC2 sub-catchments for each scenario.

5.2 Reductions in load

A 29% reduction in load is seen across the region between the initial and contemporary baseline scenarios (Table 4). This is a result of changing landcover (which caused an increase in load in some reaches) between 1996 and 2018, and the implementation and maturity of WFPs and riparian fencing. A 15% reduction in load is seen across the region between the contemporary and future conservation scenarios, resulting from maturing of soil conservation works, and completion of riparian fencing. A 40% reduction is seen between the initial baseline and future conservation scenario.

Table 4. Regional changes in mean annual suspended sediment load between scenarios, rounded to significant figures

Scenarios	Absolute change (t yr ⁻¹)	Proportional change
Initial baseline to contemporary baseline	-698,000	-29%
Initial baseline to future mitigation	-947,000	-40%
Contemporary baseline to future mitigation	-249,000	-15%

At the water quality monitoring sites, reductions are seen at all sites between the initial and contemporary baseline scenarios, and at all but one site between the contemporary baseline and future mitigations scenario (Table 5). The local net load reductions achievable within the water quality monitoring site catchments between the contemporary baseline and future conservation scenario are shown in Figure 4.

Table 5. Absolute and proportional reductions in mean annual suspended sediment load between modelled scenarios at water quality monitoring sites

Site Code	Location	Initial baseline to contemporary baseline	Initial baseline to future scenario	Contemporary baseline to future scenario
MGH000950	Mangaehu River at Raupuha Rd Bridge	138,330 (37%)	173,957 (47%)	35,627 (15%)
MKW000300	Maketawa Stream at Tarata Rd	556 (45%)	581 (47%)	25 (4%)
MRK000420	Mangaoraka Stream at Corbett Rd	302 (28%)	399 (38%)	97 (13%)
PAT000200	Patea River at Barclay Rd Bridge	20 (12%)	20 (12%)	0 (0%)
PAT000360	Patea River at Skinner Rd Bridge	682 (25%)	1,082 (40%)	400 (20%)
PNH000200	Punehu Stream at Wiremu Rd	180 (24%)	194 (26%)	14 (2%)
PNH000900	Punehu Stream at SH45	720 (42%)	744 (44%)	25 (3%)
STY000300	Hangatahua (Stony) River at Mangatete Rd	542 (6%)	559 (6%)	17 (0.2%)
WGG000500	Waingongoro River at Eltham Rd Bridge	243 (11%)	272 (13%)	29 (2%)
WGG000900	Waingongoro River at SH45	4,128 (31%)	4,791 (36%)	663 (7%)
WKH000500	Waiwhakaiho River at SH3	660 (15%)	876 (20%)	216 (6%)
WNR000450	Whenuakura River at Nicholson Rd	49,682 (26%)	58,619 (30%)	8,937 (6%)
WTR000540	Waitara River at Autawa Rd	193,572 (36%)	246,494 (46%)	52,921 (15%)
WKR000700	Waiokura pumphouse	28 (22%)	37 (29%)	9 (9%)

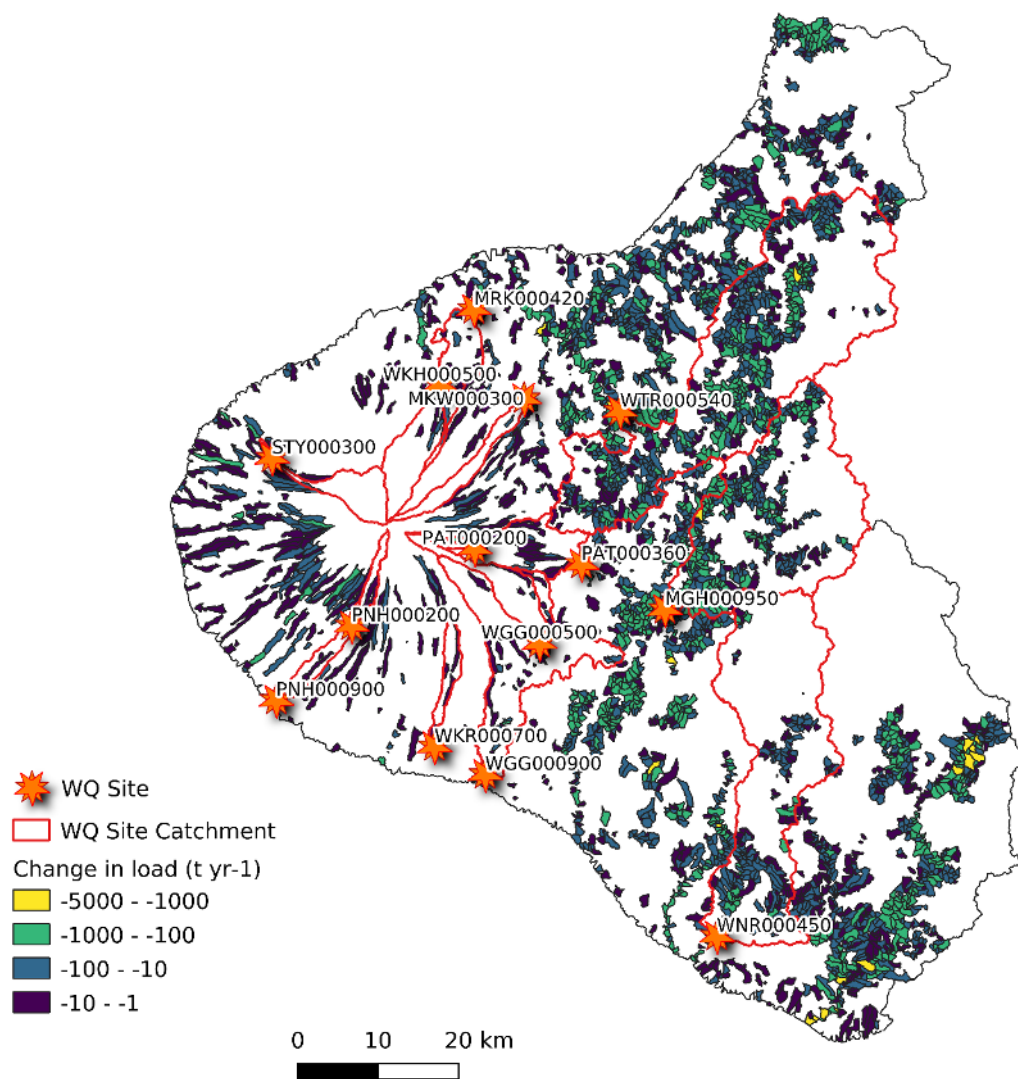


Figure 5. Achievable load reductions (t yr⁻¹) in each REC2 sub-catchment between the contemporary baseline and future conservation scenarios.

5.3 Suspended sediment attribute states

The contemporary attribute band for each water quality monitoring site based on the NPS-FM 2020 are presented in Table 6 and Figure 6. Of the 14 monitoring sites assessed, seven are in band A (highest achievable state), two are in band B, two are band C, and three do not achieve the national bottom line (band D).

Table 6. Baseline visual clarity and attribute state at water quality monitoring sites. Baseline visual clarity was calculated as the median of the most recent 5 years (60 samples) of monthly monitoring data.

Site Code	Location	NPS-FM 2020 sediment class	Baseline visual clarity (m)	Contemporary attribute band
MGH000950	Mangaehu River at Raupuha Rd Bridge	4	1.075	C
MKW000300	Maketawa Stream at Tarata Rd	1	2.1	A
MRK000420	Mangaoraka Stream at Corbett Rd	1	2.1	A
PAT000200	Patea River at Barclay Rd Bridge	1	4.045	A
PAT000360	Patea River at Skinner Rd Bridge	1	1.975	A
PNH000200	Punehu Stream at Wiremu Rd	1	1.7	B
PNH000900	Punehu Stream at SH45	1	1.6	B
STY000300	Hangatahua (Stony) River at Mangatete Rd	1	2.335	A
WGG000500	Waingongoro River at Eltham Rd Bridge	1	1.79	A
WGG000900	Waingongoro River at SH45	1	1.42	C
WKH000500	Waiwhakaiho River at SH3	1	3.205	A
WNR000450	Whenuakura River at Nicholson Rd	2	0.32	D
WTR000540	Waitara River at Autawa Rd	2	0.4	D
WKR000700	Waiokura pumphouse	1	0.67	D

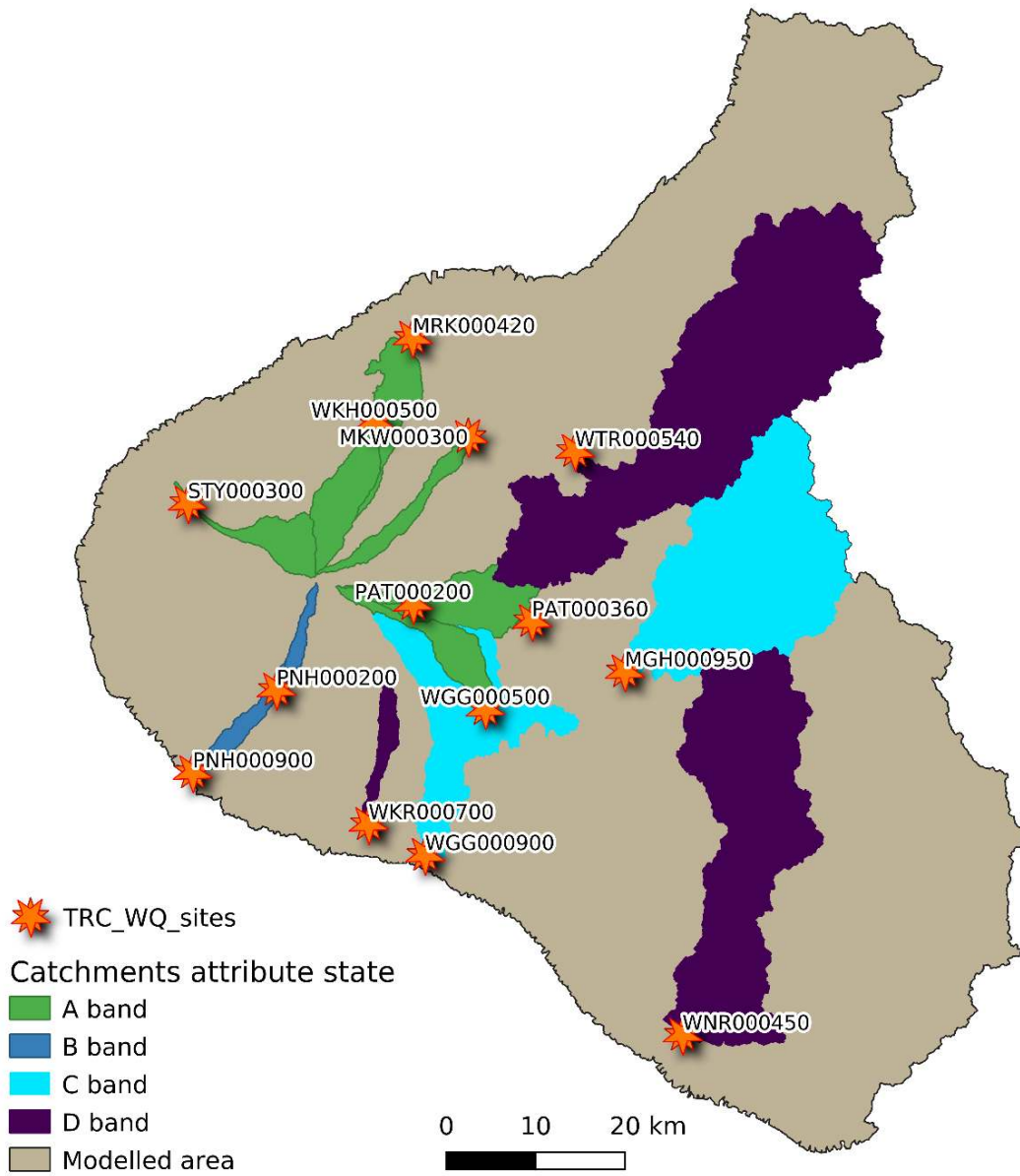


Figure 6. Contemporary attribute state of the 14 water quality monitoring sites.

5.4 Achievement of NPS-FM 2020 suspended sediment attribute states

The proportional and absolute reductions in load required for water quality monitoring sites to achieve each attribute band are presented in Table 7. Where the reduction is zero, the band is already achieved. Based on the reduction in load achieved between the contemporary baseline and future mitigation scenarios, the ability of soil conservation works to achieve each attribute state at water quality monitoring sites is presented in Table 8. The SedNetNZ data layer accompanying this report can be used to rank sub-catchments from highest to lowest achievable reductions within each water quality monitoring catchment, and identify farms associated with the sub-catchments to prioritise for soil conservation works.

Table 7. Proportional and absolute reductions in mean annual suspended sediment load required to achieve NPS-FM 2020 attribute states at water quality monitoring sites, round to significant figures

Site Code	Location	Proportion reduction in load required			Absolute reduction in load required (t yr ⁻¹)		
		National bottom line	B band	A band	National bottom line	B band	A band
MGH000950	Mangaehu River at Raupuha Rd Bridge	0%	11%	28%	0	28,300	75,200
MKW000300	Maketawa Stream at Tarata Rd	0%	0%	0%	0	0	0
MRK000420	Mangaoraka Stream at Corbett Rd	0%	0%	0%	0	0	0
PAT000200	Patea River at Barclay Rd Bridge	0%	0%	0%	0	0	0
PAT000360	Patea River at Skinner Rd Bridge	0%	0%	0%	0	0	0
PNH000200	Punehu Stream at Wiremu Rd	0%	0%	6%	0	0	30
PNH000900	Punehu Stream at SH45	0%	0%	13%	0	0	130
STY000300	Hangatahua (Stony) River at Mangatete Rd	0%	0%	0%	0	0	0
WGG000500	Waingongoro River at Eltham Rd Bridge	0%	0%	0%	0	0	0
WGG000900	Waingongoro River at SH45	0%	11%	26%	0	1,000	2,300
WKH000500	Waiwhakaiho River at SH3	0%	0%	0%	0	0	0
WNR000450	Whenuakura River at Nicholson Rd	57%	68%	75%	99,800	118,600	131,600
WTR000540	Waitara River at Autawa Rd	43%	57%	67%	167,700	224,500	264,000
WKR000700	Waiokura pumphouse	60%	67%	72%	60	67	72

Table 8. Achievable load reductions (t yr^{-1}) at the WQ sites between the contemporary baseline and future conservation scenarios, rounded to significant figures

Site Code	Location	Load reduction achievable (t/yr^{-1})	Load reduction achievable (%)	Achievable attribute state
MGH000950	Mangaehu River at Raupuha Rd Bridge	27,300	15%	B
MKW000300	Maketawa Stream at Tarata Rd	30	4%	A
MRK000420	Mangaoraka Stream at Corbett Rd	100	13%	A
PAT000200	Patea River at Barclay Rd Bridge	0	0%	A
PAT000360	Patea River at Skinner Rd Bridge	400	20%	A
PNH000200	Punehu Stream at Wiremu Rd	10	2%	B
PNH000900	Punehu Stream at SH45	25	3%	B
STY000300	Hangatahua (Stony) River at Mangatete Rd	20	0.2%	A
WGG000500	Waingongoro River at Eltham Rd Bridge	30	2%	A
WGG000900	Waingongoro River at SH45	660	7%	C
WKH000500	Waiwhakaiho River at SH3	200	6%	A
WNR000450	Whenuakura River at Nicholson Rd	4,400	6%	D
WTR000540	Waitara River at Autawa Rd	46,200	15%	D
WKR000700	Waiokura pumphouse	10	9%	D

6 Discussion

6.1 Effectiveness of soil conservation works

A significant reduction in mean annual suspended sediment loads has been achieved across the region since Whole Farm Plans were established, with a 29% ($698,000 \text{ t yr}^{-1}$) net reduction in modelled load between the initial and contemporary baseline scenarios. A further reduction of $249,000 (15\%) \text{ t yr}^{-1}$ is estimated to be achievable once existing soil conservation works reach full maturity, and riparian fencing is completed across the region, giving a total net reduction of $947,000 \text{ t yr}^{-1} (40\%)$ between the initial baseline and future mitigation scenario.

