



AGENDA

Operations & Regulatory

Tuesday 11 June 2024, 9.00am

Operations and Regulatory Committee

11 June 2024 09:00 AM



Agenda Topic	Page
1. Cover	1
2. Karakia	3
3. Apologies	
4. Confirmation of Operations and Regulatory Minutes - 30 April 2024	4
5. Resource Consents Issued under Delegated Authority and Applications in Progress	10
6. Incidents, Compliance Monitoring Non- Compliance and Enforcement	51
7. SEM Hill/Coastal Sand Country Sustainable Landuse Report by Landcare Rearch Ltd.	87
8. Assessment of Fish Mortalities within the Waingongoro and Kaūpokonui Rivers	186
9. Public Excluded	
10. Public Excluded Recommendations	207
11. Confirmation of PE Operations and Regulatory Minutes - 30 April 2024	208
12. Agenda Authorisation	212



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 te 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 Papatūānuku
Ko Papatūānuku e takoto ake nei	below
Tūturu o whiti whakamaua kia	Let there be certainty
tina	Secure it!
Tina! Hui e! Taiki e!	Draw together! Affirm!



Date: 11 June 2024

Subject: Operations and Regulatory Minutes – 30 April 2024

Author: M Jones, Governance Administrator

Approved by: AJ Matthews, Director - Environment Quality

Document: 3278227

Recommendations

That Taranaki Regional Council:

- a. takes as read and confirms the minutes of the Operations and Regulatory Committee meeting of the Taranaki Regional Council held in the Taranaki Regional Council chambers, 47 Cloten Road, Stratford on 30 April 2024 at 9.00am
- b. notes the recommendations therein were adopted by the Taranaki Regional Council on Tuesday 14 May 2024.

Appendices/Attachments

Document 3269783: [Operations and Regulatory Minutes 30 April 2024.](#)



Date:	30 April 2024	
Venue:	Taranaki Regional Council Boardroom, 47 Cloten Road, Stratford	
Document:	3269783	
Present:	S W Hughes	<i>Chair</i>
	M J Cloke	
	D M Cram	
	M G Davey	
	B J Bigham	(zoom)
	D L Lean	(zoom)
	C L Littlewood	<i>ex officio</i>
	N W Walker	<i>ex officio</i>
	Ā White	Iwi Representative
	R Buttimore	Iwi Representative
	P Muir	Federated Farmers
	D H McIntyre	(Joined meeting at 10.02am)
Attending:	S J Ruru	Chief Executive (joined meeting at 9.40am)
	A J Matthews	Director - Environment Quality
	A D McLay	Director – Resource Management
	L Millar	Manager – Resource Consents
	T McElroy	Manager – Science and Technology
	A Collins	Scientist – Water Quality
	V McKay	Manager – Environmental Assurance (zoom)
	C Woollen	Communications Advisor
	K Holland	Team Lead – Communications
	S Ellis	Environmental Services Manager (joined meeting at 10.16am)
	M Jones	Governance Administrator
	N Chadwick	Executive Assistant
	P Turner	Taranaki Catchment Communities

Three members of the public were in attendance at 10.28am.
Three members of the public were in attendance via zoom at 10.30am.

Karakia: The meeting opened with a group karakia at 9.00am.

Apologies: Were received and sustained from Councillor McIntyre for lateness and D Luke.

Cloke/Littlewood

1. Confirmation of Minutes Operations and Regulatory Committee 13 February 2024

Recommended

That the Taranaki Regional Council:

- a) took as read and confirmed the minutes of the Operations and Regulatory Committee of the Taranaki Regional Council held on 15 March 2024 at Taranaki Regional Council 47 Cloten Road Stratford
- b) noted the recommendations therein were adopted by the Taranaki Regional Council on Tuesday 2 April 2024.

Cram/Walker

2. Taranaki Catchment Communities

- 2.1 P Turner from Taranaki Catchment Communities delivered a presentation on the role of Taranaki Catchment Communities in the region.

Recommended

That the Taranaki Regional Council:

- a) received the presentation from Taranaki Catchment Communities
- b) noted the positive work undertaken by the Taranaki Catchment Communities to ensure a more environmental, economic and socially sustainable future for farmers.

Muir/Davey

3. Resource Consents Issued under Delegated Authority & Applications in Progress

- 3.1 L Millar advised the Committee of consents granted, consents under application and of consent processing actions since the last meeting.

Recommended

That the Taranaki Regional Council:

- a) received the schedule of resource consents granted and other consent processing actions, made under delegated authority.

Cram/Cloke

4. Consent Monitoring Annual Reports

- 4.1 V McKay provided the committee with an update on tailored monitoring reports.
- 4.2 M Davey declared a conflict and abstained from discussions and the vote.

Recommended

That the Taranaki Regional Council:

- a) received the 10 compliance monitoring reports listed in table 1
- b) noted the recommendations therein.

Cloke/Walker

5. Incidents, Compliance Monitoring Non Compliances and Enforcement Summary - 1 March 2024 – 11 April 2024

- 5.1 J Glasgow provided the Committee with a summary of the incidents, compliance monitoring non-compliances and enforcement for the period 1 March 2024 – 11 April 2024.
- 5.2 C Littlewood declared a conflict and abstained from discussions and the vote.

Recommended

That the Taranaki Regional Council:

- a) received this memorandum Incident, Compliance Monitoring Non-Compliances and Enforcement Summary – 1 March 2024 to 11 April 2024
- b) received the summary of the incidents, compliance monitoring non-compliances and enforcement for the period from 1 March 2024 to 11 April 2024
- c) noted the action taken by staff acting under delegated authority
- d) adopted the recommendations therein.

Cloke/Muir

6. Farm Discharge Monitoring Programme Review 2024

- 6.1 A D McLay provided an update on the review of the Farm Discharge Monitoring Programme.

Recommended

That the Taranaki Regional Council:

- a) received this memorandum on the review of the Farm Dairy Discharge Monitoring Programme
- b) endorsed the Farm Dairy Discharge Monitoring Programme
- c) noted the programme utilises the latest technology and pragmatic approaches
- d) noted the programme delivers cost effective monitoring
- e) noted the programme, when benchmarked against others, could be considered best practice
- f) determined that this decision be recognised as not significant in terms of section 76 of the Local Government Act 2002
- g) determined 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, determined 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.

Davey/Walker

7. Urenui Stormwater Investigation (2019 – 2022)

- 7.1 T McElroy provided an update of the Urenui Stormwater investigation undertaken during 2019 to 2022.

Recommended

That the Taranaki Regional Council:

- a) received the Urenui stormwater investigation memorandum
- b) noted the findings therein.

Walker/Littlewood

8. Towards Predator Free Taranaki Project

- 8.1 S Ellis gave a presentation to provide an update on the progress made with the Towards Predator Free Taranaki Project.
- 8.2 Hoegh Hunting provided a demonstration of their scat dog at work.

Recommended

That the Taranaki Regional Council:

- a) received this memorandum Towards Predator Free Taranaki Project Update
- b) noted the progress achieved in respect of the urban, rural and zero density possum projects of the Towards Predator-Free Taranaki project
- c) noted officers will be increasing the use of regulatory tools to ensure ongoing mustelid trapping continues under the RPMP.

Muir/Davey

9. Prosecution Sentencing Decision - Goodwin

- 9.1 Mr J Glasgow provided an update on the successful prosecution decision outcome of Mr Goodwin for the breach of the Proposed Land and Freshwater Plan for Taranaki.

Recommended

That the Taranaki Regional Council:

- a) received the report Prosecution Sentencing Decision - Goodwin
- b) noted the successful outcome of the prosecution.

Littlewood/Walker

(All non-committee members and staff not directly related to the public excluded item left the meeting at 10.43am).

In accordance with section 48(1) of the *Local Government Official Information and Meetings Act 1987*, resolves that the public is excluded from the following part of the proceedings of the Operations and Regulatory Committee Meeting on Tuesday 10 October 2023:

Item 15:

Public Excluded – Prosecution under the Resource Management National Environmental Standards for offences against section 338 of the Resource Management Act 1991 for contravening Section 15 and any other offences’.