Contemporary reductions in suspended sediment load range from 6 to 45% at water quality monitoring sites since WFPs were established. Lower reductions are projected between the contemporary baseline and future mitigation scenarios at all sites (0.2 – 20%) due to the estimated maturity of WFPs and extent of riparian fencing being high in the contemporary baseline, therefore leaving less room for improvement in the future. However, it is possible we have overestimated the maturity of WFPs in the contemporary scenario, and there may therefore be more room for maturing of soil conservation works in the future, thus achieving greater reductions than estimated here.

This analysis excludes any consideration of the likely impact of climate change in increasing erosion rates and sediment loads. Basher et al. (2020) modelled the effect of erosion mitigation and climate change on sediment loads in the Manawatu-Whanganui region and suggested that the increase in sediment load resulting from climate change impacts may exceed the reductions achieved by land management by 2090. This may have significant implications for sediment management policy.

6.2 Attribute bands

Seven of the 14 water quality monitoring sites are presently in the A band under the NPS-FM 2020. This is the highest achievable standard. Two sites are in band B, and two in band C. These bands are above the national bottom line (minimum standard) and therefore do not require further reductions. Three sites (WNR000450, WTR000540, and WKR000700) sit below the national bottom line. Of the seven sites below band A, only the Mangaehu is predicted to see an improvement in attribute state under the future scenario. The inability to achieve the reductions required to meet the national bottom line may result from a combination of factors. First, the reductions required in load for these sites are significant as their visual clarity is well below the national bottom line. To achieve the reductions needed to meet the national bottom line would require a significant proportion of the catchment to be available for future soil conservation works. However, a significant proportion of the catchment area is already woody vegetation as per LCDBv5, and the majority of hill country pasture in the catchments has an existing farm plan, and the maturity of these farm plans is relatively high in the contemporary scenario. Thus, there is relatively little room for further soil conservation works or increasing effectiveness of existing works through maturation. Given their high proportion of woody land cover, these catchments could be considered to have naturally high levels of erosion and therefore sediment loads. The NPS-FM 2020 does allow for flexibility in visual clarity targets for sites affected by naturally occurring processes which contribute to high sediment loads, such as in naturally highly coloured brown-water streams. The sites at WNR000450, WTR000540, and WKR000700 may fall within this category.

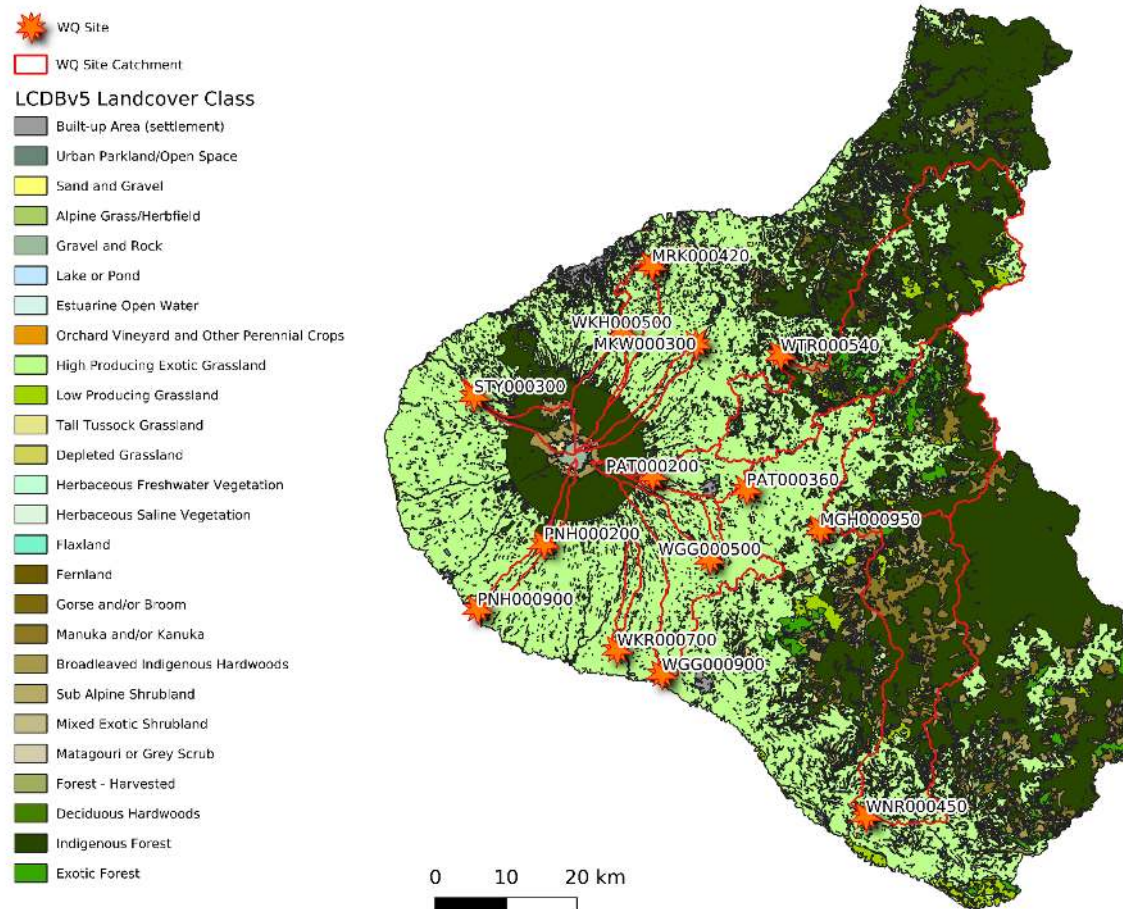


Figure 7. Land cover as represented by LCDBv5.

6.3 Model assumptions and limitations

There are several limitations in SedNetNZ modelling of baseline loads, and in the calculation of the load reductions required to meet NPS-FM 2020 fine suspended sediment attribute states. We outline these limitations in terms of each modelling component below. Model outputs should be interpreted in the context of these limitations.

6.3.1 Surficial erosion

The key limitations in the surficial erosion component of SedNetNZ relate to the calculation of the C and K factors in the NZUSLE, and the availability of suitable input data. We have improved the calculation of the K factor within the Taranaki region by utilising FSL data to compute a spatially variable K factor instead of the uniform K factor previously used in the NZUSLE (e.g. Dymond et al. 2016). Higher resolution soils data from the region, such as S-map, may improve estimates of surficial erosion for Taranaki.

6.3.2 Shallow landslide erosion

In the absence of regional multi-temporal data on shallow landslide occurrence, it was necessary to use data from other regions to calibrate the landslide component of SedNetNZ for the Taranaki region. Calibration data from the Manawatu (Dymond et al. 2016) was used to define the slope thresholds for landslide occurrence and density. $f(s)$ was therefore adjusted using information on storm rainfall magnitude-frequency (NIWA HIRDS v4) and estimated landslide triggering rainfall thresholds (Basher et al. 2020).

Regional multi-temporal mapping of shallow landslides would enable better parametrisation of the shallow landslide component of SedNetNZ and, combined with regional LiDAR data, would enable better spatial representation of slope thresholds for shallow landslide initiation and density.

6.3.3 Earthflow and Gully erosion

Both earthflow and gully erosion are represented in SedNetNZ using a spatial averaging approach based on estimated presence and spatial extent of these erosion features in the Erosion Terrains layer, and their erosion rate is uniform (Dymond et al. 2016). It is therefore possible that earthflow and gully erosion may be represented in sub-catchments that do not contain these features, or may not be represented where they are present. Spatial variation in erosion rates between individual earthflow or gully features is also not captured. Future modelling could benefit from individual erosion feature mapping to enable more accurate spatial representation across the region and further data collection on erosion rates.

6.3.4 Riverbank erosion

There are several limitations related to the revised bank erosion component that require consideration when analysing results at the sub-catchment scale. In the absence of local data on riverbank migration rates, it was necessary to calibrate the bank migration model

using available measurements from the Manawatu and Kaipara catchments in the North Island. We recognise this potentially introduces additional and unquantified error into model predictions for Taranaki catchments due to differences in catchment geology and channel planform. However, the dataset from Manawatu and Kaipara does span a large range in observed bank migration rates, riparian woody vegetation extents, soil textures, channel slope, and sinuosity variables for the mapped reaches (Spiekermann et al. 2017; Smith et al. 2019a).

Representation of riparian woody vegetation has been derived from EcoSat Woody (Dymond & Shepard 2004) as LCDB is less suitable for representing narrow strips of riparian corridor. Predictions of bank migration rates are therefore based on woody vegetation presence/absence in 2002. A further challenge results from the spatial correspondence of mapped channel location and woody vegetation resulting from the alignment of REC2 to the channel, and changes in channel planform since mapping occurred. Availability of catchment-wide LiDAR data would enable improved spatial representation of riparian woody vegetation and coherence with channel locations.

6.3.5 Soil conservation works

Modelling of soil conservation works assumes all existing Whole Farm Plans include space-planted trees on all appropriate land, and these trees have been planted at the recommended density to achieve a 70% reduction in erosion, and there is no mortality. It also assumes all G class slopes have been reverted.

Hawley and Dymond (1988) reported that space-planting does not always achieve a 70% reduction in hillslope erosion due to mortality of trees and/or ineffective tree spacing.

When accounting for the maturity of these space-planted trees and scrub reversion, we assume all mitigatable land was planted or retired during the year the WFP was established; however, planting may have been phased over a number of years, or not undertaken. There is therefore some uncertainty about the maturity and effectiveness of existing WFPs in 2018. It is also possible some space-planting or scrub reversion has occurred on farms that is not captured in the existing WFP data used in this modelling, or in LCDBv5. If this is the case, baseline loads in catchments where this occurs may be underestimated here. The model may therefore underestimate what further reductions are achievable from baseline, although this is likely to be minor.

6.3.6 Load reductions and achievable attribute states

Mean annual suspended sediment load reductions to achieve visual clarity attribute states were estimated using equations developed by Hicks et al. (2019) from simplifications in the relationships reported by Dymond et al. (2017). The key assumption for calculating required load reductions to meet attribute states is the relationship between sediment load and flow remain constant at a site. In reality, this relationship may change due to changes in catchment hydrology, leading to changes in the relationship between a given flow and suspended sediment concentration (Hicks et al. 2019). As data are not presently available to predict these changes, we assume that the associated relationships remain constant.

We have also estimated the required load reductions using empirical models fitted to a national dataset. This should result in the models being fitted to a wide range of catchment variables and therefore representing the variability across Taranaki, and sites from Taranaki were used in the national dataset (see Hicks et al. 2019), but this may lead to under- or over-estimation of required reductions at any one site. This relationship does not account for the local variability in the relationship between sediment load and visual clarity that arises due to variations in the sediment characteristics that affect the optical properties of flows between sites, such as the presence of fine-grained clay minerals (Hicks et al. 2019). Future improvements could be made by locally calibrating the relationship between visual clarity and sediment loads at the assessment sites.

It is also important to consider that visual clarity baseline attribute states are derived from monthly fixed interval sampling. This sampling likely results in visual clarity being mostly measured at or near baseflow, when the majority of the sediment load may be derived from within-channel sources (e.g. remobilisation from channel bed or from bank erosion). In contrast, the modelled mean annual sediment loads reflect storm event-driven erosion and sediment loads, where shallow landslide erosion is a dominant sediment source in hill country areas of Taranaki over multi-decadal timescales. There may therefore be some disconnect between the sediment sources reduced by soil conservation works and those that contribute to fixed-interval visual clarity samples (while acknowledging that some storm-derived hillslope sediment may enter channel bed storage where it could undergo subsequent remobilisation during lower flows).

6.3.7 Riparian fencing

It is assumed that any fence segment in the vicinity of the buffered REC2 stream links are in place to exclude stock, and that woody vegetation can establish in the area between the fence and channel. This approach is complicated by the potential misalignment of the REC2 network and the true channel location, which is particularly challenging in low order streams. This may lead to incorrect fencing lengths at any given REC2 segment. However, this approach is spatially explicit, and is a better spatial representation of existing stock exclusion than the regionally uniform estimate used by Neverman et al. (2019), and therefore better represents the spatial variation in the effect of pre-existing mitigations, particularly at larger scales. Future modelling could benefit from the inclusion of an attribute field in fencing databases to demarcate those fences providing stock exclusion from riparian areas.

7 Conclusions

SedNetNZ modelling for the Taranaki region suggests soil conservation works implemented since ~1996 have resulted in a 29% net reduction in mean annual suspended sediment loads across the region. As existing soil conservation works mature, and further riparian fencing is completed, a further 15% reduction is expected across the region under the current landcover configuration.

Based on the past 5 years of monthly water quality monitoring data from 14 sites across the region, seven of the 14 sites presently sit in the A band for suspended sediment in the NPS-FM 2020. This is the highest achievable attribute state. Of the remaining seven sites, only the Mangaehu is predicted to see an improvement in attribute state under the future scenario, moving from band C to band B. Four of these sites are above the national bottom line so do not require further reductions. Three sites presently fall below the national bottom line for visual clarity in the NPS-FM 2020. The inability to achieve the reductions required to meet the national bottom line may result from a combination of factors, including overestimation of the contemporary effectiveness of soil conservation works in the model, limiting the room for future improvement, or the naturally occurring high rates of erosion in the catchments which could be naturally highly coloured streams, and therefore may warrant some reduction in their bottom line from that of the national bottom line for their sediment class.

8 Recommendations

- One of the key limitations of the analysis presented in this report is the assumption of soil conservation maturity based on the establishment date of Whole Farm Plans, and the assumption that WFPs are fully implemented in their first year. This may result in an over estimation of the maturity and effectiveness of trees for erosion reduction in the contemporary baseline scenario, resulting in an underestimation of achievable load reductions in the future scenario. Data for each farm plan detailing the degree of implementation to date (i.e. proportion of planned tree planting that has been undertaken) and the maturity of implemented works would improve our estimation of contemporary reductions, and room for further reduction.
- While a timeline has not been explicitly given for full effectiveness of soil conservation works to take effect, it is likely to be several decades as recent space-planted trees and retired land reach full maturity. It is possible that climate change may result in an increase in loads despite conservation works by the end of the century (Basher et al. 2020). Future work could look at modelling the potential impact of climate change on sediment loads in the Taranaki region using SedNetNZ and implications for meeting NPS-FM (2020) sediment attribute targets.
- Availability of S-Map data for Taranaki would enable better representation of soil parameters in the surficial erosion component of SedNetNZ.
- The availability of regional LiDAR data will enable better representation of erosion processes within SedNetNZ. Future work could update SedNetNZ modelling for the region when LiDAR data become available.

- Building a regional multi-temporal shallow landslide database would enable better calibration of the shallow landslide component in future applications of SedNetNZ in the Taranaki region.

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10 References

- Abernethy B, Rutherford ID 2000. The effect of riparian tree roots on the mass-stability of riverbanks. *Earth Surface Processes and Landforms* 25: 921–937.
- Alber A, Piégay H 2017. Characterizing and modelling river channel migration rates at a regional scale: case study of south-east France. *Journal of Environmental Management* 202: 479–493.
- Arulanandan K, Gillogley E, Tully R 1980. Development of a quantitative method to predict critical shear stress and rate of erosion of natural undisturbed cohesive soils. USACE, Waterways Experiment Station Technical Report GL-80-5. Vicksburg, MS: USACE.
- Basher L, Spiekermann R, Dymond J, Herzig A, Hayman E, Ausseil AG 2020. Modelling the effect of land management interventions and climate change on sediment loads in the Manawatū–Whanganui region. *New Zealand Journal of Marine and Freshwater Research* 2020 54: 490–511.
- Betts H, Basher L, Dymond J, Herzig A, Marden M, Phillips C 2017. Development of a landslide component for a sediment budget model. *Environmental Modelling & Software* 92: 28–39.
- Brune GM 1953. Trap efficiency of reservoirs. *Eos, Transactions American Geophysical Union* 34: 407–18.
- Byrd RH, Lu P, Nocedal J, Zhu C 1995. A limited memory algorithm for bound constrained optimization. *SIAM Journal on Scientific Computing* 16: 1190–1208.
- Crosato A 2009. Physical explanations of variations in river meander migration rates from model comparison. *Earth Surface Processes and Landforms* 34: 2078–2086.
- DeRose RC 2013. Slope control on the frequency distribution of shallow landslides and associated soil properties, North Island, New Zealand. *Earth Surface Processes and Landforms* 38: 356–371.
- De Rose R, Basher LR 2011. Measurement of river bank and cliff erosion from sequential LiDAR and historical aerial photography. *Geomorphology* 126: 132–147.

- De Rose R, Prosser IP, Weisse M, Hughes AO 2003. Patterns of erosion and sediment and nutrient transport in the Murray-Darling Basin. CSIRO Land and Water Technical Report 32/03.
- Desmet PJJ, Govers G. 1996. A GIS procedure for automatically calculating the USLE LS factor on topographically complex landscape units. *Journal of Soil and Water Conservation* 51(5): 427–433.
- Duncan MJ, Woods RA 2013. Water regulation. In Dymond JR ed. *Ecosystem services in New Zealand – conditions and trends*. Lincoln: Manaaki Whenua Press.
- Dunn IS 1959. Tractive resistance of cohesive channels. *Journal of the Soil Mechanics and Foundations Division* 85: 1–24.
- Dymond JR, Betts HD, Schierlitz CS 2010. An erosion model for evaluating regional land-use scenarios. *Environmental Modelling and Software* 25: 289–298.
- Dymond, JR, Davies-Colley, RJ, Hughes, AO, Matthaei, CD 2017. Predicting improved optical water quality in rivers resulting from soil conservation actions on land. *Science of the Total Environment* 603–604: 584–592.
- Dymond JR, Herzig A, Basher L, Betts HD, Marden M, Phillips CJ, Ausseil AE, Palmer DJ, Clark M, Roygard J 2016. Development of a New Zealand SedNet model for assessment of catchment-wide soil-conservation works. *Geomorphology* 257: 85–93.
- Dymond JR, Jessen MR, Lovell LR 1999. Computer simulation of shallow landsliding in New Zealand hill country. *International Journal of Applied Earth Observation and Geoinformation* 122–131.
- Dymond JR, Shepherd JD 2004. The spatial distribution of indigenous forest and its composition in the Wellington region, New Zealand, from ETM+ satellite imagery. *Remote Sensing of Environment* 90: 116–125.
- Eyles GO 1983. The distribution and severity of present soil erosion in New Zealand. *New Zealand Geographer* 39: 12–28.
- Foster GR, Meyer LD, Onstad CA 1977. A runoff erosivity factor and variable slope length exponents for soil loss estimates. *Transactions of the ASAE* 20: 683–687.
- Franklin P, Stoffells R, Clapcott J, Booker D, Wagenhoff A, Hickey C 2019. Deriving potential fine sediment attribute thresholds for the National Objectives Framework. NIWA Client Report No: 2019039HN prepared for Ministry for the Environment.
- Fryirs KA, Wheaton JM, Brierley GJ 2016. An approach for measuring confinement and assessing the influence of valley setting on river forms and processes. *Earth Surface Processes & Landforms* 41: 701–710.
- Gill MA 1979. Sedimentation and useful life of reservoirs. *Journal of Hydrology* 44: 89–95.
- Guy GG 1977. Landslide investigations, Main North Line Railway, South Island, New Zealand. Unpublished MSc thesis, University of Canterbury.
<http://ir.canterbury.ac.nz/handle/10092/8095>
- Hall JE, Holzer DM, Beechie TJ 2007. Predicting river floodplain and lateral channel migration for salmon habitat conservation. *Journal of the American Water Resources Association* 43: 786–797.

- Hanson GJ, Simon A 2001. Erodibility of cohesive streambeds in the loess area of the midwestern USA. *Hydrological Processes* 15: 23–38.
- Hawley JG, Dymond JR 1988. By how much do trees reduce landsliding? *Journal of Soil and Water Conservation* 43: 495–498.
- Hickin EJ, Nanson GC 1984. Lateral migration rates of river bends. *Journal of Hydraulic Engineering* 110: 1557–1567.
- Hicks M, Haddadchi A, Whitehead A, Shankar U, 2019. Sediment load reductions to meet suspended and deposited sediment thresholds. NIWA Client Report 2019100CH prepared for Ministry for the Environment.
- Hicks DM, Shankar U, McKerchar AI, Basher L, Jessen M, Lynn I, Page M 2011. Suspended sediment yields from New Zealand rivers. *Journal of Hydrology (NZ)* 50: 81–142.
- Hooke JM 1979. An analysis of the processes of river bank erosion. *Journal of Hydrology* 42: 39–62.
- Hubble TCT, Docker BB, Rutherford ID 2010. The role of riparian trees in maintaining riverbank stability: a review of Australian experience and practice. *Ecological Engineering* 36: 292–304.
- Hughes AO 2016. Riparian management and stream bank erosion in New Zealand. *New Zealand Journal of Marine and Freshwater Research* 50: 277–290.
- Julian JP, Torres R 2006. Hydraulic erosion of cohesive riverbanks. *Geomorphology* 76: 193–206.
- Konsoer KM, Rhoads BL, Langendoen EJ, Best JL, Ursic ME, Abad JD, Garcia MH 2015. Spatial variability in bank resistance to erosion on a large meandering, mixed bedrock-alluvial river. *Geomorphology* 252: 80–97.
- Marden M, Phillips CJ, Rowan D 2008. Recurrent displacement of a forested earthflow and implications for forestmanagement, East Coast Region, New Zealand. *IAHS Publications* 325: 491–501.
- Marden M, Herzig A, Basher L 2014. Erosion process contribution to sediment yield before and after the establishment of exotic forest: Waipaoa catchment, New Zealand. *Geomorphology* 226: 162–174.
- McCool DK, Foster GR, Mutchler CK, Meyer LD 1989. Revised slope length factor for the Universal Soil Loss Equation. *Transactions of the ASA* 32: 1571–76.
- McDowell RW, Monaghan RM, Smith C, Manderson A, Basher L, Burger DF, Laurenson S, Pletnyakov P, Spiekermann, Depree C 2020. Quantifying contaminant losses to water from pastoral land uses in New Zealand III. What could be achieved by 2035? *New Zealand Journal of Agricultural Research* 0: 1–21.
- Midgley TL, Fox GA, Heeren DM. 2012. Evaluation of the bank stability and toe erosion model (BSTEM) for predicting lateral retreat on composite streambanks. *Geomorphology* 145–146: 107–114.
- Monaghan R, Manderson A, Basher L, Spiekermann R, Dymond J, Smith C, Muirhead R, Burger D, McDowell R 2021. Quantifying contaminant losses to water from pastoral landuses in New Zealand II. The effects of some farm mitigation actions over the past two decades. *New Zealand Journal of Agricultural Research* 0: 1–25.

- Nanson GC, Hicken EJ 1983. Channel migration and incision on the Beatton River. *Journal of Hydraulic Engineering* 109: 327–337.
- Nanson GC, Hickin EJ 1986. A statistical analysis of bank erosion and channel migration in western Canada. *Geological Society of America Bulletin* 97: 497–504.
- Neverman AJ, Djanibekov U, Soliman T, Walsh P, Spiekermann R, Basher L 2019. Impact testing of a proposed suspended sediment attribute: identifying erosion and sediment control mitigations to meet proposed sediment attribute bottom lines and the costs and benefits of those mitigations. Manaaki Whenua – Landcare Research Contract Report LC3574 prepared for Ministry for the Environment.
- Neverman A, Smith HG, Herzig A, Basher L (2020) Modelling baseline suspended sediment loads and load reductions required to achieve Draft Freshwater Objectives for Southland. Landcare Research Contract Report LC3749 prepared for Environment Southland.
- Newsome PFJ, Wilde RH, Willoughby EJ 2008. Land resource information system spatial data layers: data dictionary. Palmerston North, Landcare Research New Zealand Ltd. <http://digitallibrary.landcareresearch.co.nz/cdm/ref/collection/p20022coll14/id/67>
- Page MJ, Trustrum NA, Dymond JR 1994. Sediment budget to assess the geomorphic effect of a cyclonic storm, New Zealand. *Geomorphology* 9: 169–88.
- Polvi LE, Wohl E, Merritt DM 2014. Modeling the functional influence of vegetation type on streambank cohesion. *Earth Surface Processes & Landforms* 39: 1245–1258.
- Reid LM, Page MJ 2003. Magnitude and frequency of landsliding in a large New Zealand catchment. *Geomorphology* 49: 71–88.
- Renard, KG, 1997. Predicting soil erosion by water: a guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). Washington DC: United States Government Printing.
- Rosewell CJ, Loch RJ 2002. Estimation of the RUSLE soil erodibility factor. In: McKenzie N, Coughlan K, Cresswell H eds *Soil physical measurement and interpretation for land evaluation*. Melbourne, Australia: CSIRO Publishing.
- Simon A, Collinson AJC 2002. Quantifying the mechanical and hydrologic effects of riparian vegetation on streambank stability. *Earth Surface Processes & Landforms* 27: 527–546.
- Smith HG, Spiekermann R, Dymond J, Basher L 2019a. Predicting spatial patterns in riverbank erosion for catchment sediment budgets. *New Zealand Journal of Marine and Freshwater Management* 53: 338–362.
- Smith HG, Herzig A, Dymond J, Basher L 2019b. Application of a revised SedNetNZ model to the Oreti and Aparima catchments, Southland. Manaaki Whenua – Landcare Research Contract Report LC3507 prepared for Our Land and Water National Science Challenge.
- Smith HG, Spiekermann R, Betts H, Neverman AJ 2021. Comparing methods of landslide data acquisition and susceptibility modelling: Examples from New Zealand. *Geomorphology* :107660.

- Smith HG, Spiekermann R, Herzig A, Dymond J 2020. Application of a revised bank erosion model to update SedNetNZ results for Hawke's Bay. Landcare Research Contract Report LC3740 prepared for Hawke's Bay Regional Council.
- Spiekermann R, Betts H, Dymond J, Basher L 2017. Volumetric measurement of riverbank erosion from sequential historical aerial photography. *Geomorphology* 296: 193–208.
- Thorne CR 1990. Effects of vegetation on riverbank erosion and stability. In: Thornes JB ed. *Vegetation and erosion*. Chichester UK: John Wiley & Sons. Pp. 125–144.
- Trimble SW 1994. Erosional effects of cattle on streambanks in Tennessee, U.S.A. *Earth Surface Process & Landforms* 19: 451–464.
- Walker M, Rutherford ID 1999. An approach to predicting rates of bend migration in meandering alluvial streams. In Rutherford ID, Bartley R eds *Proceedings of the Second Australian Stream Management Conference*. Melbourne, Australia: Cooperative Research Centre for Catchment Hydrology. Pp. 659–665.
- Wang G, Gertner G, Xianzhong L, Anderson A 2001. Uncertainty assessment of soil erodibility factor for revised universal soil loss equation. *Catena* 46: 1–14.
- Wischmeier WH, Johnson CB, Cross BV 1971. Soil erodibility nomograph for farmland and construction sites. *Journal of Soil and Water Conservation* 26: 189–193.
- Woods R, Hendrikx J, Henderson R, Tait A. 2006. Estimating mean flow of New Zealand rivers. *Journal of Hydrology (NZ)* 45: 95–110.
- Wyn T, Mostaghimi S 2006. The effects of vegetation and soil type on streambank erosion, southwestern Virginia, USA. *Journal of the American Water Resources Association* 42: 69–82.
- Yang X, Gray J, Chapman G, Zhu Q, Tulau M, McInnes-Clarke S 2018. Digital mapping of soil erodibility for water erosion in New South Wales, Australia. *Soil Research* 56: 15870.
- Zhang X, Phillips C, Pearce A 1991. Surface movement in an earthflow complex, Raukumara Peninsula, New Zealand. *Geomorphology* 4: 261–27



Date 8 June 2021

Subject: **Towards Predator-Free Taranaki Project**

Approved by: D Harrison, Director - Operations
S J Ruru, Chief Executive

Document: 2777177

Purpose

1. The purpose of this memorandum is to present for Members' information a quarterly update on the progress of the *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki* project.
2. A presentation will be provided by officers.

Executive summary

3. On 30 May 2018, the Minister of Conservation launched the *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki* project.
4. *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki* is the first large-scale project with the long term aim of progressing towards removing introduced predators from a region.
5. Three different phases of work are continuing around the mountain, working from north to south. This item reports on the three different elements to the project: urban trapping, rural control, and zero possums.
6. Monitoring work and site-led work is continuing and Council officers have had input into several technological innovations.
7. The project has recently received a \$750,000 funding boost through 'jobs for nature' allocated through Predator Free 2050 Ltd. This has allowed for the employment of four additional internal staff and three additional external staff to be engaged in the project.
8. Year three of the rural predator control project is now complete. The completion of year three significantly increases the predator control on the western side of the maunga.
9. The mop up phase of the zero density possum programme has now moved its emphasis towards night hunting with possum detection dogs and thermal monocular. The trap barrier at Pukeiti is now functioning as it should.

Recommendations

That the Taranaki Regional Council:

- a) receives this memorandum *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki project*
- b) notes the progress and milestones achieved in respect of the urban, rural and zero density possum projects of the *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki project*.

Background

10. On 30 May 2018, the Minister of Conservation launched the *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki project*.
11. The *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki project* is the first large-scale project with the long-term aim of progressing towards removing introduced predators from the region. Supported by more than \$11 million from Predator Free 2050 Ltd (the company set up by the Government to help New Zealand achieve its predator-free 2050 goals), the Taranaki Regional Council (the Council) aims to restore the sound and movement of our wildlife, rejuvenate native plants in urban and rural Taranaki, and protect agriculture.
12. The project's ultimate aim is to eradicate stoats, rats, and possums across the region by 2050. This ambitious goal has not been attempted before, and the first phases of the project have trialled control methodologies and new tools to inform future implementation. The latest technologies – including remote sensors, wireless nodes and a trapping app - are being used to remove predators and prevent re-infestations. The high-tech equipment makes trapping more efficient, particularly in rural areas, and sends a smartphone alert to the user when the trap goes off.
13. Project work is well underway around the mountain. There are three elements to the project:
 - Rural landscape predator control
 - Urban predator control
 - Zero density possums.
14. There has been a hugely positive response from communities wanting to restore our regional biodiversity by getting behind the *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki Project* as it continues to roll out across the region. Monitoring work and site-led work is well advanced and officers have had input into several technological innovations.
15. Set out below is a summary of key progress and milestones in respect of the main elements of the project and details future work.

Urban predator control

16. The urban project continues to grow with traps distributed at public workshops, markets, schools and retail outlets in New Plymouth.
17. Two new part time community liaison officers have been employed to assist with community engagement especially in New Plymouth. These positions were funded through the governments Jobs for Nature fund.