The matter to be considered while the public is excluded, the reason for passing this resolution in relation to the matter, and the specific grounds under section 48(1) of the *Local Government Official Information and Meetings Act 1987* are as follows:

General subject of each matter to be considered	Ground(s) under section 48(1) for the passing of this resolution	Reason for passing this resolution in relation to each matter

<p>Item 15: Prosecution- Under section 338 of the <i>Resource Management Act 1991</i> for contravening section 15 and any other offences’.</p>	<p>That the public conduct of the whole or the relevant part of the proceedings of the meeting would be likely to result in the disclosure of information for which good reason for withholding would exist under section 6 (a) and section 7 (2) (a) and (2) (g) of the <i>Local Government Official Information and Meetings Act 1987</i>.</p>	<p>The alleged offender(s) has not as yet had the opportunity to respond to the charges laid. It is therefore important that the principles of natural justice are applied and that legal privilege is maintained.</p> <p>Making any of this information publically available would result in a breach of the <i>Privacy Act 2020</i>.</p> <p>The public interest in knowing the nature of the offence and why Council has made the decision to prosecute is not outweighed by the harm that would be caused to the alleged offender(s).</p>
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Cloke/Cram

There being no further business the Committee Chairperson, Councillor S W Hughes, declared the meeting of the Operations and Regulatory Committee closed at 10.50am.

**Operations and
Regulatory
Committee Chairperson:** _____



Date: 11 June 2024

Subject: Resource Consents Issued Under Delegated Authority and Applications in Progress

Author: L Miller, Manager - Resource Consents

Approved by: A D McLay, Director - Resource Management

Document: 3275827

Purpose

1. The purpose of this memorandum is to advise the consents granted, consents under application and of consent processing actions since the last meeting. This information is summarised in attachments at the end of this report.

Executive summary

2. Memorandum to advise of recent consenting actions made under regional plans and the Resource Management Act 1991, in accordance with Council procedures and delegations.

Recommendation

That Taranaki Regional Council:

- a) receives the schedule of resource consents granted and other consent processing actions, made under delegated authority.

Background

3. The attachments show resource consent applications, certificates of compliance and deemed permitted activities that have been investigated and officer decisions. They are activities having less than minor adverse effects on the environment, or having minor effects where affected parties have agreed to the activity. In accordance with sections 87BB, 104 to 108 and 139 of the Resource Management Act 1991, and pursuant to delegated authority to make these decisions, the Chief Executive or the Director—Resource Management, has allowed the consents, certificates of compliance and deemed permitted activities.
4. The exercise of delegations under the Resource Management Act 1991 is reported for Members' information. Under the delegations manual, consent processing actions are to be reported to the Operations and Regulatory Committee.

5. In addition to the details of the activity consented, the information provided identifies the Iwi whose rohe (area of interest) the activity is in. If the activity is in an area of overlapping rohe both Iwi are shown. If the activity is within, adjacent to, or directly affecting a statutory acknowledgement (area of special interest), arising from a Treaty settlement process with the Crown, that is also noted.
6. Also shown, at the request of Iwi members of the Council, is a summary of the engagement with Iwi and Hapū, undertaken by the applicant and the Council during the application process. Other engagement with third parties to the consent process is also shown. The summary shows the highest level of involvement that occurred with each party. For example, a party may have been consulted by the applicant, provided with a copy of the application by the Council, served notice as an affected party, lodged a submission and ultimately agreed with the consent conditions. In that case the summary would show only 'agreed with consent conditions', otherwise reporting becomes very complicated.
7. The attachment titled 'Consent Processing Information' includes the figure 'Consent Applications in Progress' which shows the total number of applications in the consent processing system over the last twelve months. The number of applications for the renewal of resource consents is also shown. The difference between the two is the number of new applications, including applications for a change of consent conditions. New applications take priority over renewal applications. Renewal applications are generally put on hold, with the agreement of the applicant, and processed when staff resources allow. A consent holder can continue to operate under a consent that is subject to renewal. The above approach is pragmatic and ensures there are no regulatory impediments to new activities requiring authorisation.
8. The attachment also includes:
 - a. Applications in progress table - the number of applications in progress at the end of each month (broken down into total applications and the number of renewals in progress) for this year and the previous two years
 - b. Potential hearings table outlining the status of applications where a hearing is anticipated and the decision maker(s) (e.g. a hearing panel) has been appointed
 - c. Consents issued table - the number of consents issued at the end of each month for this year and the previous two years
 - d. Breakdown of consents issued. This is the number of consents issued broken down by purpose – new, renewals, changes or review
 - e. Types of consents issued, further broken down into notification types – non-notified, limited notified or public notified
 - f. Number of times that the public and Iwi were involved in an application process for the year so far
 - g. Application processing time extensions compared to the previous years
 - h. Consent type process shows the notification type including applications submitted on and the pre-hearing resolution numbers
 - i. Applications that have been returned because they are incomplete.

Financial considerations—LTP/Annual Plan

9. 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

10. 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

11. 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

12. 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

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

Appendices/Attachments

Document 3275581: [List of non-notified consents](#)

Document 3275783: [Schedule of non-notified consents](#)

Document 3274405: [Consents processing charts](#)

**Non-notified authorisations issued by the Taranaki Regional Council
between 06 Apr 2024 and 15 May 2024**

Coastal Permit						
Consent	Holder	Subtype	Industry Primary	Industry Secondary	Purpose Primary	Activity Purpose
R2/6411-2.0	New Plymouth District Council	Structure - Protection (Coastal)	Local Government		Erosion protection	Replace
R2/6520-2.0	Fairhurst Holdings Limited	Occupy (Coastal)	Hospitality	Restaurant	Recreational	Replace
R2/11030-1.0	South Taranaki District Council	Structure - Boat Ramp (Coastal)	Local Government	Recreational	Boating	New
R2/11215-1.0	New Plymouth District Council	Structure - Outfall (Coastal)	Local Government		Flood Control	New
Discharge Permit						
Consent	Holder	Subtype	Industry Primary	Industry Secondary	Purpose Primary	Activity Purpose
R2/0696-3.0	RW & MJ Goldsworthy	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	New
R2/1179-3.0	Dennis Mark & Diane Lillian Bourke	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/1720-4.0	Nodgin Partners	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/1858-4.0	Stratford District Council	Land - Animal Waste	Local Government	Farming - Dairy	Effluent disposal	Replace
R2/2141-3.0	Tir Mynydd Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/2147-3.0	Waimate Fields Limited	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/2245-3.0	LJ Symes Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/2756-3.0	Robert Gibson Methodist Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/2773-3.0	DP & SM Hurley Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/2780-3.1	Cornwall Park Farms Limited	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Change
R2/2950-3.0	Double D Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3059-3.0	Johnson and Parkes Limited Partnership	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3060-3.0	Killarney No 1 Pastoral Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3069-3.0	BL Kaiser Trust No 1	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3079-3.0	Ida Lea Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3087-3.0	Foskin Family Limited	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3146-3.0	M G Prankerd Ltd	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3167-3.0	Vintage Farm Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3201-3.0	M R Cleaver Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3357-3.0	SM Muller and NK Buckthought	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3486-3.0	OR & JM Perrett Trust Limited	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3758-3.0	Ivy Plains Limited	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3790-3.0	SE & SA Nicholas Family Trusts Partnership	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3795-3.0	Mangimangi Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3812-3.0	C A Myers Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/3845-3.0	Okawanui Farm Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace

**Non-notified authorisations issued by the Taranaki Regional Council
between 06 Apr 2024 and 15 May 2024**

R2/3898-3.0	Edridge Partnership	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/4038-7.0	Tegel Foods Limited	Air - Industry	Agricultural Services	Feedmill		Replace
R2/4073-4.0	Greymouth Petroleum Central Limited	Land/Water Industry	Energy	Wellsite	Exploration and Production	Replace
R2/4692-3.0	Airport Farm Trustee Limited	Land - Animal Waste	Agriculture	Farming - Poultry	Effluent disposal	Replace
R2/6025-2.0	Aviagen New Zealand Limited	Land - Animal Waste	Agriculture	Farming - Poultry	Effluent disposal	Replace
R2/6418-2.0	Zimmermann R & E Family Trust	Land - Animal Waste	Agriculture	Farming - Dairy	Effluent disposal	Replace
R2/9908-1.1	Fonterra Limited	Land - Industry	Manufacturing and Processing	Dairy Processing		Change
R2/11202-1.0	Waka Kotahi NZ Transport Agency	Land - Earthworks	Central Government	Transport	Roading	New
Land Use Consent						
Consent	Holder	Subtype	Industry Primary	Industry Secondary	Purpose Primary	Activity Purpose
R2/6468-2.0	Stratford District Council	Structure - Culvert	Local Government		Flood Control	Replace
R2/6785-2.1	Shaugh Partnership	Structure - Culvert	Agriculture	Farming - Dairy	Access	Replace
R2/6934-2.1	Washer Family Trust	Structure - Culvert	Property Development		Access	Replace
R2/7225-2.0	Ranald & Robyn Gordon	Structure - Culvert	Agriculture	Farming - Dairy	Access	Replace
R2/11205-1.1	First Gas Limited	Earthworks	Energy	Gas Supply		Change
Water Permit						
Consent	Holder	Subtype	Industry Primary	Industry Secondary	Purpose Primary	Activity Purpose
R2/10449-1.2	Joblin Partners Limited	Take Groundwater	Agriculture	Farming - Dairy	Stock water	Change

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/0696-3.0](#)

RW & MJ Goldsworthy

Commencement Date: 19 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 125 Lower Duthie Road, Hawera

To discharge farm dairy effluent onto land

Application Purpose: New

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

[R2/10449-1.2](#)

Joblin Partners Limited

Commencement Date: 11 Apr 2024

Expiry Date: 01 Jun 2035

Review Dates: Jun 2023, Jun 2029

Activity Class: Discretionary

Location: 152 Lower Stuart Road, Eltham

To take and use groundwater from a bore for farm water supply purposes

Application Purpose: Change

Change of consent conditions to enable an increase in the volume of take from 1050 cubic metres to 1658 cubic metres in any 7 day period

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

Te Korowai o Ngāruahine Trust

Applicant provided application

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/11030-1.0](#)

South Taranaki District Council

Commencement Date: 23 Apr 2024

Expiry Date: 01 Jun 2058

Review Dates: Jun 2028, Jun 2034, Jun 2040, Jun 2046, Jun 2052

Activity Class: Discretionary

Application Purpose: New

Location: True Right Bank of the Pātea Estuary
(directly adjoining Turi Street, Patea)

To extend the Patea boat ramp, including any associated occupation of coastal space, disturbance and deposition to the foreshore or seabed, and discharge of sediment

Rohe:

Ngaa Rauru Kīitahi (Statutory Acknowledgement)

Ngāti Ruanui (Statutory Acknowledgement)

Engagement or consultation:

Coastguard South Taranaki

Consulted by applicant

Maritime New Zealand

No return correspondence was received

Te Kaahui o Rauru

Consulted by applicant

Te Rūnanga o Ngāti Ruanui Trust

Consulted by applicant

Te Rūnanga o Ngāti Ruanui Trust

Written approval provided

Te Kaahui o Rauru

Response received

Comments from Ngaa Rauru Kīitahi

Return correspondence was received from Te Kaahui o Rauru advising that they would let Ngāti Ruanui take the lead on this application and support their position.

Response and considerations during processing of application

Te Rūnanga o Ngāti Ruanui Trust subsequently provided written approval in respect of the application.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/11202-1.0](#)

Waka Kotahi NZ Transport Agency

Commencement Date: 19 Apr 2024

Expiry Date: 01 Jun 2029

Review Dates:

Activity Class: Controlled

Location: 2778 – 2717 Mountain Road, State Highway 3, Taranaki

Application Purpose: New

To discharge stormwater and sediment from earthworks associated with road safety improvements onto and into land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Te Atiawa (Statutory Acknowledgement)

Engagement or consultation:

Derrick & Sharon Dewing

Written approval provided

Te Korowai o Ngāruahine Trust

No return correspondence was received

Te Kotahitanga o Te Atiawa Trust

Response received

Comments from Te Atiawa

Return correspondence was received from Te Kotahitanga o Te Atiawa Trust on 02 February 2024. A summary of the comments received is provided below:

- Te Atiawa and Pukerangiora hapū believe consultation would have been appropriate and they expected to be engaged given their established relationship with the applicant.
- Their relationship with land and water is not restricted to sites and areas of significance to Māori.
- Assessments of the RMA 1991 Part 2 and Te Mana o Te Wai in the National Environmental Standards for Freshwater, cannot be considered complete without tangata whenua input.
- The P45 Accidental Discovery Protocol the applicant intends to use for archaeological needs references Ngāi Tahu procedures that are not relevant to Pukerangiora.
- The assessment of "Tai Whenua, Tai Tangata, Tai Ao" was omitted from the application.
- The application should be returned as incomplete in accordance with Section 88 of the RMA 1991 or further information should be required in accordance with Section 92 of the RMA 1991.
- Pukerangiora are identified as an affected party in accordance with Section 95 of the RMA 1991.

Response and considerations during processing of application

Council replied on 2 February 2024 to thank Te Atiawa for their response, advising that cultural effects were outside the matters for control of the activity and this therefore limited what Council could require. Council had recommended to the applicant to perform engagement and advised them of the gaps in their assessment and accidental discovery protocol. The S92 required an assessment of the applicant's activity against Te Atiawa's iwi management plan to which they responded, this was included in Council's reply to Te Atiawa.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/11205-1.1](#)

First Gas Limited

Commencement Date: 02 May 2024

Expiry Date: 01 Jun 2029

Review Dates:

Activity Class: Discretionary

Location: 169 Clifton Road, Tongaporutu

Application Purpose: Change

To undertake earthworks and vegetation clearance within, or within 10 metres of a natural wetland

Change of Special Conditions 1 & 3 of consent 11205-1.0 to enable earthworks and vegetation clearance within, and within 10 metres of a natural wetland, to occur during the month of May

Rohe:

Ngāti Maniapoto

Ngāti Tama (Statutory Acknowledgement)

Engagement or consultation:

Te Nehenehenui (TNN)

No return correspondence was received

Te Rūnanga o Ngāti Tama

Response received

Comments from Ngāti Tama

Return correspondence was received from Te Runanga o Ngāti Tama Te Pou Ārahi/Manager, Te Amoroa Clifton, on 17 April 2024. A summary of their response is provided below:

- Based on the information provided in the application, Te Rūnanga o Ngāti Tama support the granting of this variation application.*
 - The applicant's decision to remove redundant infrastructure from the environment is commended.*
 - Te Runanga o Ngāti Tama expect engagement and feedback is sought from the landowner in relation to the proposed variation too.*
-

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/11215-1.0](#)

New Plymouth District Council

Commencement Date: 12 Apr 2024

Expiry Date: 01 Jun 2056

Review Dates: Jun 2026, Jun 2032, Jun 2038, Jun 2044, Jun 2050

Activity Class: Controlled

Application Purpose: New

Location: 1 Tisch Avenue, New Plymouth

To erect an outfall structure in the coastal marine area including the associated occupation, disturbance, deposition and incidental discharge of sediment

Rohe:

Te Atiawa (Statutory Acknowledgement)

Engagement or consultation:

Maritime New Zealand

Response received

Ngāti Te Whiti Hapū

Consulted by applicant

Te Kotahitanga o Te Atiawa Trust

Consulted by applicant

Te Kotahitanga o Te Atiawa Trust

No return correspondence was received

[R2/1179-3.0](#)

Dennis Mark & Diane Lillian Bourke

Commencement Date: 24 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, 01/07/2033

Activity Class: Controlled

Application Purpose: Replace

Location: 136 Onewhaia Road, Normanby

To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Ngāti Ruanui

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

Responded they had no comment to make

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/1720-4.0](#)

Nodgin Partners

Commencement Date: 03 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 1298 Eltham Road, Kaponga

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

[R2/1858-4.0](#)

Stratford District Council

Commencement Date: 22 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 202 Flint Road East, Stratford

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāti Maru

Ngāti Ruanui

Engagement or consultation:

Te Rūnanga o Ngāti Maru (Taranaki) Trust

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

No return correspondence was received

[R2/2141-3.0](#)

Tir Mynydd Trust

Commencement Date: 24 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 89 Ahipaipa Road, Hawera

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/2147-3.0](#)

Waimate Fields Limited

Location: 263 Ketemarae Road, Hawera
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)
Ngāti Ruanui

Engagement or consultation:

Te Korowai o Ngāruahine Trust
Te Rūnanga o Ngāti Ruanui Trust

Commencement Date: 01 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

No return correspondence was received

[R2/2245-3.0](#)

LJ Symes Trust

Location: 187 Rowan Road, Kaponga
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 24 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/2756-3.0](#)

Robert Gibson Methodist Trust

Location: 439 Mangawhero Road, Riverlea
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 06 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/2773-3.0](#)

DP & SM Hurley Trust

Commencement Date: 30 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 307 Upper Duthie Road, Kaponga

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

[R2/2780-3.1](#)

Cornwall Park Farms Limited

Commencement Date: 15 Apr 2024

Expiry Date: 01 Dec 2047

Review Dates: Jun 2029, Jun 2035, Jun 2041

Activity Class: Discretionary

Location: 55 Cornwall Road, Ngaere

To discharge farm dairy effluent onto land

Application Purpose: Change

Change of conditions to change the herd size, and update purpose so discharge is to land only

Rohe:

Ngāruahine (Statutory Acknowledgement)

Ngāti Ruanui

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/2950-3.0](#)

Double D Trust

Commencement Date: 26 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 1054 Manaia Road, Kaponga

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

[R2/3059-3.0](#)

Johnson and Parkes Limited Partnership

Commencement Date: 10 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 815 Hastings Road, Hawera

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Response received

Comments from Ngāruahine

Return correspondence was received on 25 January 2024 from Taela O'Shea-Herewini (Pou Whirinaki Taiao – Environmental Planner) at Te Korowai o Ngāruahine Trust on behalf of Ōkahu-Inuāwai and Kanihi-Umutahi hapū as follows:

- Ōkahu-Inuāwai and Kanihi-Umutahi opposes any discharge consents to the whenua that affect groundwater, discharges that impact streams, waterways, tributaries that feed the streams and rivers.
- Protection of Waingongoro River is urgent due to heavy pollutants from the activity that surrounds the Waingongoro and streams/tributaries that feed into Waingongoro Awa that have rendered it one of the most polluted waterways in Aotearoa.
- This is their current stance on discharge consents until further notice. Please note that a formal response will be developed in the coming weeks regarding all consents in the Ōkahulnuāwai and Kanihi-Umutahi takiwā.

Considerations during processing of the application

On 4 March 2024 James Cookson, Programme Lead – Primary Industry, responded to Te Korowai o Ngāruahine Trust with the following:

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

We would like to acknowledge the time taken to consider these applications and for providing the Council with comments on behalf of Ōkahu-Inuāwai and Kanihi-Umutahi hapū.

We acknowledge hapū have commented in opposition to any discharges to the whenua that affect groundwater, discharges that impact streams, waterways and tributaries that feed the streams and rivers. We recognise the historical, spiritual and cultural connection of Okahu-Inuawai and Kanahi-Umutahi hapū to the whenua, and waterways within their takiwa.

In response to the comments received, these applications are replacements of an existing activity and a controlled activity under the Regional Fresh Water Plan for Taranaki (RFPW). In practical terms this means that if applications we receive can meet the standards/terms/conditions of a controlled activity then they must be granted.

However, the Council does set the terms and conditions of a resource consent granted under a controlled activity. When granted, the activity will be subject to the conditions reasonably necessary to avoid or mitigate adverse environmental effects in accordance with the Regional Freshwater Plan for Taranaki. Resource consent conditions require that the consent holder shall, at all times, manage effluent irrigation so that, while complying with the other requirements of the consent, the storage available in the effluent disposal system is maximised.

A number of conditions are set so that the farm dairy effluent (FDE) disposal system shall be designed, managed, operated and regularly maintained to ensure that the conditions of the consent are adhered to and no unauthorised discharge of FDE occurs to surface water.

There is also a requirement for the consent holder and/or whoever operates the FDE disposal system, to keep a record of effluent discharged to land, including as minimum the:

- a) date of discharge;*
- b) depth, volume or rate of discharge of liquid effluent;*
- c) volume of solid effluent;*
- d) effluent type (e.g. liquid, slurry, solid);*
- e) source of any solid effluent (e.g. anaerobic pond sludge, sand trap);*
- f) the specific area that effluent was applied to (shown on a map, plan or aerial photograph); and*
- g) the size (in ha or m²) of the area that effluent was applied to.*

This information shall be provided to the Taranaki Regional Council upon request, which is generally requested during a monitoring inspection.

I appreciate the concern raised by hapū regarding the protection the Waingongoro river from pollutants and the current state of the awa. Our Council is in the process of developing a new Land and Freshwater Plan for Taranaki which will replace our current Regional Freshwater Plan. Key to this is kōrero about how we manage freshwater. Your comments and feedback are valued as part of this process, and your concerns relating to this matter have been shared with the policy team. Councils policy team are working closely with Ngāruahine Pou Taiao in the development of policy and through this relationship have offered the opportunity to discuss anything further with hapū. Please let the team know if you would like to do so.

I would like to again thank you for your comments as they provide valuable insight to both the Council and the applicant. We will continue to encourage early engagement from applicants and will be sharing your comments with them. If you have any further comments, or queries, please do not hesitate to contact me.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/3060-3.0](#)

Killarney No 1 Pastoral Trust

Commencement Date: 14 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 113 Katene Road, Normanby

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Ngāti Ruanui

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

Response received

Comments from Ngāti Ruanui

Return correspondence was received on 23 February 2024 from Te Rūnanga o Ngāti Ruanui Trust as follows:

Ngāti Ruanui suggests that there is Areas of cultural value and would like this amended. Ngāti Ruanui has no other comment with regards to this application.

Considerations during processing of the application

On 18 March 2024, James Cookson, Programme Lead – Primary Industry, responded to Te Rūnanga o Ngāti Ruanui Trust with the following:

Firstly, I would like to acknowledge the time you have taken to consider application 23-03060-3.0, Killarney No 1 Pastoral Trust and provide Council with your comments.

As you are aware, almost every dairy discharge application received by council is a replacement of an existing activity and a controlled activity under the Regional Fresh Water Plan for Taranaki. Applications, which meet the standards/terms/conditions of a controlled activity must be granted.

However, the council sets the terms and conditions of a resource consent, granted under a controlled activity. When granted, the activity will be subject to the conditions reasonably necessary to avoid or mitigate adverse environmental effects in accordance with the Regional Freshwater Plan for Taranaki.

Each application received for the discharge of FDE, the information provided, is reviewed by council staff, which includes an on farm investigation with the applicant and individuals involved in the day-to-day operation of the dairy farm.

Also, all farm dairy effluent discharge (FDE) consent are subject to a monitoring programme, ensuring conditions of their consent are adhered to.

A number of those condition ensure, the FDE disposal system shall be designed, managed, operated and regularly maintained to ensure that the conditions of the consent are adhered to and no discharge of FDE occurs to surface water.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

Furthermore, council will advise the applicant that section 11.8 should be amended due to the awa (Waingongoro) flowing at the north-west boundary of their property, which is an area of natural and cultural value.

Thank you for your response and council will pass on your comments to the applicant.