Rural landscape predator control

18. Trap network deployment completed for year three area.
19. The completion of year three significantly increases the predator control area on the western side of the maunga.
20. Camera monitoring in Year 1 and 2 of the rural landscape predator control project indicates that there has been a greater than 90% reduction in mustelid numbers following control.
21. One new rural liaison officer has been employed to assist landowners as they take over the ongoing checking of traps. This position was funded through the governments Jobs for Nature fund.

Zero-density possums

22. The 'mop up' phase of the project is continuing and wide scale leghold trapping has been completed across the Kaitake range. The primary focus of the project within the Kaitake range is now moving from trapping to night hunting with possum detection dogs and thermal imaging monocular. The lean trap network based on remote reporting leg-hold traps continues to remove individuals, and the catch rate in this network continues to decline. Possums have now been eliminated from the farmland portion of the zero-density possum area and any incursions into the farmland area are removed as quickly as possible.
23. The trap barrier at Pukeiti has been upgraded with new magnet sensors and is now functioning as planned.
24. Collared possums in both farmland and forest are providing interesting insights into possum movement patterns and home range size, which is informing control and detection techniques.
25. One new part time field officer and three contractors have been employed to accelerate the final removal of possums from the Zero block. These positions were funded through the governments Jobs for Nature fund.

Staff changes

26. After three years as the Predator free Project Manager, Toby Shanley is leaving the team. Toby has been instrumental in setting up the project and will be missed. Recruitment has commenced for his replacement.

Decision-making considerations

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

Financial considerations—LTP/Annual Plan

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

Policy considerations

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

Iwi considerations

30. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. All eight iwi provided letters of support for the funding of this project, Council are in regular contact with both Ngāti Tairi and Ngā Mahanga regarding the Zero-density possum operation within their rohe and iwi chairs are updated through the Taranaki Mounga Board.

Legal considerations

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

Appendices/Attachments

Document 2748493: April 2021 Quarterly report to PF2050.

PREDATOR FREE 2050 Limited LANDSCAPE PROJECTS



Quarterly reporting

Project Title: Towards Predator-Free Taranaki

Report Author: Toby Shanley

Project period reported on: April 2021

Highlights of overall progress

- Year three of the rural landscape predator control project completed.
- Four new internal project staff have joined the team along with three additional positions working on the zero possum project (two managed by TMP and one contractor).
- 17 trap barrier captures over the last three months.
- Additional possum trapping work has been undertaken inside the Kaitake range in an attempt to further disrupt the residual population, resulting in the removal of an additional 53 possums for this quarter.
- The lean detection trap network in the Kaitake range is continuing to remove possums and the capture rate per month continues to decline.
- To date 508 possums have been removed by the lean detection network (75 since last quarterly report), a total of 157 possums have been caught in the barrier.
- A and B lines of the barrier have been closed and all nodes in the barrier have been replaced with upgraded nodes that include new magnet sensors and batteries.
- 9 out of the 15 possums GPS collared in Pukeiti for the g0 and sigma (σ) research project have been removed. All farmland collared possums have been removed.

Part 1 – Reporting against Project Schedule Milestones and Decision Points

1(a) Open and Completed Milestones

Code	Description	Due date	Status
TEG1	Four FTE's employed to accelerate zero programme	20-Jan-21	Completed
	All positions in place.		

Code	Description	Due date	Status
TEG6	1 FTE employed to transfer mustelid control from the Regional Council to Landowners in the suppression zone	20-Jan-21	Completed
Position filled.			

Code	Description	Due date	Status
TEG9	1 FTE employed to increase advocacy and volunteer coordination across the programme	20-Jan-21	Completed
Position filled by two part time employees (0.5 FTE each).			

Code	Description	Due date	Status
SLM1b	TRC 1st extended area for rodent control in Pukeiti chosen.	28-Feb-21	Completed
Extended area chosen, tracks cut and traps being deployed.			

Code	Description	Due date	Status
TEG4	Discuss with 'experts' possible extension scenarios for the remainder of the ring-fenced funding (\$2,432,509)	20-Apr-21	Completed
Discussions and planning are continuing for possible extension scenarios.			

Code	Description	Due date	Status
TEG7	Transfer of mustelid control from the Regional Council to Landowners in the Rural landscape predator control zones 1, 2 and 3 completed	20-Apr-21	Completed
Transfer of responsibility completed and RPMP rule due to come into force this month.			

Code	Description	Due date	Status
TEG10	Increase in direct support to householders currently trapping in their backyards	20-Apr-21	Completed
New urban community liaison positions are providing an increase in direct support to householders currently trapping in their backyards.			

Code	Description	Due date	Status
TEG11	Increase in volunteer engagement and coordination across the urban project	20-Apr-21	Completed
New urban community liaison positions are providing an increase in volunteer engagement and coordination across the urban project			

Code	Description	Due date	Status
LSM11c	Year 3 trap layout complete as per agreed control plan	1-May-21	Completed
Trap layout complete			

Code	Description	Due date	Status
LSM11d	Year 3 traps connected to wireless network as per agreed control plan	1-May-21	Completed
Year 3 traps connected to network.			

1(b) Future Milestones

Code	Description	Due date	Status
OM1b	A minimum 3:1 funding ratio to be maintained annually throughout the project	30-May-21	In progress
On track.			

Code	Description	Due date	Status
LSM11d	Year 3 traps connected to wireless network as per agreed control plan	1-May-21	In progress
Approx. 80% of traps connected.			

1(c) Decision Points

Code	Description	Due date	Status
LSDP5a	Measurable increase in indicator bird species abundance, as per agreed monitoring plan	1-Nov-20	In progress
Results are to be provided to MWLCR for analysis.			

Code	Description	Due date	Status
UPDP7a	Measurable increase in indicator bird species abundance, as per agreed monitoring plan	1-Nov-20	In progress
Results are to be provided to MWLCR for analysis.			

Code	Description	Due date	Status
UPDP8a	Canopy condition assessment, as per monitoring plan shows recovery of canopy over time	1-Nov-20	In progress
Preliminary canopy monitoring completed.			

Code	Description	Due date	Status
ZDDP3	Zero possums detected in control blocks A,B,C, as per agreed monitoring plan	31-Dec-20	In progress
Detections are continuing to be followed up near the boundary of the national park and the lean detection trap network is continuing to remove individuals within the national park. Additional trapping work has been undertaken inside the national park in an attempt to further disrupt the residual population.			

Code	Description	Due date	Status
ZDDP6a	Evidence that zero possum density is being maintained within Blocks A,B,C; monitoring plan revised (with associated new milestones and decision points) as necessary	30-Nov-20	In progress
Varied along with ZDDP3			

Code	Description	Due date	Status
SLDP1b	Rodent numbers in 1st extended area of the Pukeiti landscape (100ha) are below a 5% tracking card index.	1-May-21	In progress
Tracking tunnel monitoring scheduled for mid-April.			

Part 2 – Reporting against other operational requirements

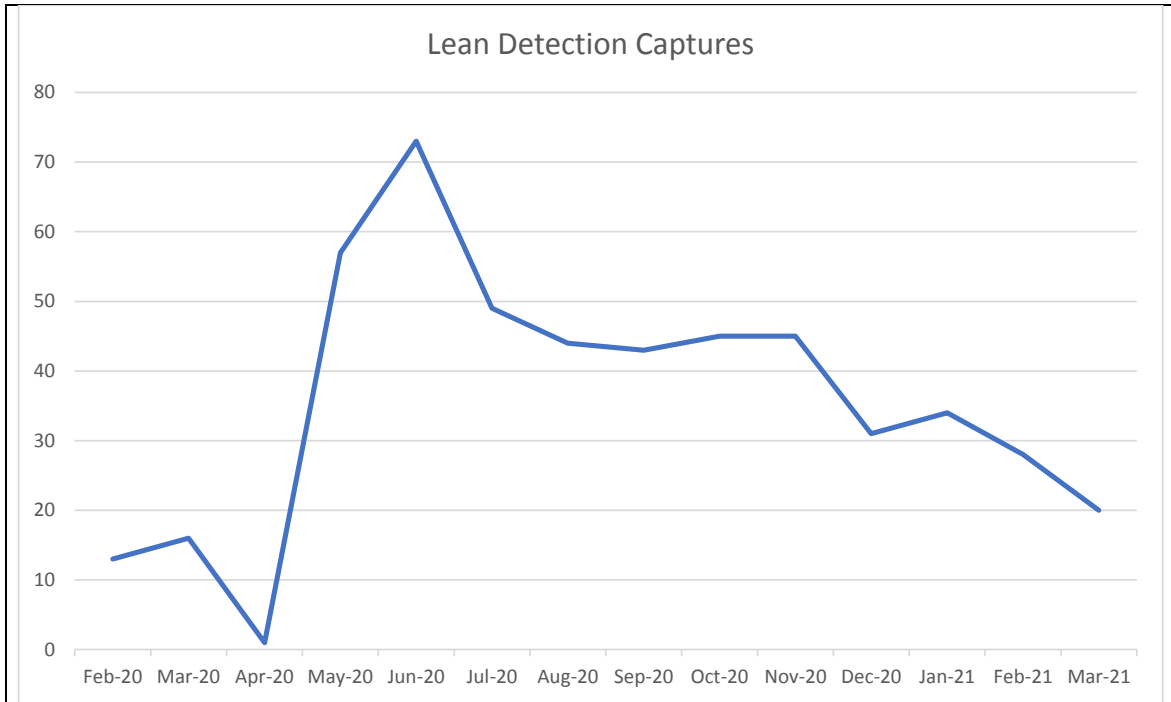
Health and Safety
<p>All staff and contractors involved in the project are regularly reminded to ensure all incidents and near misses are reported on.</p> <p>One incident:</p> <ul style="list-style-type: none"> Staff member slipped down a small bank while working in the bush.

Financial performance
<p><i>Please attach spreadsheet showing the details of project income and expenditure for the period in the financial template provided.</i></p> <p>Is Project financial performance proceeding as planned? Yes If No, please provide details</p>

Employment created			
<i>Estimate number of FTEs currently paid to deliver the project including contractors.</i>			
FTEs	Total at last quarter	Increase/decrease since last quarter	Total at this quarter
Internal	11	-1	10
External	20	+0.5	20.5

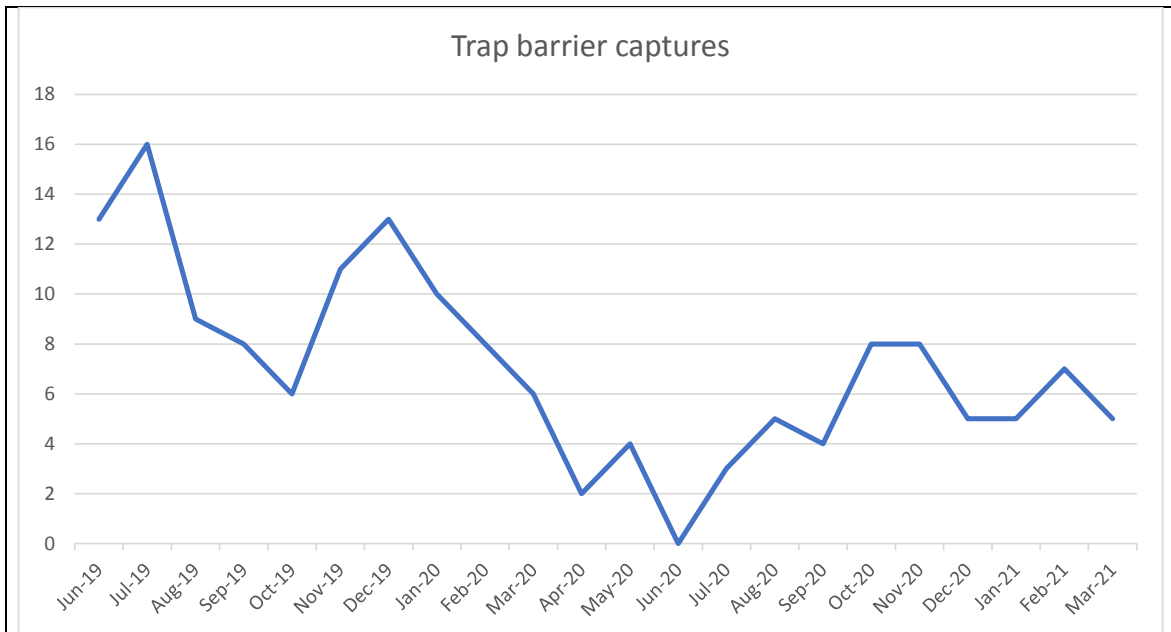
Innovation, learnings and research
<p>The g0 and sigma (σ) project within Pukeiti concluded in late December and MWLCR technicians have managed to live capture three of the collared possums and take them into captivity for further study as part of the 'Eradication Science' MBIE Endeavour project. The remaining collared possums are being removed by night hunting using telemetry tracking, a possum detection dog and a thermal monocular. Out of the 15 collared possums 6 are yet to be removed.</p> <p>This quarter also included a meeting at MWLCR to set the research priorities for next FY.</p>

Eradication progress
<p>The project is continuing with the survivor mop-up phase. The lean detection network in the Kaitake range continues to remove possums from inside the national park and the numbers caught per month continues to decline (see graph below). Additional trapping work has been undertaken inside the national park in an attempt to further disrupt the residual population within the national park. This has resulted in an additional 53 possums being removed since the last quarterly report.</p>



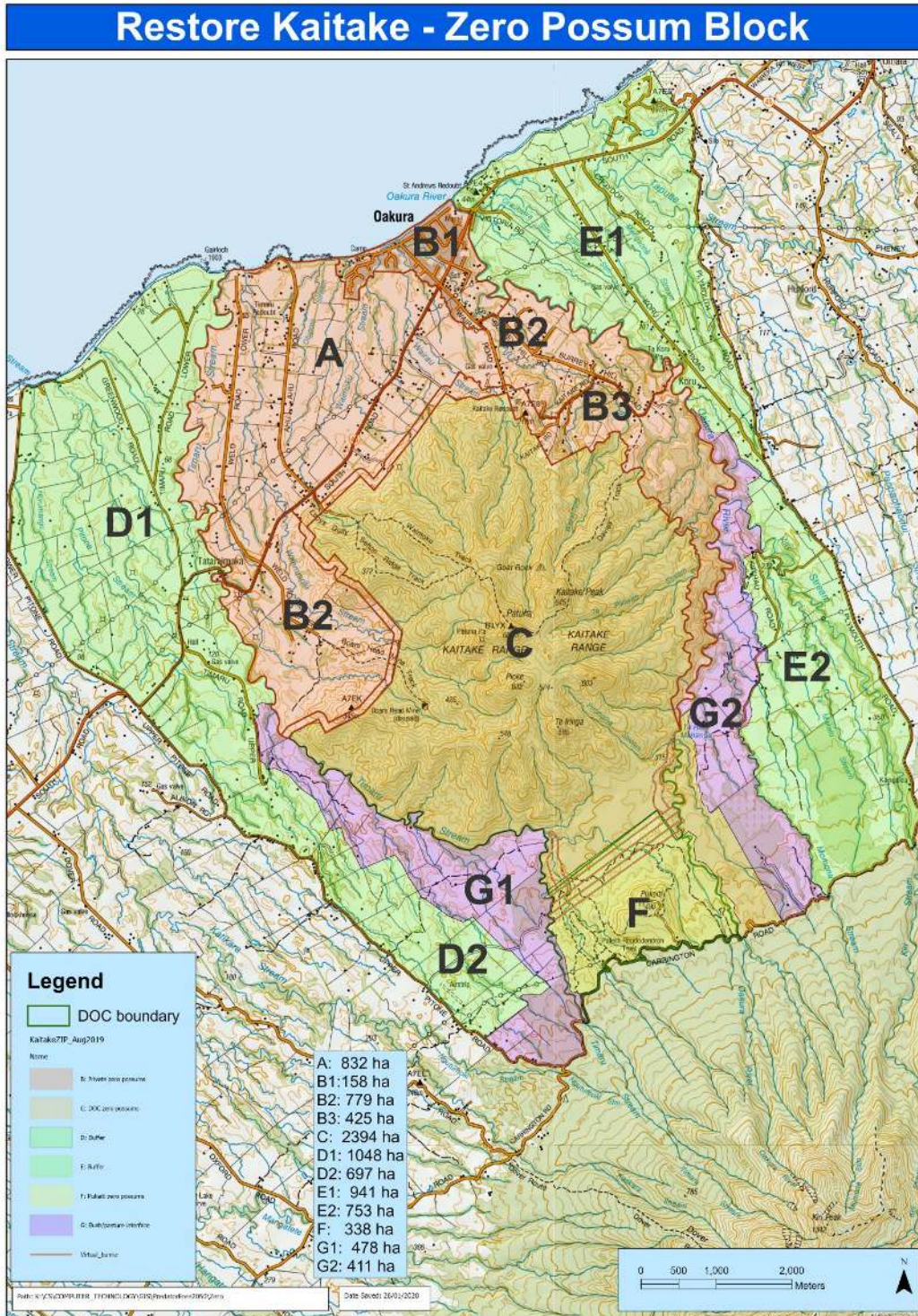
In the A block of the zero area the one active possum camera detection has resulted in the removal of one adult and one juvenile possum by night hunting with a possum detection dog.