[R2/3069-3.0](#)

BL Kaiser Trust No 1

Location: 1934 Skeet Road, Hawera
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 01 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/3079-3.0](#)

Ida Lea Trust

Location: 353 Mangawhero Road, Auroa
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 09 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/3087-3.0](#)

Foskin Family Limited

Location: 991 Manaia Road, Kapuni
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 03 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/3146-3.0](#)

M G Pranker Ltd

Location: 506 Rawhitiroa Road, Eltham
To discharge farm dairy effluent onto land

Rohe:

Ngāti Ruanui

Engagement or consultation:

Te Rūnanga o Ngāti Ruanui Trust

Commencement Date: 23 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/3167-3.0](#)

Vintage Farm Trust

Location: 57 Upper Duthie Road, Stratford
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 26 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/3201-3.0](#)

M R Cleaver Trust

Commencement Date: 06 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 513 Hastings Road, Matapu

Application Purpose: Replace

To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Response received

Comments from Ngāruahine

Return correspondence was received on 5 May 2023 from Te Korowai o Ngāruahine Trust as follows:

- There has been no pre-application consultation or communication from the applicant with Te Korowai or Ōkahu-Inuawai and Kanihi-Umutahi hapū.
- We acknowledge that Section 36A of the RMA does not require applicants to consult with anyone about resource consent applications.
- However, it is the expectation of Te Korowai that applicants and/or their consultants are following best practice and engaging early with hapū and Iwi to identify potential issues.
- The applicant has indicated in their application that the distance from their effluent discharge point is 830 metres from the Mangatoki Stream however, there are two unnamed tributaries of the Waingongoro River which are the closest waterways to the effluent discharge pond pointed out in the picture below.
- In further applications we would like the applicant to include the metres from the unnamed tributaries of the Waingongoro river as the distance from the effluent discharge point not the Mangatoki Stream.
- The applicants AEE summarise the issues and mitigation measures they propose to manage those issues.
- This is especially important given there is no clear indication of where the effluent exclusion zone begins or ends
- While we are supportive of the equipment and storage improvements that are being made by the applicant, our first and most significant concern is the protection of the Waingongoro River and its tributaries.
- Te Korowai supports all findings and recommendations within the Diary Effluent Systems Report.
- We would like the applicant to provide evidence of their Riparian Management Plan (if available). This will assist us in assessing the potential impact of the discharge activity.

Considerations during processing of the application

Council sent the riparian plan to Te Korowai o Ngāruahine Trust on 19 October 2023. On 9 November 2023, James Cookson, Programme Lead – Primary Industry, responded to Te Korowai o Ngāruahine Trust thanking them for their comments.

Thank you for providing council with your comments, on application 23-03201-3.0 M R Cleaver Trust.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

Each application received for the discharge of farm dairy effluent (FDE), the information provided, is reviewed by council staff, which includes an on farm investigation with the applicant and individuals involved in the day-to-day operation of the dairy farm.

The Waingongoro River has been identified as the catchment for this property and the applicants have been advised.

The applicants have simply identified the Mangatoki stream as the largest body of water near their property.

All FDE consents are subject to a monitoring programme, ensuring conditions of their consent are adhered to.

Council sets limits on the distance an activity, like the discharge of FDE can occur near surface water bodies as a consent condition.

Resource consents requires that no contaminants shall be discharged within:

- a) 25 metres of any surface water body; or*
- b) 25 metres of any fenced (or otherwise identified) urupa without the written approval of the relevant Iwi; or*
- c) 50 metres of any bore, well or spring used for water supply purposes; or*
- d) 100 metres of any wetland; or*
- e) 150 metres from any marae, unless the written approval of the marae Chair has been obtained to allow the discharge at a closer distance.*

Also, this includes, a requirement for the consent holder and/or whoever operates the FDE disposal system to keep a record of effluent discharged to land including as minimum the:

- a) date of discharge;*
- b) depth, volume or rate of discharge of liquid effluent;*
- c) volume of solid effluent;*
- d) effluent type (e.g. liquid, slurry, solid);*
- e) source of any solid effluent (e.g. anaerobic pond sludge, sand trap);*
- f) the specific area that effluent was applied to (shown on a map, plan or aerial photograph); and*
- g) the size (in ha or m²) of the area that effluent was applied to*

This information shall be provided to the Taranaki Regional Council upon request, which is mostly requested during a monitoring inspection.

Council will pass on your comments on to the applicant.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/3357-3.0](#)

SM Muller and NK Buckthought

Commencement Date: 26 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 454 Rama Road, Kaupokonui

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

[R2/3486-3.0](#)

OR & JM Perrett Trust Limited

Commencement Date: 13 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 438 Finnerty Road, Stratford

To discharge farm dairy effluent onto land

Application Purpose: Replace

Rohe:

Ngāruahine (Statutory Acknowledgement)

Ngāti Ruanui

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Response received

Te Rūnanga o Ngāti Ruanui Trust

Response received

Comments from Ngāruahine

Return correspondence was received on 25 January 2024 from Taela O'Shea-Herewini (Pou Whirinaki Taiao – Environmental Planner) at Te Korowai o Ngāruahine Trust on behalf of Ōkahu-Inuāwai and Kanihi-Umutahi hapū as follows:

- Ōkahu-Inuāwai and Kanihi-Umutahi opposes any discharge consents to the whenua that affect groundwater, discharges that impact streams, waterways, tributaries that feed the streams and rivers.
- Protection of Waingongoro River is urgent due to heavy pollutants from the activity that surrounds the Waingongoro and streams/tributaries that feed into Waingongoro Awa that have rendered it one of the most polluted waterways in Aotearoa.
- This is their current stance on discharge consents until further notice. Please note that a formal response will be developed in the coming weeks regarding all consents in the Ōkahu-Inuāwai and Kanihi-Umutahi takiwā.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

Comments from Ngāti Ruanui

Return correspondence was received on 3 October 2023 from Te Rūnanga o Ngāti Ruanui Trust as follows:

"Thank you for informing us of this application.

Ngāti Ruanui notes that the unnamed stream comes off the Waingongoro and therefore questions 11.6, 11.7 and 11.8 should be yes.

Ngāti Ruanui makes no further comment with regards to this application."

Considerations during processing of the application

On 4 March 2024 James Cookson, Programme Lead – Primary Industry, responded to Te Korowai o Ngāruahine Trust with the following:

Firstly, we would like to acknowledge the time taken to consider these applications and for providing the Council with comments on behalf of Ōkahu-Inuāwai and Kanihi-Umutahi hapū.

We acknowledge hapū have commented in opposition to any discharges to the whenua that affect groundwater, discharges that impact streams, waterways and tributaries that feed the streams and rivers. We recognise the historical, spiritual and cultural connection of Okahu-Inuāwai and Kanahi-Umutahi hapū to the whenua, and waterways within their takiwa.

In response to the comments received, these applications are replacements of an existing activity and a controlled activity under the Regional Fresh Water Plan for Taranaki (RFP). In practical terms this means that if applications we receive can meet the standards/terms/conditions of a controlled activity then they must be granted.

However, the Council does set the terms and conditions of a resource consent granted under a controlled activity. When granted, the activity will be subject to the conditions reasonably necessary to avoid or mitigate adverse environmental effects in accordance with the Regional Freshwater Plan for Taranaki. Resource consent conditions require that the consent holder shall, at all times, manage effluent irrigation so that, while complying with the other requirements of the consent, the storage available in the effluent disposal system is maximised.

A number of conditions are set so that the farm dairy effluent (FDE) disposal system shall be designed, managed, operated and regularly maintained to ensure that the conditions of the consent are adhered to and no unauthorised discharge of FDE occurs to surface water.

There is also a requirement for the consent holder and/or whoever operates the FDE disposal system, to keep a record of effluent discharged to land, including as minimum the:

- a) date of discharge;*
- b) depth, volume or rate of discharge of liquid effluent;*
- c) volume of solid effluent;*
- d) effluent type (e.g. liquid, slurry, solid);*
- e) source of any solid effluent (e.g. anaerobic pond sludge, sand trap);*
- f) the specific area that effluent was applied to (shown on a map, plan or aerial photograph); and*
- g) the size (in ha or m²) of the area that effluent was applied to.*

This information shall be provided to the Taranaki Regional Council upon request, which is generally requested during a monitoring inspection.

**Non-notified authorisations issued by Taranaki Regional Council
between 06 Apr 2024 and 15 May 2024**

I appreciate the concern raised by hapū regarding the protection the Waingongoro river from pollutants and the current state of the awa. Our Council is in the process of developing a new Land and Freshwater Plan for Taranaki which will replace our current Regional Freshwater Plan. Key to this is kōrero about how we manage freshwater. Your comments and feedback are valued as part of this process, and your concerns relating to this matter have been shared with the policy team. Councils policy team are working closely with Ngāruahine Pou Taiao in the development of policy and through this relationship have offered the opportunity to discuss anything further with hapū. Please let the team know if you would like to do so.

I would like to again thank you for your comments as they provide valuable insight to both the Council and the applicant. We will continue to encourage early engagement from applicants and will be sharing your comments with them. If you have any further comments, or queries, please do not hesitate to contact me.

On 14 November 2023 James Cookson, Programme Lead – Primary Industry, responded to Te Rūnanga o Ngāti Ruanui Trust with the following:

Thank you for providing council with your comments, on application 23-03486-3.0 OR & JM Perrett Trust.

As you are aware, almost every dairy discharge application received by council is a replacement of an existing activity and a controlled activity under the Regional Fresh Water Plan for Taranaki. Applications, which meet the standards/terms/conditions of a controlled activity must be granted.

However, the council sets the terms and conditions of a resource consent, granted under a controlled activity. When granted, the activity will be subject to the conditions reasonably necessary to avoid or mitigate adverse environmental effects in accordance with the Regional Freshwater Plan for Taranaki.

Each application received for the discharge of FDE, the information provided, is reviewed by council staff, which includes an on farm investigation with the applicant and individuals involved in the day-to-day operation of the dairy farm.

Also, all farm dairy effluent discharge (FDE) consent are subject to a monitoring programme, ensuring conditions of their consent are adhered to.

A number of those condition ensure, the FDE disposal system shall be designed, managed, operated and regularly maintained to ensure that the conditions of the consent are adhered to and no discharge of FDE occurs to surface water.

Council officers will advise the applicant of Ngāti Ruanui comments, regarding the two unnamed tributaries, which feed in to the Waingongoro River, where food has been traditionally gathered and it is areas of natural, cultural, heritage or scientific value.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/3758-3.0](#)

Ivy Plains Limited

Location: 290 Lower Glenn Road, Kaupokonui
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 23 Apr 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/3790-3.0](#)

SE & SA Nicholas Family Trusts Partnership

Location: 468 Palmer Road, Hawera
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 10 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/3795-3.0](#)

Mangimangi Trust

Location: 677 Maata Road, Eltham
To discharge farm dairy effluent onto land

Rohe:

Ngāti Ruanui

Engagement or consultation:

Te Rūnanga o Ngāti Ruanui Trust

Commencement Date: 09 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/3812-3.0](#)

C A Myers Trust

Location: 289 South Road, Hawera
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)
Ngāti Ruanui

Engagement or consultation:

Te Korowai o Ngāruahine Trust
Te Rūnanga o Ngāti Ruanui Trust

Commencement Date: 10 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

No return correspondence was received

[R2/3845-3.0](#)

Okawanui Farm Trust

Location: 166 Upper Glenn Road, Kaupokonui
To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

Commencement Date: 14 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

[R2/3898-3.0](#)

Edridge Partnership

Location: 173 Anderson Road, Eltham
To discharge farm dairy effluent onto land

Rohe:

Ngāti Ruanui

Engagement or consultation:

Te Rūnanga o Ngāti Ruanui Trust

Commencement Date: 10 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Application Purpose: Replace

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/4038-7.0](#)

Tegel Foods Limited

Commencement Date: 10 Apr 2024

Expiry Date: 01 Jun 2038

Review Dates: Jun 2026, Jun 2032

Activity Class: Discretionary

Location: 39/57 Paraite Road, Bell Block

Application Purpose: Replace

To discharge emissions into the air from the milling and blending of grain and/or animal meals together with associated activities

Rohe:

Te Atiawa (Statutory Acknowledgement)

Engagement or consultation:

Nexans New Zealand Limited

Written approval provided

Olex New Zealand Limited

Consulted by applicant

Paula Northcott

Written approval provided

Robert Weston

Written approval provided

Te Kotahitanga o Te Atiawa Trust

Consulted by applicant

Te Kotahitanga o Te Atiawa Trust

Response received

Comments from Te Atiawa

Return correspondence was received from Te Kotahitanga o Te Atiawa Trust on 13 January 2020 as follows:

"Generally, it is our opinion that the application is lacking in a number of areas making a comprehensive review difficult and we set out the key matters of concern below, as the basis for our assessment.

Specifically:

- Puketapu Hapū and Te Kotahitanga o Te Atiawa Trust have not been engaged to inform this resource consent application. The assessment of environmental effects appears incomplete in that consideration of cultural effects on natural and physical resources is not made (as required by Schedule 4, section 7(1)(d) of the Resource Management Act 1991).*
 - The Te Atiawa Claims Settlement Act was promulgated in 2016 and introduced statutory acknowledgement on the Mangatī Stream. No assessment of the actual and potential adverse effects on the statutory acknowledgement is made.*
 - It is unclear from the application what resource consent is being sought for.*
 - It appears no assessment of Part 2 of the Resource Management Act 1991 (RMA) has been undertaken. We consider sections 6(e), 7(a) and 8 are most relevant to the proposal.*
 - It appears no assessment has been undertaken in relation to the Regional Air Quality Plan for Taranaki, the NPS for Freshwater Management, Regional Policy Statement for Taranaki and Operative and Proposed New Plymouth District Plan. Policy 3.2 of the Air Quality Plan requires iwi to participate in air management decision-making processes.*
 - In addition to the above, no assessment of the proposed development has been made against Te Atiawa's iwi environmental management plan Tai Whenua, Tai Tangata, Tai Ao (IEMP). The IEMP states 'Awhi-Rangi is another name for Ranginui or sky father. The air and atmosphere are viewed as a gift from Awhi-Rangi. It [Awhi-Rangi] is acknowledged as a taonga and therefore its mauri must be protected from inappropriate use, and to ensure it is passed onto future generations in health and pristine state'. Te Atiawa expect that the following points (not limited to) are addressed:*
-

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

- Require the adoption of clean technologies which reduce adverse effects of discharge activities on air and atmosphere quality (policy TTAR1.2 of the IEMP);
- Require the use of site-specific native plantings programmes to off-set the effects resulting from air and atmosphere discharges (policy TTAR1.4 of the IEMP);
- Require the adoption of clean technologies to reduce odour pollution (policy TTAR3.1 of the IEMP);
- Require monitoring of odour to ensure compliance with existing standards and conditions of consents (policy TTAR3.2 of the IEMP).

Notwithstanding, for the Taranaki Regional Council to take into account the values of Puketapu Hapū and Te Atiawa hold in the area, we recommend:

1. Additional information be provided in line with this feedback via the Section 92 of the RMA to inform the consent process;
2. Puketapu Hapu and Te Kotahitanga o Te Atiawa Trust are identified as affected parties under Section 95 of the RMA."

Considerations during processing of the application

Council required an assessment against Te Atiawa Environmental Management Plan and advised the applicant to consult with Te Atiawa. The applicant's agent subsequently committed to the consultation and supplied the required assessment.