The trap barrier capture rate has remained steady this quarter at around 6 possums per month (see graph below). All nodes in the barrier have been replaced with nodes that contain the new type of magnet sensor which will hopefully prove more reliable. For now both A and B line of the barrier have been turned off, but the traps, platforms and ramps remain in place.



Efforts in the farmland part of the zero density area will continue to focus on camera detections and then following up on individuals when detected. The mop up effort in the farmland is focused on the B2 and B3 blocks (see map below) with a combination of intensive trapping and night hunting using possum dogs and thermal imaging monocular.

Target species	Hectares	Remove		Protect	
		Removal progress % estimate	Mop up progress % estimate	Date of last proof of freedom	Number of incursion events to date
Possum	4500	100%	80%	n/a	n/a
Stoat					
Rat					





Date: 8 June 2021

Subject: **Review of Council's approach in managing Pampas**

Approved by: D Harrison, Director - Operations
S J Ruru, Chief Executive

Document: 2771001

Purpose

1. The purpose of this memorandum is to inform members of the issues caused by the pest species Common Pampas (*Cortaderia selloana*) and Purple Pampas (*Cortaderia jubata*) and the programmes in which the Taranaki Regional Council (the Council) undertake to ensure and promote the management of this and other non-regulatory species in the Taranaki region.

Executive summary

2. Council members may recall that at the previous Policy and Planning meeting officers were requested to report back on the management of Pampas in the Taranaki region, the reasoning for Pampas not currently being identified as a pest species in the *Regional Pest Management Plan for Taranaki* (Pest Plan) and instead being identified in the *Taranaki Regional Council Biosecurity Strategy* (the Strategy).
3. Pampas was introduced in to New Zealand and was commonly used for ornamental and decorative purposes. In the Taranaki region, farmers and land occupiers often used Pampas as shelterbelts and for live fences.
4. Pampas is an invasive species and can become a threat to native vegetation and prevent the regeneration of native seedlings. Pampas can also be an issue in forestry areas where it can disrupt the growth of production species.
5. The Pest Plan is a regulatory document, which contains rules for the control of pest species within the Taranaki region, the Strategy is a non-statutory document that complements and supports the Pest Plan.
6. Historically, Pampas has been controlled in the Pest Plan using rules. Following a review of the Pest Plan and the Strategy in 2017 Pampas was taken out of the Pest Plan and is now identified as a 'harmful species' in the Strategy.
7. Pampas is now actively managed in the Strategy using a site-led voluntary approach. Officers believe that this method of management is most appropriate given how widespread it is in Taranaki and without imposing significant costs on land occupiers who may otherwise not be adversely effected by Pampas.

Recommendations

That the Taranaki Regional Council:

- (a) receives this memorandum entitled *Review of Council's approach in managing Pampas*;
- (b) notes the Council's historic approaches in managing Pampas through the Pest Plan and the Strategy;
- (c) notes the current programmes and responses undertaken by the Council under the Strategy relating to the management of Pampas within the Taranaki region; and
- (d) notes the merits in not declaring Pampas in the Pest Plan.

Background

8. At the Policy and Planning Committee meeting of 27 April 2021, Councillor N W Walker requested (and it was agreed) that officers review and report back to Council on the history of managing Common Pampas (*Cortaderia selloana*) and Purple Pampas (*Cortaderia jubata*) in the region, the rationale for not identifying the species as a pest in the *Pest Management Plan for Taranaki 2018* (the Plan), and the merit of that decision. This memorandum gives effect to that request.
9. Common Pampas and Purple Pampas are tall-growing, cutting grasses, native to South America, with erect seed heads and white, pink or purple flowers. Pampas threatens indigenous biodiversity values in coastal areas where Pampas cannot be easily shaded out and/or managed. It is a particular threat on coastal cliffs, islands and sand dune habitats but can also affect wetlands, and scrub and forest margins. It is an extremely resilient and invasive species that is tolerant of most soil types, heat, salt, wind, wet and drought conditions.
10. Accordingly, Pampas are widespread throughout Taranaki, where it is planted along rural property boundaries. Many dairy farms have Pampas hedges as a windbreak or around their dairy effluent ponds either as a screen or as a device to create a microclimate. In 2016 it was estimated that the total length of Pampas shelterbelts would be at least 70,000 metres.
11. In uncontrolled circumstances, Pampas establishes where there is bare soil (e.g. from soil disturbance) and/or increased light levels. It is, particularly, noticeable on roadside verges where the plants reduce visibility and can then encroach on to other areas, including conservation areas, areas being prepared for forestry replanting and recreational walking and cycling tracks.
12. The Council has two plans in which it can effectively manage pest and plant species. The Pest Plan is a regulatory document containing rules and management programmes for 20 'pest' animal and plant species. The Strategy is a non-regulatory document, which supports the Pest Plan and includes mandatory and discretionary programmes for biosecurity management in Taranaki.
13. Set out below is further discussion, on the scale and intensity of adverse unintended potential or actual impacts of Pampas in the region and the rationale behind declaring it as a 'harmful organism' in the Strategy.

What is the problem?

14. A weed can generally be considered as any plant in the wrong place at the wrong time. Pampas have previously been a popular ornamental plant and was deliberately

introduced across New Zealand by early settlers for the purpose of shelter and stock fodder. In Taranaki, it was commonly used as a windbreak or for screening.

15. However, as previously noted, Pampas is a highly competitive and invasive species that produce adverse effects on biodiversity and economic opportunities within the region:
 - (a) **Conservation impacts:** Pampas will suppress the growth of other vegetation and is known to affect the structure, species composition and native regeneration on sites with high conservation value. It is also commonly observed along roadside verges, riparian areas, shrubland and canopy gaps in forested areas.
 - (b) **Economic impacts:** Pampas may impact on plantation forestry. It interferes with afforested areas and will compete with newly planted forestry species (slowing or causing uneven tree growth) and reduce accessibility and establishment reducing the overall production yield. The plant offers other benefits to farmers as providing living edges and shelterbelts. As Pampas is palatable to stock it often only infests steep inaccessible areas. This often is the only vegetation in these areas and aids in erosion control.

History of management in the region

16. Prior to 2001 Pampas was not included in the first Pest Management Strategy with ragwort, thistles and gorse being the main focus of regional rules
17. In 2001, the new *Pest Management Strategy for Taranaki: Plants* stated that as of 1 July 2004, strategy rules would take effect requiring land occupiers throughout Taranaki to control Pampas wherever it appears on the property - unless the plants were being used as a hedging plant for live fencing.
18. Under this rule, land occupiers were required to destroy all adult and juvenile forms of the plants on occupied land. The occupiers were required to maintain and trim any hedges or shelterbelts consisting of Pampas to prevent those plants from flowering. This rule also made it an offence for any person to knowingly distribute, propagate, sell, or offer for sale, or hold in premises (where plants are offered for sale) the Pampas plant.
19. A subsequent plan review in 2007 amended the rule and introduced a stricter regulation so that land occupiers were not allowed to keep Pampas for hedging or live fencing - effectively requiring all land occupiers to destroy Pampas grass irrespective of its purpose or whether it was intentionally planted or not.
20. In the latest review, carried out in 2018, the Council released and consulted on a proposal that, amongst other things, recommended identifying Pampas as a pest and a good neighbour rule requiring land occupiers to destroy any infestations 2,000 metres off the property boundary. This would allow for protection of adjacent indigenous biodiversity and/or production forestry values where the land occupier is controlling the plant.
21. However, public submissions, including a submission by Federated Farmers, opposed the sustained control management programme because of the high costs this approach imposed on farmers despite the plant being of low impact (and in some cases even providing benefits to the farm environment) in these areas. In their submission, Federated Farmers also noted that the benefits to be gained by the regulated approach could be achieved at less cost to farmers through a site-led non-regulatory approach that targeted areas where the existence of Pampas has the highest impact.

22. In 2018, the Council granted the relief sought by Federated Farmers and removed Pampas from sustained management in the *Proposed Regional Pest Management Plan* and instead be included and addressed through targeted site-led programmes in the Strategy.
23. Pampas is now managed through site-led non-regulatory and community advocacy programmes.

Current management approach

24. As noted above, Pampas is currently being managed through the Strategy, which identifies it as a 'harmful species'. In accordance with that Strategy, Council undertakes a suite of regulatory and non regulatory actions including enforcement, advocacy and site led management programmes.
25. Currently, Pampas is declared as an "unwanted organism" under the *Biosecurity Act 1993* and in the National Pest Plant Accord (NPPA). As a result, the Council (and other regional councils) inspect and enforce a ban on the distribution, sale or propagation of the plants in New Zealand. Every year, Council annually inspects all plant nurseries in the region to ensure no Pampas is being grown or sold.
26. The Council further undertakes a community advocacy / engagement programme promoting the voluntary control of all invasive species such as Pampas and provides information to facilitate its control.
27. The Council also undertakes direct control through its site-led Key Native Ecosystem programme. That is the Council in conjunction with the land occupier will destroy any infestations of Pampas (and other invasive species) in accordance with a biodiversity plan. Pampas control is promoted by officers for the protection of indigenous biodiversity values in areas identified as being regionally significant, e.g. wetlands, Key Native Ecosystems and coastal areas.

Appropriateness of management approach

28. In deciding to switch to the current management approach, Council considered and assessed a range of management options for Pampas – they included two regulated methods, one non-regulatory method, and also the *status quo* approach.
29. A summary of the findings from this assessment are detailed below:

Good neighbour rule

- (a) This method involves the adoption of a rule that would require landowners and occupiers to destroy all Pampas within 2km of their property boundary. While the approach was expected to have high benefits it was also noted that the costs on land owners would also be high. There would also be high costs that could be imposed on the Department of Conservation (DOC), landowners and occupiers associated with the Council having to monitor compliance with the rule. It was also noted that, in a study by Waikato University, Pampas seeds could still be dispersed over large areas and therefore had the potential to undermine the management approach over time if adopted. This option was therefore considered a too costly and impractical option for boundary control.

General rule

- (b) This method involves the adoption of a rule that would require any new infestation of Pampas to be destroyed and any existing hedgerows or shelterbelts be prevented

from flowering. An assessment of this option concluded that the benefits would be moderate despite high costs for landowners and occupiers. There would also be high costs that could be imposed on DOC and landowners and occupiers associated with Council having to monitor compliance with the rule. With low expected efficiency and effectiveness and high costs, this option was not considered appropriate for the management of Pampas.

Site-led non-regulatory approach

- (c) This method does not specify a rule or regulation which must be adhered to, however, relies on a targeted, non-regulatory approach that identifies sites of regional significance and/or areas supporting national initiatives such as native conservation areas, wetlands and sand dunes for management. This approach was considered cost effective with high, although site specific benefits. As it is a non-regulatory approach, no compliance costs would be imposed on the DOC or landowners or occupiers.

No regulation

- (d) This approach would see Pampas addressed as one of many invasive plant species (but no 'pest' status) through regulatory and non regulatory programmes under the Strategy. Compliance costs would be significantly lower however, the control of Pampas is at the discretion of land occupiers and other interested parties.
30. The impacts on landowners and the public from Pampas will differ across the region according to the significance and values associated with a site. By choosing a site-led approach, areas of significance can be targeted without unnecessary compliance costs being imposed on farmers and land occupiers (whom are not significantly impacted upon and in terms of stock shelter have a need for Pampas).
 31. As Pampas predominantly affects indigenous biodiversity and, to a lesser extent, forestry production values, this approach allows resources to be allocated to protect values at different sites, while not interfering with individuals ability to undertake their own control.
 32. This approach also recognises that the Council has finite resourcing and, where compliance and monitoring costs are high, should consider other available options that achieve appropriate results. In the past, the costs of regulatory enforcement of rules for Pampas was considered an inefficient investment of time and money especially considering that in 2016 it was estimated that there was 70,000 metres of Pampas shelter belts across the region.
 33. Through identifying Pampas as a 'harmful species' in the Strategy, control can be strategically focussed on a site-led basis to protect particular values of a site or area of regional significance. This allows the Council to work with communities by providing a suite of advisory, extension, direct control and other assistance to support successful biosecurity outcomes.
 34. Officers are developing a public awareness campaign for the Strategy pests including Pampas.

Financial considerations—LTP/Annual Plan

35. This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included

in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

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

Iwi considerations

37. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum.

Community considerations

38. This memorandum and the associated recommendations have considered the views of the community, interested and affected parties and those views have been recognised in the preparation of this memorandum.

Legal considerations

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



Date: 8 June 2021

Subject: **Council works supporting the protection of Kororā in Taranaki**

Approved by: A D McLay, Director - Resource Management
S J Ruru, Chief Executive

Document: 2778429

Purpose

1. The purpose of this memorandum is to identify the work that has been undertaken by the Council in protecting the Kororā (otherwise known as the Little Blue Penguin, Northern Blue Penguin or just the Blue Penguin) and to introduce to Members the document *Coastal structure maintenance: Guidance for planning works with regard to Kororā/Blue Penguins* which is appended to this memorandum.

Executive summary

2. The *Proposed Coastal Plan for Taranaki* (the Proposed Plan) requires the management of activities in the coastal marine area that does not create adverse effects on significant indigenous biodiversity, of which the Kororā is included.
3. Kororā are listed as 'at risk (declining)' under the New Zealand Threat Classification System. This is due to periods of heightened vulnerability during the breeding, nesting and moulting stages within their life cycle, where they depend upon safe and undisturbed burrows.
4. The Council can manage effects on the Kororā through the consenting process, however, relies on plan users to appropriately manage permitted activities in a manner that avoids adverse effects.
5. Since the notification of the Proposed Plan, Council officers have identified opportunities to further assist plan users undertaking permitted maintenance activities to ensure good outcomes for the Kororā.
6. To enhance awareness and encourage education, Council officers have identified areas around Taranaki where Kororā hotspots are located and included them on the publicly accessible Biodiversity portal with accompanying fact sheet.
7. The Council has also prepared guidance material on how plan users conducting permitted maintenance through the Proposed Plan should undertake that activity, having specific consideration to the vulnerabilities of Kororā and how best to avoid disturbing them.

8. This material will be distributed to all consent holders who have structures that are likely to require the use of the permitted maintenance rule and will also be available generally to the public through the Council's web page.
9. The guidance material has been prepared with the assistance of officers from the Department of Conservation (DOC) and recognises the overlapping interest that DOC (and other agencies) have in protecting the Kororā.

Recommendations

That the Taranaki Regional Council:

- a) receives this agenda memorandum on titled *Council works supporting the protection of Kororā in Taranaki*;
- b) notes that the attached guidance document will be made available on the Council's website and will be provided directly to consent holders who have relevant coastal permits
- c) notes that this guidance material has been prepared with the assistance of officers from the Department of Conservation and recognises the overlapping interest that DOC (and other agencies) have in protecting the Kororā.

Background

10. At the Policy and Planning Committee meeting of 27 April 2021, Members discussed responsibilities for the management and monitoring of Kororā (otherwise known as Little Blue Penguins, Northern Blue Penguins or just Blue Penguins). As noted at the meeting, the Council is doing considerable new work that has a direct bearing on the protection of Kororā much of it arising out of the review of the Coastal Plan.
11. Northern Blue Penguins are listed as 'At Risk (Declining)' in the New Zealand Threat Classification System and the Little Blue Penguin is also listed as absolutely protected under the *Wildlife Act 1953* which is administered and enforced by the Department of Conservation.
12. The greatest threat to Kororā are introduced predators such as dogs, cats, ferrets and stoats. However, coastal development and the associated loss of natural habitat is also affecting the species.
13. Kororā are particularly vulnerable during the life stages of breeding, nesting, and moulting. During these periods (which take place over much of the year), Kororā seek refuge in their burrows. The safety and shelter of the burrow is critical for the survival of the adults and their offspring.
14. Kororā create burrows along much of the Taranaki coastline, with nesting "hotspots" often occurring near river mouths and other sheltered parts of the coast. Kororā commonly burrow in and amongst man made coastal structures such as boulder rip rap walls and groynes, as well as underneath houses and other structures. This overlap with penguins and people therefore poses an issue which must be managed.
15. Currently, the Taranaki Regional Council (the Council) is undertaking or is in the process of undertaking a number of initiatives that it hopes will contribute to the better protection of Kororā in the region. These initiatives include completing the review of the Coastal Plan (currently in appeals through the Environment Court), the development of a biodiversity portal that identifies, amongst other things, the location of 'hotspots' of

Kororā, and the development of guidance material for plan users. Further information on these initiatives is provided below.

Proposed Coastal Plan provisions

16. The *Proposed Coastal Plan for Taranaki* (the 'Proposed Plan') contains new policies and rules that significantly increase the protection of indigenous biodiversity in the region, and particularly significant indigenous biodiversity that includes threatened species such as the Little Blue Penguin. Of note, the rules apply to activities in the coastal marine area (mean high water springs out to 12 nautical miles) while the policies for indigenous biodiversity apply to the wider coastal environment, which includes the landward component.
17. Objectives 8 of the Proposed Plan states:
Indigenous biodiversity in the coastal environment is maintained and enhanced and areas of significant indigenous biodiversity in the coastal environment are protected.
18. The policies and rules that flow from this objective provide additional considerations and directions on how this objective is to be achieved, including by identifying species of significant indigenous biodiversity which require protection, of which, the Kororā/Little Blue Penguin is included.
19. The Proposed Plan allows the maintenance, minor alteration and minor extension of structures in the coastal marine area without the need for a consent (under Rule 35).
20. The purpose of this rule is to ensure that infrastructure is kept in good repair and encourages consent holders who may have conditions on their coastal permits to be proactive in their management.
21. However, to adhere to the permitted standard, the rule requires (amongst other things) no adverse effects on significant indigenous biodiversity, which includes the Kororā/Northern Blue Penguin/Little Blue Penguin.
22. Recent activities at the Port and other areas along the New Plymouth foreshore have highlighted the need to support plan users in being able to comply with the conditions of the permitted activity rule in order to prevent adverse effects on the Kororā.

Mapping Kororā

23. The Council is aware of several hot spot locations for Kororā around Taranaki. These 'hotspots' consist of known locations where communities of Kororā are known to be present.
24. These 'hotspots' were identified through officer knowledge as well as through iNaturalist (a web based tool which allows members of the community to log sightings and assist in the development of databases for a huge variety of species).
25. To support the implementation and application of the Proposed Coastal Plan, known Kororā hot spots (amongst other known coastal bird hotspots) in Taranaki are identified for Plan users and others on the TRC maps biodiversity portal under the layer titled 'coastal bird feeding and nesting areas'.
26. The biodiversity portal is accessible at:
<https://maps.trc.govt.nz/LocalMapView/?map=8c336441e5d44a699354ef777d8ac86>
8. In brief the biodiversity portal shows Kororā are particularly prevalent between Opunake to the south and Mohakatino to the north. The portal identifies hotspots at:

- a) Opunake Mangahume Stream to Otahi Stream
- b) Oakura Pitone Stream to Corbett Park;
- c) New Plymouth Back beach to Huatoki Stream;
Strandon Waterfront Lookout to New Plymouth Airport;
- d) Onaero Motukara Stream to passed Onaero River and ~700m inland;
Urenui 1.5 km coastline at township and 1.3 km upstream;
- e) Mimi ~1.8 km of coastline at Mimi river and ~800 m upstream;
- f) Waiiti Waiiti Stream to 800 m passed Papatiki Stream;
- g) Waikaramaramara Waikaramarama Stream and 200 m upstream;
- h) Whitecliffs Waipingau Stream to the Te Horo Stock tunnel;
- i) Tongaporutu 2 km of coast at Tongaporutu River and 2.5 km upstream;
- j) Rapanui 700 m of coast at Rapanui from River and 600m upstream;
- k) Mohakatino Kuwatahi Stream to Pukerewa Stream;
Mohakatino River 1km of coast and 1 km upstream.

However, more hotspots may exist, or may become established over time and will be included in the portal as the information becomes available.

Guidance material

- 27. Guidance material is any information package created by the Council to support the implementation of rules and policies within a Regional Plan. At present, there is no existing guidance material for the Proposed Coastal Plan, however, it is expected that more material will be prepared and distributed over time as areas of need are identified.
- 28. It is also expected that guidance material will be prepared in conjunction with drafting the Natural Resources Plan, which incorporates the Air, Freshwater and Soil Plans for Taranaki.
- 29. Guidance material will assist plan users in understanding the intent behind and implementation expectations of rule conditions or policies. Guidance will focused on providing clear directions to users and ensuring that Council expectations are made as simple to follow as possible.
- 30. In particular, guidance material is helpful for permitted activities, where conditions cannot be tailored on a case-by-case basis through consenting, however, relies on the user to interpret and appropriately implement the conditions of the rule.
- 31. Guidance may be targeted to certain plan users, topics or may be more general. In this instance, the guidance material is largely targeted to consent holders who own or operate structures in the coastal marine area, in particular, those that are proximate to identified penguin hotspot areas.
- 32. This guidance material aims to address maintenance activities in the coastal marine area which may result in adverse effects on the Kororā (which are to be avoided) in order to establish a process for plan users to use to ensure that adverse effects can be avoided.
- 33. For the guidance material appended to this Agenda item: *Guidance for planning maintenance, minor alteration or minor extension works with regard to Little Blue Penguins* (at

Appendix 1), the purpose is to assist plan users in carrying out their maintenance activities so that there will be no adverse effects on Kororā/Little Blue Penguins.

34. For this to occur, it is expected that plan users will absolutely avoid certain times of the year that correspond with important and vulnerable life stages for the Kororā and will also undertake site assessments to detect any sign of the blue penguin in the area. If further assessment is required, the guidance material identifies two handlers who operate penguin detection dogs who can offer more certainty for the assessment.
35. While guidance material is not regulation and is therefore not enforceable, it is expected that the material will assist plan users to better prepare for maintenance activities.
36. If adverse effects on Kororā cannot be avoided, then the activity cannot occur as a permitted activity and it is likely that a consent would be required so that a more specific Kororā management plan (which may include relocation of penguins) can be prepared. An example of this type of management practice has been demonstrated at Napier Port in 2019¹ where the regional council, local iwi, the Department of Conservation and the Port staff came together to implement an avian management plan.
37. Concern over the welfare of Kororā in resource management practices has been highlighted over recent months following protests at Waiheke Island where members of the community have protested the construction of a new marina and occupied the area of concern at Kennedy Point for over a month.
38. While this guidance material, does not intend to address activities of this magnitude (which would be addressed through a consented pathway) it highlights community expectations to consider and manage activities in a way that is appropriate and provides good outcomes for Kororā.
39. Noting the above points, this guidance material is timely and it has allowed the Council to feed into other activities regarding Kororā taking place around Taranaki. It is clear that education will be ongoing, however, setting clear expectations will go some way to enhancing community awareness and creating a sense of responsibility and ownership for the wellbeing of these important taonga.
40. The guidance material will be distributed to all affected consent holders as appropriate, to local Department of Conservation rangers and will also be shared broadly with local interest groups. Lastly, the guidance material will also be available to the public via the TRC website, under the Coastal Plan web page at: www.trc.govt.nz/coastal-plan-review-2/ where it will be given appropriate visibility for plan users going forward.
41. The notification requirement for permitted activities also ensures that Council officers are aware of works proposed to be undertaken and can provide the material on a case-by-case basis as required and check in with those using the guidance material to ensure that it is achieving its purpose and providing greater clarity to the community.

Financial considerations—LTP/Annual Plan

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

¹ https://www.napierport.co.nz/wp-content/uploads/2019/09/FINAL_Avian-Management-Plan_6-Wharf_Ver-2_HBRC-Certified.pdf

Policy considerations

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

Iwi considerations

44. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum.

Community considerations

45. This memorandum and the associated recommendations have considered the views of the community, interested and affected parties and those views have been recognised in the preparation of this memorandum.

Legal considerations

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

Appendices/Attachments

Document 2628497: Coastal structure maintenance: Guidance for planning works with regard to Kororā/Blue Penguins



Coastal structure maintenance

Guidance for planning works
with regard to Kororā/Blue Penguins



Guidance for planning works with regard to kororā (Little Blue Penguins)

If you're maintaining or altering a structure on the coastline, you must ensure that your project does not adversely affect significant indigenous biodiversity.

This leaflet gives guidance on what you should do to avoid disturbing or harming little blue penguins, or kororā, which nest along much of the Taranaki coastline and are particularly vulnerable to disturbance.

There are several kororā hotspots along the Taranaki coast, mostly in and around estuaries and built-up areas around New Plymouth, such as Port Taranaki. The known hotspots are mapped in the Taranaki Regional Council (TRC) Biodiversity Portal. Go to www.trc.govt.nz/seabird-areas (select 'Layers', then 'Biodiversity', then 'Coastal bird feeding and nesting areas', then 'Little blue penguin'). However, more hotspots may exist in other areas that are yet to be identified.

Kororā commonly burrow in and among man-made coastal structures such as rock walls, as well as natural coastal habitats. So they can be right in among structures that may require maintenance works at some time.



Protecting kororā is your legal obligation

While you generally don't need a resource consent to carry out maintenance, minor alterations or minor extensions to a structure which may be partly or entirely in the coastal marine area (the 'wet bit' below high-tide mark), there are still conditions you must follow. The key one is that the work must have 'no adverse effects on significant indigenous biodiversity'. That includes kororā.

It's all set out in Rule 34 of the Taranaki Regional Council's *Proposed Coastal Plan for Taranaki*, which has the force of regulation under the Resource Management Act. Non-compliance with Coastal Plan rules may result in enforcement action up to and including prosecution.

Taranaki Regional Council (TRC) and the Department of Conservation

The TRC manage activities in the coastal marine area such as structures and disturbances that may affect the kororā. However, the Department of Conservation (DOC) has separate responsibilities in protecting kororā under the Wildlife Act.

If you have concerns about the welfare of native wildlife please contact **DOC's hotline 0800 DOC HOT (0800 362 468)**.

Separately, the *Wildlife Act 1953* classifies blue penguins as absolutely protected, making it an offence to interfere, handle, injure or kill them or to disturb or destroy their nests.

For some infrastructure, ongoing maintenance of a structure may be a requirement of the consent. However, all maintenance works must be consistent with the rules of the Plan.

So it's worth taking the time to understand the TRC and communities expectations for how maintenance works should be managed to keep kororā safe, and the process to follow if the kororā are discovered.

Notification required



You must give the TRC at least five working days' notice before beginning any maintenance, minor alterations or minor extensions to a coastal structure, however, the TRC recommends that you provide notice as early as possible.

Follow the link at www.trc.govt.nz/notifycouncil.

You must tell us what you're planning to do, and where and when. This includes a description of the area and any assessments on whether significant indigenous species, including kororā, are in the locality. Attaching images or drawings to the notification form can be helpful for explaining the proposed works. Such an assessment is critical to ensuring the avoidance of adverse effects. If no assessment has been made, we will advise you to undertake one consistent with the recommendations included in this guidance before continuing with the work.

If no assessment is carried out and the work results in adverse effects to significant indigenous biodiversity, the TRC will take enforcement action for not complying with conditions of the rule.



How to tell if penguins are near

Kororā burrows are typically occupied for most of the year, except for a short window in autumn when kororā remain out at sea. During burrow occupation, there are two distinct life stages of kororā – nesting (breeding) from winter to spring and moulting in summer as shown in Table 1 below.

Therefore, the TRC will recommend that in most cases work be preferentially planned for late summer-autumn, and that no work is planned for the winter-spring nesting season.

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
●●	●	●			●	●	●	●	●	●●	●●
● – Nesting ● – Moulting											

Table 1. Note that this table is indicative only and generally shows nesting and moulting for kororā across a year. Depending on seasonal variability exact timing may vary; therefore these timings should not be solely relied upon.



During the nesting season, kororā are particularly vulnerable to disturbance. If disturbed, nests can be abandoned and the probability of chick survival is greatly reduced.

During the moulting period, kororā remain in their burrows without going out to sea to fish while their new feathers come through. Although this is also a sensitive time, by this point the chicks have fledged and so nest abandonment is not such a significant concern, however, they cannot swim and therefore are unable to feed so are still sensitive.

Burrows are typically well hidden under rocks and scrub, and penguin movements occur under the cover of darkness, so they're often difficult to detect.

The TRC's biodiversity portal contains identified kororā ('Little Blue Penguin') hotspots. These are areas where communities of kororā are known to congregate and confirmed sightings have been made. Other hotspots may become established over time or their range may extend so remember to check back regularly whenever you are thinking about undertaking maintenance or alteration works.

To find the kororā 'Little Blue Penguin' layers go to www.trc.govt.nz/seabird-areas (select 'Layers', then 'Biodiversity', then 'Coastal bird feeding and nesting areas', then 'Little blue penguin' see Figure 1 below).