<p>R2/4073-4.0</p> <p>Greymouth Petroleum Central Limited</p> <p>Location: Ngatoro-A Wellsite, 561 Dudley Road Upper, Inglewood</p> <p>To discharge treated stormwater from hydrocarbon exploration and production activities at the Ngatoro-A wellsite onto and into land and into an unnamed tributary of the Ngatoro Stream</p> <p>Rohe:</p> <p>Taranaki (Statutory Acknowledgement) Te Atiawa (Statutory Acknowledgement)</p> <p>Engagement or consultation:</p> <p>New Plymouth District Council Te Kāhui o Taranaki Trust Te Kotahitanga o Te Atiawa Trust Te Kotahitanga o Te Atiawa Trust</p>	<p>Commencement Date: 07 May 2024</p> <p>Expiry Date: 01 Jun 2039</p> <p>Review Dates: Jun 2027, Jun 2033</p> <p>Activity Class: Controlled</p> <p>Application Purpose: Replace</p> <p>No return correspondence was received No return correspondence was received Consulted by applicant No return correspondence was received</p>
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Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/4692-3.0](#)

Airport Farm Trustee Limited

Commencement Date: 03 May 2024

Expiry Date: 01 Jun 2038

Review Dates: Jun 2026, Jun 2032

Activity Class: Controlled

Location: 58 Airport Drive, Bell Block

Application Purpose: Replace

To discharge washdown water from the cleaning of poultry sheds onto and into land

Rohe:

Te Atiawa (Statutory Acknowledgement)

Engagement or consultation:

Te Kotahitanga o Te Atiawa Trust

Response received

Comments from Te Atiawa

Return correspondence was received from Te Kotahitanga o Te Atiawa Trust on 13 April 2021 as follows:

"Thank you for providing a copy of the resource consent application. Puketapu hapū are the Te Atiawa hapū with mana whenua over the application site. Puketapu hapū and Te Kotahitanga o Te Atiawa Taranaki have reviewed the application.

The proposed discharges to land and to air occur within 400 m of the Mangaoraka Stream and the Puketapu hapū pā site Pahau (site #451). The discharges therefore have the potential to result in adverse effects on the mauri of the air, water, and soil, the health and well-being of our people, and on taonga species.

The Mangaoraka Stream is a tributary of the Waiongana River. The Waiongana River and its tributaries are identified as areas subject to statutory acknowledgement in the Te Atiawa Claims Settlement Act 2016. Statutory acknowledgements provide formal recognition of the traditional, historical, cultural, and spiritual associations with the identified area.

The application lacks sufficient information, making an informed review difficult (i.e. no copies of the existing resource consents provided, no information around what rules are being triggered and the activity status of the proposal). Notwithstanding this, the application has been aligned with Tai Whenua, Tai Tangata, Tai Ao – the Te Atiawa Iwi Environmental Management Plan (EMP) and the following comments are made:

- We require that as far as practicable applicants shall manage discharges to air and atmosphere on-site (Pol. TTAR1.5). We require the use of site-specific native planting programmes to off-set the effects resulting from air and atmosphere discharges (Pol. TTAR1.4)*
 - Point-source discharges of contaminants to water, and to land where contaminants may enter the water shall be avoided (Pol. TTOM3.3)*
 - Discharges shall be managed onsite utilising the land as a filter (Ob. TTAN9.1). All discharges are required to be going to appropriate soil types and topography (Pol. TTAN9.1). Over saturation and over contamination of soil shall be avoided (Pol. TTAN9.2)*
 - We require regular monitoring of soil, groundwater and surface water where discharges are going onto land in the Te Atiawa rohe, and these reports shall be sent to Puketapu hapū and TKOTAT (Pol. TTAN9.3). Where the monitoring shows that the accumulation of contaminants is affecting the mauri of the soil and land, discharge activities shall cease until this is rectified (Pol. TTAN9.4)*
 - We require the adoption of clean technologies which reduce adverse effects resulting from the discharge of contaminants on air and atmosphere quality (Pol. TTAR1.2)*
-

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

- Puketapu hapū shall be resourced to prepare and approve a Cultural Health Index monitoring programme to assess the health of the nearby Mangaoraka Stream using mātauranga Māori monitoring techniques (Gen. Pol. TTOM1.6)
- Puketapu hapū shall be resourced to prepare and implement a restoration planting programme along the Mangaoraka Stream, or an alternative site as decided by Puketapu hapū

The following recommendations were made:

- Puketapu hapū and Te Kotahitanga o Te Atiawa Taranaki are identified as affected parties under section 95E of the Resource Management Act 1991
- If consent is granted, conditions of consent are applied under Sections 104 and 108 of the Resource Management Act 1991 in line with the response provided above.”

Considerations during processing of the application

The application complies with the requirement to avoid direct discharges to water, instead directing discharges to an upgraded soakage pond via two sand traps. The proposed discharge point is located on land approximately 380 meters from the nearest surface water body. These washdown events occur approximately once every two months. While the request for site-specific native planting programs to offset air and atmosphere discharges falls outside the scope of this controlled activity, it is acknowledged as a valuable recommendation. The Council will set the conditions for a resource consent granted under a controlled activity. When granted, the activity will be subject to conditions reasonably necessary to avoid or mitigate adverse environmental effects, in accordance with the Regional Freshwater Plan for Taranaki.

[R2/6025-2.0](#)

Aviagen New Zealand Limited

Commencement Date: 03 May 2024

Expiry Date: 01 Jun 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 658 Mokau Road, Urenui

Application Purpose: Replace

To discharge washdown water from the cleaning of a poultry shed onto and into land

Rohe:

Ngāti Mutunga (Statutory Acknowledgement)

Engagement or consultation:

Te Rūnanga o Ngāti Mutunga

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/6411-2.0](#)

New Plymouth District Council

Commencement Date: 02 May 2024

Expiry Date: 01 Jun 2051

Review Dates: Jun 2027, Jun 2033, Jun 2039, Jun 2045

Activity Class: Controlled

Location: Corner of Whakapaki & Mokena Street, Urenui

Application Purpose: Replace

To occupy the Coastal Marine Area with a gabion basket and rock riprap protection on the true left bank of the Urenui River estuary for erosion control purposes

Rohe:

Ngāti Mutunga (Statutory Acknowledgement)

Engagement or consultation:

Te Rūnanga o Ngāti Mutunga

Consulted by applicant

Te Rūnanga o Ngāti Mutunga

Discussions with Council

Council Discussions with Ngāti Mutunga

Council informed Te Rūnanga o Ngāti Mutunga of the application on 17 March 2020 and a follow up email was sent on 8 January 2024. The Environmental Planner processing this application, phoned Te Rūnanga o Ngāti Mutunga on 16 January 2024 to discuss the application and a representative of Ngāti Mutunga advised that the structure does not fall within an official site of significance.

[R2/6418-2.0](#)

Zimmermann R & E Family Trust

Commencement Date: 01 May 2024

Expiry Date: 01 Sep 2039

Review Dates: Jun 2027, Jun 2033

Activity Class: Controlled

Location: 1197 Skeet Road, Hawera

Application Purpose: Replace

To discharge farm dairy effluent onto land

Rohe:

Ngāruahine (Statutory Acknowledgement)

Engagement or consultation:

Te Korowai o Ngāruahine Trust

No return correspondence was received

**Non-notified authorisations issued by Taranaki Regional Council
between 06 Apr 2024 and 15 May 2024**

[R2/6468-2.0](#)

Stratford District Council

Commencement Date: 29 Apr 2024

Expiry Date: 01 Jun 2040

Review Dates: Jun 2028, Jun 2034

Activity Class: Discretionary

Location: 1 Cordelia Street, Stratford

Application Purpose: Replace

To use a culvert in an unnamed tributary of the Kahouri Stream for flood control purposes

Rohe:

Ngāti Maru

Ngāti Ruanui

Engagement or consultation:

Te Rūnanga o Ngāti Maru (Taranaki) Trust

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

Consulted by applicant

Te Rūnanga o Ngāti Ruanui Trust

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/6520-2.0](#)

Fairhurst Holdings Limited

Commencement Date: 22 Apr 2024

Expiry Date: 01 Jun 2058

Review Dates: Jun 2028, Jun 2034, Jun 2040, Jun 2046, Jun 2052

Activity Class: Discretionary

Application Purpose: Replace

Location: Port Taranaki, Breakwater Road, New Plymouth

To occupy the coastal marine area with a restaurant deck structure

Rohe:

Te Atiawa (Statutory Acknowledgement)

Engagement or consultation:

Ngamotu Marine Reserve Society

Consulted by applicant

Te Kotahitanga o Te Atiawa Trust

Response received

Comments from Te Atiawa

Return correspondence was received from Te Kotahitanga o Te Atiawa Trust on 24 October 2019 with questions regarding the application. These questions were forwarded on to the applicant on 26 November 2019. Subsequently, Te Kotahitanga o Te Atiawa Trust responded to the applicant via email on 3 March 2020 with the following correspondence:

"We understand you met with members of Ngati Te Whiti Hapū in 2004/ 2005 to discuss the project to construct the restaurant building. The boulders placed at the base of the deck foundations are much more appealing visually than the solid concrete wall. In addition, the boulders are likely to provide an improved habitat than the solid concrete wall would have offered to coastal wildlife – it also provides easier access. We understand the foundations for the deck were required to be engineer designed given the coastal marine environment that they are located within. We noted yours and your neighbours commitment to voluntarily providing habitat for kororā and pest (rat) management. Stormwater and wastewater from the building is connected to NPDC's reticulated systems.