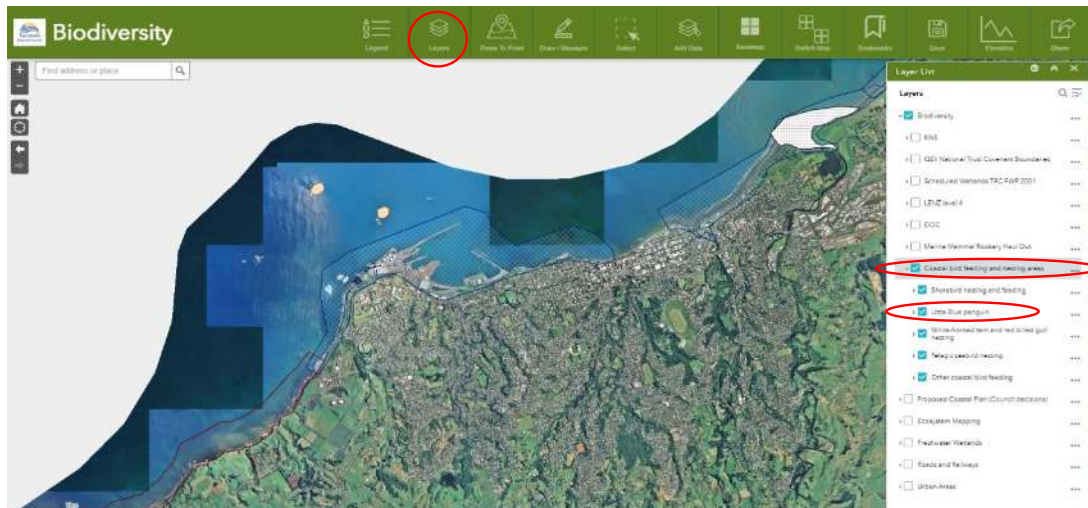


Figure 1 Screen shot of the biodiversity portal with coastal bird feeding and nesting areas selected

Kororā/Penguin presence assessment



It is best to get in contact with the marine ecologist at the Council in the early stages of planning the maintenance in order to discuss the penguin assessment. It is recommended that you conduct your own initial assessment using the information below, however, note that the Council may make additional recommendations on a case-by-case basis.



INSPECT

Go to the location several days before planned works. Look for any open crevices, dug areas or scrub that a kororā could fit into. Kororā are small, only 25 cm tall, so they can fit into lots of small spaces. Get right in close and take your time. Undertake another full assessment immediately prior to undertaking works to ensure that no kororā have taken up residence in the meantime.



FEATHERS

Feathers may be present during moulting months (November to March) when adults and chicks moult their non-waterproof feathers which can be found in and around their burrows.



FOOTPRINTS

Kororā footprints are easiest to spot after sunrise, before the wind or tide can erase them. They typically go straight from the sea to the burrow and vice versa. They are about 5.5 cm in length. Look for three distinctive claw marks and a well rounded heel. The angle of each footprint (between the 1st and 3rd toe) is about 75° and is narrower than most other coastal birds.



DETECTION DOG

The most reliable assessment for kororā is carried out by a penguin detection dog and handler. These specially trained dogs can detect occupied burrows.

Contact details:

Joanna Sim
021 073 2023
dabchicknz@gmail.com

Alastair Judkins
027 937 4833
Kaikourakori@gmail.com



SOUND

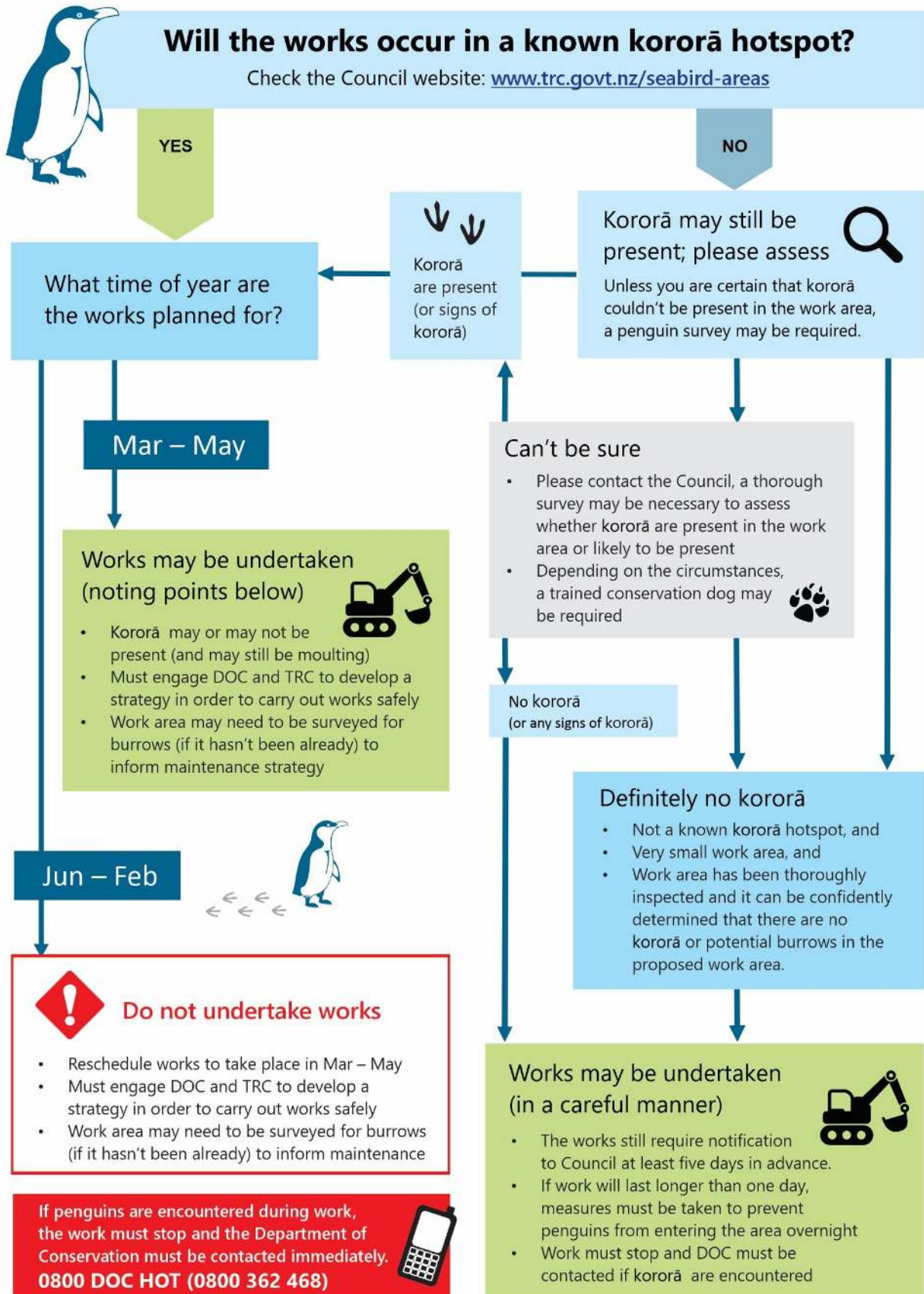
Kororā have a distinct call. They can call on both the exhale and the inhale. Familiarize yourself with the different types of Kororā calls at NZ Birds Online nzbirdsonline.org.nz/species/little-penguin



IMAGE TO COME

GUANO

Check for guano (kororā droppings) on and between rocks. Kororā guano is white, generally found in little spots and may a smell quite strong. Look for any sign of flies as an indication of where guano may be present.



Structure maintenance minor alteration or minor extension

Activity	Rule	Coastal management area	Classification	Standards/terms/conditions	Matters of control/discretion	Policy reference
<p>Maintenance, minor alteration or minor extension of an existing lawfully established structure</p> <p>and any associated:</p> <p>(a) occupation of space in the common marine and coastal area;</p> <p>(b) disturbance of the foreshore or seabed;</p> <p>(c) deposition in, on or under the foreshore or seabed; and</p> <p>(d) discharge of sediment</p> <p><i>Note (1): If the activity does not come within or meet the standards, terms and conditions in this Rule refer to Rule 37 and 38 for network utility structures, Rule 39 and 40 for Port structures, and Rule 41 or Rule 42 for other structures depending on the coastal management area involved.</i></p> <p><i>Note (2): Iwi authorities that have requested to be informed of this activity will be advised by the Council.</i></p>	36	<p>Outstanding Value</p> <p>Estuaries Unmodified</p> <p>Estuaries Modified</p> <p>Open Coast</p> <p>Port</p>	Permitted	<p>(a) Minor extensions are incidental to maintenance or alteration activities and the structure, including length, width and height, does not increase beyond 5% of the original size;</p> <p>(b) for existing communications cables, electricity transmission or distribution lines the activity does not cause an increase in the design voltage above 33kV and the new or altered cables or lines are not lower in height above the foreshore or seabed;</p> <p>(b) materials used match the existing materials in form and appearance;</p> <p>(c) for structures identified in Schedule 6A and B [Historic heritage]:</p> <p>(i) there are no changes to the existing surface treatment of fabric, painting of any previously unpainted surface, or the rendering of any previously un-rendered surface;</p> <p>(ii) there are no changes to the design, texture, or form of the fabric; and</p> <p>(iii) there is no abrasive or high-pressure cleaning method, such as sand or water blasting, used;</p> <p>(d) after reasonable mixing, any discharge does not give rise to:</p> <p>(i) any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;</p> <p>(ii) any conspicuous change of colour or visual clarity; or</p> <p>(iii) any emission of objectionable odour;</p> <p>(e) the extent of disturbance of the foreshore and seabed is limited to the minimum required to undertake the activity and is restored to its previous state 48 hours following the completion of the activity;</p> <p>(f) the activity complies with general standards in Section 8.6;</p> <p>(g) the activity does not have an adverse effect on significant indigenous biodiversity, including those identified in Schedule 4 [Significant indigenous biodiversity];</p> <p>(h) the activity does not have a significant adverse effect on the values associated with taonga species identified in Schedule 5 [Taonga species]; and</p> <p>(i) Taranaki Regional Council is informed of the activity at least five working days before commencement by entering details of the activity at www.trc.govt.nz/informcouncil.</p>		



More information

Visit these websites for downloadable pdfs and helpful details

www.trc.govt.nz/council/plans-and-reports/resource-user-guidance/biodiversity-guides/biodiversity-information-sheets/

www.trc.govt.nz/assets/Documents/Guidelines/Biodiversity-infosheets/BioInfoSheet34-SeabirdAreas.pdf

www.inaturalist.nz/taxa/3817-Eudyptula-minor

www.doc.govt.nz/nature/native-animals/birds/birds-a-z/penguins/little-penguin-korora/

www.nzbirdsonline.org.nz/

www.findinglittleblue.nz/

Contact us

 www.trc.govt.nz

 coastal@trc.govt.nz

 Private Bag 713, Stratford 4352

 0800 736 222 - we can give you more information

Working with people | caring for Taranaki



Taranaki
Regional Council



Date: 6 June 2021

Subject: **Submission on proposed changes to the registration conditions for Brodifacoum**

Approved by: D Harrison, Director - Operations
S J Ruru, Chief Executive

Document: 2785924

Purpose

1. The purpose of this memorandum is to introduce the Taranaki Regional Council's (the Council) submission prepared in response to the discussion document *Proposed changes to the registration conditions applied to the Vertebrate Toxic Agent Brodifacoum*.
2. The submission was sent to the Ministry for Primary Industries (MPI) to meet the deadline date 18 May 2021. A copy of the submission is attached to this agenda item.

Executive summary

3. Under section 26 of the *Agricultural Compounds and Veterinary Medicines Act 1997* (ACVM Act), MPI are reviewing the conditions of registration applied to all registered vertebrate toxic agenda (VTA), commencing with brodifacoum.
4. Brodifacoum is an essential tool to the success of the Self Help Possum Control programme as it is one of only two effective toxins available to landowners without a Controlled Substance License.
5. The reassessment of brodifacoum conditions reviews existing information and practices and takes into account new information, including significant changes in the use of the VTA.
6. As part of this review, MPI undertook preliminary consultation with registrants and interested parties before requesting further feedback and comments on the proposed new controls for the manufacture, sale and use of brodifacoum.
7. Key submission points are noted below, but primarily request clarification on a number of proposed conditions.
8. The deadline for submissions on the Proposal was 18 May 2021 (due on this date). The attached submission aligns with and supports a sector response to this review.
9. Council is now asking that the Policy and Planning Committee endorse this submission.

Recommendations

That the Taranaki Regional Council:

- a) receives this memorandum entitled *Submission on proposed changes to the registration conditions for Brodifacoum*; and
- b) endorses the attached submission.

Background

10. Brodifacoum is an anticoagulant toxin widely used for both possum and rodent control. It is one of only two effective toxins able to be used by landowners without a Controlled Substance License.
11. While Council recognise that, as with all toxins, brodifacoum may pose environmental risks that require careful management. However, any controls must be proportionate to the risks. The Council is concerned that some of MPI's proposals will effect landowners ability to control possums on their land.
12. Pursuant to section 29 of the ACVM Act, MPI are reassessing the 'Conditions of Registration' applied to all registered VTAs. Conditions of Registration set controls on the use of the VTA i.e. the requirement for licencing and require the use of bait stations.
13. The MPI review of Conditions of Registration will be undertaken sequentially according to the active ingredient, starting with the anti-coagulants and, most immediately the toxin brodifacoum.
14. The need to review Conditions of Registration for all VTAs has arisen from:
 - detection of VTA's in food producing animals;
 - potential to enhance the effectiveness of controls of food producing animals to VTA's; and
 - the need to strengthen conditions and label requirements.
15. Pursuant to section 29 of the ACVM Act, MPI is required to consult with affected registrants prior to initiating a reassessment. Having consulted with registrants and interested parties, MPI requested feedback from interested parties on additional controls on the sale and use of brodifacoum as a VTA in New Zealand.
16. The proposed controls are in addition to, or may replace, the current label statements and conditions of registration. MPI states that "*...these have been developed with respect to the sellers and end use of these products which reflect international best practice*".
17. Feedback received on the proposed controls will be considered by MPI and will inform the design of the new controls applied to the sale and use of brodifacoum-based VTA's. The reassessment will cover all the areas of concern required under the ACVM Act. Controls may be applied to manage the following risk areas:
 - public health;
 - animal welfare;
 - trade in primary produce and agriculture security; and
 - ensuring that the use of agricultural compounds does not result in breaches to domestic food standards and ensure provision of appropriate consumer information.

18. It is noted that the submission was filed prior to approval of the Policy and Planning Committee meeting due to the tight turn around deadlines. The submission was based on a sector response to this review and forwarded to MPI on the 18 May 2021.
19. Please see attached to the Agenda a copy of the Council's submission. MPI will notify all registrants of the decision to reassess under the ACVM Act.

Key submission points

20. The key points made in the attached submission are as follows:
 - Seek that MPI ensure that proposed new conditions for brodifacoum are not simply replicated to all other VTA's as they each have their own unique risk profile, and the conditions imposed should reflect this.
 - Seek that the proposed condition "*records kept for each bait station*" be removed as the requirement would be impractical, inefficient and costly with no benefits.
 - Seek further guidance on what measures are expected to be undertaken to satisfy the requirement of "*all practicable measures to minimise access to baits by pets, livestock and food producing animals*".
 - Note concerns that the proposed signage conditions potentially duplicate each other and could eventually create significant unintended consequences. Council requested that signage conditions are carefully considered and amended as appropriate to ensure they are justified, do not duplicate other conditions, and are easier to interpret.
 - Support better education for public users instead of limiting the brodifacoum pack size. Council highlighted that this sort of restriction would make it increasingly difficult for landowners and volunteer groups to undertake control work - particularly large scale conservation work such as 'Predator Free 2050'.
 - Agree that having a training requirement before a user can purchase larger quantities of brodifacoum is a sensible way of addressing the issue of residue in livestock. The Councils noted that issues largely relate to a lack of knowledge by unskilled users. Councils recommend that this training be simple and free to access.
 - Note that many of the definitions and proposed conditions are not overly clear as to when and to whom they apply. Councils requested amendments to the conditions to improve certainty and clarity in their application, particularly in respect of when and to whom they apply to. Key terms that the Councils requested clarification on can be found in the submission.

Financial considerations—LTP/Annual Plan

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

Policy considerations

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

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

Iwi considerations

23. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum..

Community considerations

24. This memorandum and the associated recommendations have considered the views of the community, interested and affected parties and those views have been recognised in the preparation of this memorandum.

Legal considerations

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

Appendices

Document 2775680: Taranaki Regional Council submission on brodifacoum.



11 May 2021
Document: 2775680

Ministry for the Primary Industries
34-38 Bowen Street
Wellington 6140

Submissions on the proposed changes to the registration conditions applied to the Vertebrate Toxic Agent Brodifacoum

The Taranaki Regional Council (the Council) thank you for the opportunity to provide a submission on the Ministry for Primary Industries' (MPI) proposal to reassess the Vertebrate Toxic Agent (VTA) brodifacoum under section 29 of the Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM) .

The Regional Sector, its contractors, and the community groups it supports, use brodifacoum products to control possums and rodents in a variety of situations. The Council recognise the concerns around brodifacoum residues entering the human food chain and the potential to jeopardise New Zealand's \$6.0 billion meat exports and agricultural reputation. The Council is in general support of the need to address this issue, however, the Council has concerns around the proposed approach being taken.

Background

In the first round of feedback provided by the Regional Sector in 2019 the question was asked whether there were in fact grounds to reassess brodifacoum, but supported the need to confirm the conditions of use and to ensure label requirements are fit for purpose and minimise exposure of food producing animals to brodifacoum. The Regional Sector also commented on the scope of the review being undertaken, and the proposed controls.

This position has not shifted, however the Council provides further more detailed feedback on the proposed new controls for the manufacture, sale and use of brodifacoum containing products and how they will impact the use of these products below.

Support for Orillion submission

The Council also notes that Orillion - the largest and only manufacturer of brodifacoum bait products in Australasia have also provided a submission on the proposed changes to the registration conditions/controls for Brodifacoum (dated 28th April 2021). Orillion have provided us with a copy of their submission and we support the points they have made, and in addition provide our specific feedback below.

Key Concerns

The following provides an overview of the Councils key concerns regarding the proposed new controls for the manufacture, sale and use of brodifacoum containing products as outlined in the Call for Submissions by MPI dated 7th of April 2021. MPI proposed changes to conditions are set out in [blue](#), with the Councils feedback provided under each heading in [black](#), and relief requested in [red](#).

General comment on VTA review process

The Council understands that MPI intends to reassess the conditions of registration applied to all registered vertebrate toxic agents (VTAs), and this is to be performed sequentially according to the active ingredient, starting with the anti-coagulants and, most immediately, brodifacoum. In undertaking this reassessment the Council would like to highlight the importance of ensuring that proposed new conditions for brodifacoum are not simply replicated to all other VTAs, as each VTA has its own unique risk profile, and the conditions imposed need to reflect this.

Relief Requested:

Due consideration is given to the risk profile of each VTA reassessed when proposing conditions.

Bait and Bait Stations

For quantities greater than 300 g, used by commercial users,

This product must only be used in bait stations unless otherwise specified in an ACVM approved operating plan for that product.

Bait stations must be monitored regularly during the baiting operation, with records kept for each station detailing:

- (a) the amount of bait added or removed;*
- (b) the amount of bait remaining;*
- (c) the method of disposal of surplus bait.*

All uneaten baits must be collected and removed from the area when the operation has ceased.

All records on the use of the product must be kept for a minimum of five years and made available to the Ministry for Primary Industries upon request.

Feedback:

The requirement to keep records for **each** bait station as required in (a) - (c) above is impractical when operating on the scale that commercial users do. This would require users to carry a set of scales to record information on the amount of bait added or removed, and the amount of bait remaining in each bait station. This would add significantly to the time required to monitor bait stations resulting in inefficient and more costly operations for no

additional benefit. We recommend only the total amounts for each operation at each fill should be recorded.

A hypothetical example of such a record entry following this process would look similar to the following:

“100 bait stations were put out for this operation with the first fill totalling 50kg of bait (500g per station); at the second fill, bait stations were topped up with a total of 40kg of bait, and at the end of the operation we removed a total of 20kgs of bait from the bait stations which was disposed of via a commercial waste disposal company.”

Relief Requested:

Reference to “records kept for each bait station” is removed from the condition, and the condition is reworded as per the below:

For quantities greater than 300 g, used by commercial users,

This product must only be used in bait stations unless otherwise specified in an ACVM approved operating plan for that product.

Bait stations must be monitored regularly during the baiting operation, with records kept for each operation detailing:

- (a) the amount of bait added or removed at each fill;
- (b) the amount of bait remaining at each fill;
- (c) the method of disposal of surplus bait.

All uneaten baits must be collected and removed from the area when the operation has ceased.

All records on the use of the product must be kept for a minimum of five years and made available to the Ministry for Primary Industries upon request.

Exposure of non-target animals

Exposure of non-target animals:

The user must take all practicable measures to minimise access to baits by pets, livestock, and food producing animals.

Feedback:

Further guidance on what measures are expected to be undertaken to satisfy *“all practicable measures to minimise access to baits by pets, livestock and food producing animals”* would be welcomed if this condition is to remain. For example, if MPI are expecting all bait stations to

be fenced off from livestock this may present challenges for bush blocks where fences are in poor condition and livestock wander some distance into the block and access a bait station.

Relief Requested:

The Council requests that MPI produce guidance on their expectations and possible ways to meet this condition taking into account efficacy of the operation against target animals, and non-target species that may be present in the area.

Signage

For quantities greater than 300 g,

Signs must be displayed at every normal point of access to the treatment area where the Trade named Product is used or applied.

Signs must also be displayed at prominent places around the perimeter of the operational area, and anywhere else as required by any permission or consent.

Signs must remain legible for the length of time it is displayed.

Signs must remain in place until monitoring shows that hazards associated with the application of the Trade name product no longer exist.

Signs must not be removed by any unauthorised person

Signs are required to:

- identify the person or organisation that is applying the bait, and provide sufficient information to enable the person to be contacted during normal business hours;*
- identify the substance and state that it might be present in carcasses;*
- state the date on which the substance is to be applied;*
- state that it is an offence for any person other than the authorised user to remove the signs;*
- state that it is an offence for any person other than the authorised user to remove the trade name product from the area;*
- warn of potential harm to pets, livestock and food producing animals, and*
- warn that feral animals may contain residues of the toxin.*

Feedback:

There are concerns that the condition requiring *“signs to be displayed at prominent places around the perimeter of the operational area, and anywhere else as required by any permission or consent”* duplicates the first signage condition regarding displaying signs at every normal point of access to the treatment area. Duplication of conditions, especially where conditions are intended to produce the same outcome but are worded differently, can have significant unintended consequences for control operations.

The Regional Council Sector (along with MPI) were recently involved in the development of a business case which explored this very issue in relation to the aerial use of 1080 (sodium

fluoroacetate). The business case demonstrated that duplication of conditions both within and between legislation not only increases compliance costs but also increases the risk of non-compliance when undertaking control operations due to misinterpretation of similar condition requirements. In response to this issue, ways to simplify and streamline the regulatory environment for use of aerial 1080 (sodium fluoroacetate) were explored, and the Resource Management (Exemption) Regulations 2017 under section 360(1)(h) of the Resource Management Act 1991 (RMA) were developed and made operative. These regulations have simplified and streamlined the legislative environment for a number of VTAs, including brodifacoum and sodium fluoroacetate, by removing duplication between the RMA and Hazardous Substances and New Organisms Act 1996, highlighting the need to be cognisant of this issue when reassessing or imposing new conditions.

In regard to the proposed changes requiring signs to *“warn of potential harm to pets, livestock and food producing animals”*, and *“warn that feral animals may contain residues of the toxin”*, the Council would like to highlight that the current signs already contain warnings regarding dogs (pets). For livestock, a case-by-case approach is preferred as many operators discuss the operation with landowners/occupiers prior to bait being put out to ensure there are measures in place to prevent livestock from accessing baits.

In regards to food producing animals (game animals) and feral animals, signs already state ‘do not eat animals from this area’, and these signs need to remain out for an appropriate length of time. The Council therefore query what additional benefit will result from the proposed changes to the current wording.

Relief Requested:

The Council requests that conditions are carefully considered and cross-checked within and across legislation to ensure they are justified, are not duplicated, and are easy to follow and interpret. If the proposed signage conditions are to remain as proposed, clarification of what constitutes a *“prominent place”* is required. The Regional Sector has interpreted *“prominent place”* to mean normal points of entry.

In regard to the signage changes warning of potential harm and risk of toxin residue, we suggest that proposed changes are not required as current signage wording adequately warns of the risk.

Proposed 300g pack size limits for Public Users & Impact on Community Conservation Projects

Feedback:

The Council supports the points made in the submission by Orillion with regard to pack size limits, and further add that small pack sizes will contribute a significant amount of single use plastic into the environment.

In addition, the Council would like to highlight that these restrictions will also make it increasingly difficult for landowners and volunteer groups to undertake control work - particularly large-scale community-led conservation work that contributes significantly to the retention of biodiversity and the objective of 'Predator Free 2050'.

Predator Free 2050 is an independent crown company which has received \$28M of government funding to support initiatives that advance New Zealand towards its goal of being free from rats, stoats and possums by 2050. Regional Sector Councils are involved in and supportive of the 'Predator-free 2050' initiative which brings together central and local government, iwi, philanthropists, non-government organisations, businesses, science and research organisations, communities, landowners and individuals. Achieving this ambitious goal will be a team effort by everyone, and it is therefore important that barriers to effective pest control are removed.

Pack size restrictions for public users, especially those involved in community conservation projects, will make control harder to undertake and increase cost. We have no doubt that restricting Public Users to purchasing 300g packs at a time will have an adverse impact on conservation efforts and Predator Free 2050. This change will reduce the feasibility of control work using brodifacoum and will mean that most community groups will use other less effective control tools or stop carrying out pest control.

Relief Requested:

The Council supports better education for these users instead of pack size restrictions. The Council is currently supporting community groups with a range of education initiatives around VTA use.

Training/approved user process

Feedback:

As stated in the Regional Sectors previous submission, the Council believes that the issue of brodifacoum residues in livestock relates to a lack of knowledge by semi/unskilled users around how they should be using brodifacoum baits. Therefore, having a training requirement before a user can purchase larger quantities of brodifacoum baits, is a sensible way of addressing the issue.

The Council continue to support this stance (and that taken by Orillion in their submission) and in respect of this issue would like to reiterate that if any training requirements are to be brought in, it will be imperative to make sure that the approval process is simple for users, and most importantly **free**. In the Councils view, this will help remove barriers, increase rates of education and therefore compliance.

Relief Requested:

MPI progresses with the development of a training/ approved user process that is simple and free to access, able to be understood by the lay person, and does not require a significant amount of time to complete.

General comments - Interpretation of conditions

Feedback:

When reading through the definitions and proposed conditions it is not overly clear when and to whom some of these conditions apply.

For example, the definitions proposed refer to “Public User” and “Authorised User” yet several conditions mention “domestic”, “non-domestic” and “commercial” users with no corresponding definition provided.

The Council understands that the intention of the 300g limit for Public Users is to limit the amount of VTA accessible to users who have not undergone training in the use of these toxins. However, it is possible (although onerous) for Public Users to make multiple separate purchases of 300g packs allowing them to amass and use more than the intended 300g limit. In this scenario, it is unclear whether the following conditions are intended to apply to Public Users:

<p><i>For quantities greater than 300 g,</i></p> <p><i>Prior to applying the trade name product, the user must provide the landowner and land occupier with a copy of the label and obtain consent from them for use of that product. The consent must include confirmation they have read the label, or a copy of the label which they have signed. A copy of the consent must be kept for a minimum of five years and made available to the Ministry for Primary Industries upon request.</i></p>
<p><i>For quantities greater than 300 g,</i></p> <p><i>All operational boundaries, access points, bait stations and signage are required to be mapped (preferably by GPS). This information shall be recorded by the user. These records must be kept for a minimum of five years after the baiting programme has ceased and made available to the Ministry of Primary Industries on request.</i></p>
<p><i>For quantities greater than 300 g,</i></p> <p><i>Signs must be displayed at every normal point of access to the treatment area where the Trade named Product is used or applied.</i></p> <p><i>Signs must also be displayed at prominent places around the perimeter of the operational area, and anywhere else as required by any permission or consent.</i></p>

Signs must remain legible for the length of time it is displayed.

Signs must remain in place until monitoring shows that hazards associated with the application of the Trade name product no longer exist.

Signs must not be removed by any unauthorised person

Signs are required to:

identify the person or organisation that is applying the bait, and provide sufficient information to enable the person to be contacted during normal business hours;

identify the substance and state that it might be present in carcasses;

state the date on which the substance is to be applied;

state that it is an offence for any person other than the authorised user to remove the signs;

state that it is an offence for any person other than the authorised user to remove the trade name product from the area;

warn of potential harm to pets, livestock and food producing animals, and

warn that feral animals may contain residues of the toxin.

Despite the following condition relating to Commercial Users, given the above scenario of Public Users being able to purchase and use more than 300g, it is also unclear as to whether the condition below would be expected to apply:

For quantities greater than 300 g, used by commercial users,

This product must only be used in bait stations unless otherwise specified in an ACVM approved operating plan for that product.

Bait stations must be monitored regularly during the baiting operation, with records kept for each station detailing:

(a) the amount of bait added or removed;

(b) the amount of bait remaining;

(c) the method of disposal of surplus bait.

All uneaten baits must be collected and removed from the area when the operation has ceased.

All records on the use of the product must be kept for a minimum of five years and made available to the Ministry for Primary Industries upon request.

Relief requested:

In the Councils view, conditions need to be made clearer in respect of when and to whom they apply, and definitions provided for all key terms used to ensure correct interpretation. A list of these key terms which the Council would like to see definitions for include:

- Public User
- Authorised User
- Domestic User
- Non-domestic User
- Commercial User
- Livestock
- Food producing animal
- Feral animal
- Prominent place
- Normal points of entry

Summary

The Council again thanks MPI for the opportunity to provide a submission on the proposed changes.

The Council generally supports the need to address the issue of brodifacoum ending up in the human food chain. Whilst the proposed controls appear to have been simplified post the first round of feedback, the Council seeks that further refinement needs to occur - especially in relation to ensuring the controls are justified, are not duplicated, and are easy to interpret.

Yours sincerely,

Yours faithfully
S J Ruru
Chief Executive



per: D Harrison
Director - Operations



Whakataka te hau

Karakia to open and close meetings

Whakataka te hau ki te uru	Cease the winds from the west
Whakataka te hau ki tonga	Cease the winds from the south
Kia mākinakina ki uta	Let the breeze blow over the land
Kia mātaratara ki tai	Let the breeze blow over the ocean
Kia hī ake ana te atakura	Let the red-tipped dawn come with a sharpened air
He tio, he huka, he hauhu	A touch of frost, a promise of glorious day
Tūturu o whiti whakamaua kia tina.	Let there be certainty
Tina!	Secure it!
Hui ē! Tāiki ē!	Draw together! Affirm!

Nau mai e ngā hua

Karakia for kai

Nau mai e ngā hua	Welcome the gifts of food
o te wao	from the sacred forests
o te ngakina	from the cultivated gardens
o te wai tai	from the sea
o te wai Māori	from the fresh waters
Nā Tāne	The food of Tāne
Nā Rongo	of Rongo
Nā Tangaroa	of Tangaroa
Nā Maru	of Maru
Ko Ranginui e tū iho nei	I acknowledge Ranginui above and
Ko Papatūānuku e takoto ake nei	Papatūānuku below
Tūturu o whiti whakamaua kia	Let there be certainty
tina	Secure it!
Tina! Hui e! Taiki e!	Draw together! Affirm!