Considerations during processing of the application

A conditional approval has been provided from Te Atiawa, who have statutory acknowledgement over the coastal marine area at the subject site.

Te Atiawa seeks the ongoing provision and retention of pest management and the ongoing provision and retention of habitat for kororā and other coastal wildlife at the application site. Therefore the Council recommended a condition that the boulders beneath the deck which provide nesting habitat for kororā be maintained, and the applicant has agreed to this.

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/6785-2.1](#)

Shaugh Partnership

Commencement Date: 08 May 2024

Expiry Date: 01 Jun 2042

Review Dates: Jun 2030, Jun 2036

Activity Class: Discretionary

Location: 574 Kina Road, Opunake

Application Purpose: Replace

To use a culvert in the Manganui Stream for farm access purposes

Rohe:

Taranaki (Statutory Acknowledgement)

Engagement or consultation:

Te Kāhui o Taranaki Trust

No return correspondence was received

[R2/6934-2.1](#)

Washer Family Trust

Commencement Date: 22 Apr 2024

Expiry Date: 01 Jun 2038

Review Dates: Jun 2026, Jun 2032

Activity Class: Discretionary

Location: Washer Road, Omata

Application Purpose: Replace

To use two access culverts in two unnamed tributaries of the Tapuae Stream

Rohe:

Taranaki (Statutory Acknowledgement)

Engagement or consultation:

Te Kāhui o Taranaki Trust

No return correspondence was received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/7225-2.0](#)

Ranald & Robyn Gordon

Commencement Date: 19 Apr 2024

Expiry Date: 01 Jun 2040

Review Dates: Jun 2028, Jun 2034

Activity Class: Discretionary

Location: 99 Monmouth Road, Stratford

Application Purpose: Replace

To use a culvert in an unnamed tributary of the Kahouri Stream for access purposes

Rohe:

Ngāruahine (Statutory Acknowledgement)

Ngāti Maru

Ngāti Ruanui

Engagement or consultation:

Te Rūnanga o Ngāti Maru (Taranaki) Trust

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

No return correspondence was received

Te Korowai o Ngāruahine Trust

Response received

Comments from Ngāruahine

Return correspondence was received from Te Korowai o Ngāruahine Trust on 28 January 2022. The correspondence noted that "as this is an existing culvert, there are no major concerns from Te Korowai", however it was expected that the Council would "assess the culvert according to Section 3.26 of the National Policy Statement for Freshwater."

Considerations during processing of the application

It is determined that the proposal, within the scope of the application, will not contravene the relevant objectives and policies of the iwi groups for the following reasons:

- a) The application is for the ongoing use of an existing structure, with no associated installation effects.*
 - b) Conditions imposed on this consent will remediate any barriers to fish passage and ensure this is maintained for the duration of the consent.*
-

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

[R2/9908-1.1](#)

Fonterra Limited

Commencement Date: 19 Apr 2024

Expiry Date: 01 Jun 2034

Review Dates: Jun 2026, Jun 2029, Jun 2032

Activity Class: Discretionary

Location: Various locations throughout the Taranaki region

Application Purpose: Change

To discharge dairy liquids onto land and the associated emissions to air, in various locations throughout the Taranaki region

Change of consent conditions to include the discharge of dairy processing wastewater, in addition to the currently consented discharge of dairy by-products, unprocessable dairy products and surplus dairy products ('dairy liquids'), onto land, and the associated emissions to air, in various locations throughout the Taranaki region

Rohe:

Ngaa Rauru Kītahi

Ngāruahine (Statutory Acknowledgement)

Ngāti Maniapoto

Ngāti Maru

Ngāti Mutunga

Ngāti Ruanui

Ngāti Tama

Taranaki (Statutory Acknowledgement)

Te Atiawa (Statutory Acknowledgement)

Engagement or consultation:

Fish & Game New Zealand

Consulted by applicant

South Taranaki District Council

Consulted by applicant

Taranaki District Health Board

Consulted by applicant

Te Kaahui o Rauru

No return correspondence was received

Te Kāhui o Taranaki Trust

No return correspondence was received

Te Korowai o Ngāruahine Trust

Consulted by applicant

Te Korowai o Ngāruahine Trust

No return correspondence was received

Te Nehenehenui (TNN)

No return correspondence was received

Te Rūnanga o Ngāti Maru (Taranaki) Trust

No return correspondence was received

Te Rūnanga o Ngāti Mutunga

No return correspondence was received

Te Rūnanga o Ngāti Ruanui Trust

No return correspondence was received

Te Rūnanga o Ngāti Tama

No return correspondence was received

Te Kotahitanga o Te Atiawa Trust

Response received

Non-notified authorisations issued by Taranaki Regional Council between 06 Apr 2024 and 15 May 2024

Comments from Te Atiawa

Return correspondence was received from Te Kotahitanga o Te Atiawa Trust on 18 January 2024 and is summarised as follows:

- Te Kotahitanga and ngā hapū o Te Atiawa consider that the application contains insufficient information.
- Te Kotahitanga and ngā hapū are concerned that the applicant, despite having in place a company Māori Strategy (Haea Te Ata), have failed to consult with potentially affected iwi and hapū.
- Te Kotahitanga and ngā hapū o Te Atiawa do not support the change proposal, particularly given that there are no protections for sites and areas of significance to Māori, and no advance confirmation of the 3rd party land areas
- It is recommended that Council utilise section 92 of the Resource Management Act 1991 ('RMA') to request further information, and identify ngā hapū o Te Atiawa and Te Kotahitanga as affected parties pursuant to Section 95 of the RMA.

Considerations During Processing of the Application

The Council forwarded the email correspondence from Te Kotahitanga and ngā hapū o Te Atiawa to the agent and applicant. Under the RMA, our consideration is restricted to the impact of the change to the consent and the discharge of dairy processing wastewater. Recent monitoring of the Kapuni lactose manufacturing plant's land discharge consents has shown an increase in nitrogen levels in the waste stream over the past 12 months, resulting in increased nitrogen loading of the plant's irrigation paddocks.

The applicant has committed to limiting their nitrogen loading at Kapuni and is investigating alternative treatment and management methods for the site's process wastewater. The applicant has confirmed they will establish an onsite Waste Water Treatment Plant (WWTP) to reduce both nitrogen and phosphorus levels in the wastewater. However, as the WWTP requires at least five years to establish, an interim solution is necessary.

The applicant has sought a variation to their existing global dairy liquid discharge consent to include dairy processing wastewater, addressing the nitrogen loading issues at the Fonterra Kapuni site temporarily while the WWTP is established.

To address the concerns raised by ngā hapū o Te Atiawa and Te Kotahitanga, a recommended was made to amend Special Condition 11 to include setback distances from culturally significant sites. This is an augier condition and can only be included with the applicant's agreement. The condition's intent is to mitigate concerns about the potential impact on significant cultural sites.

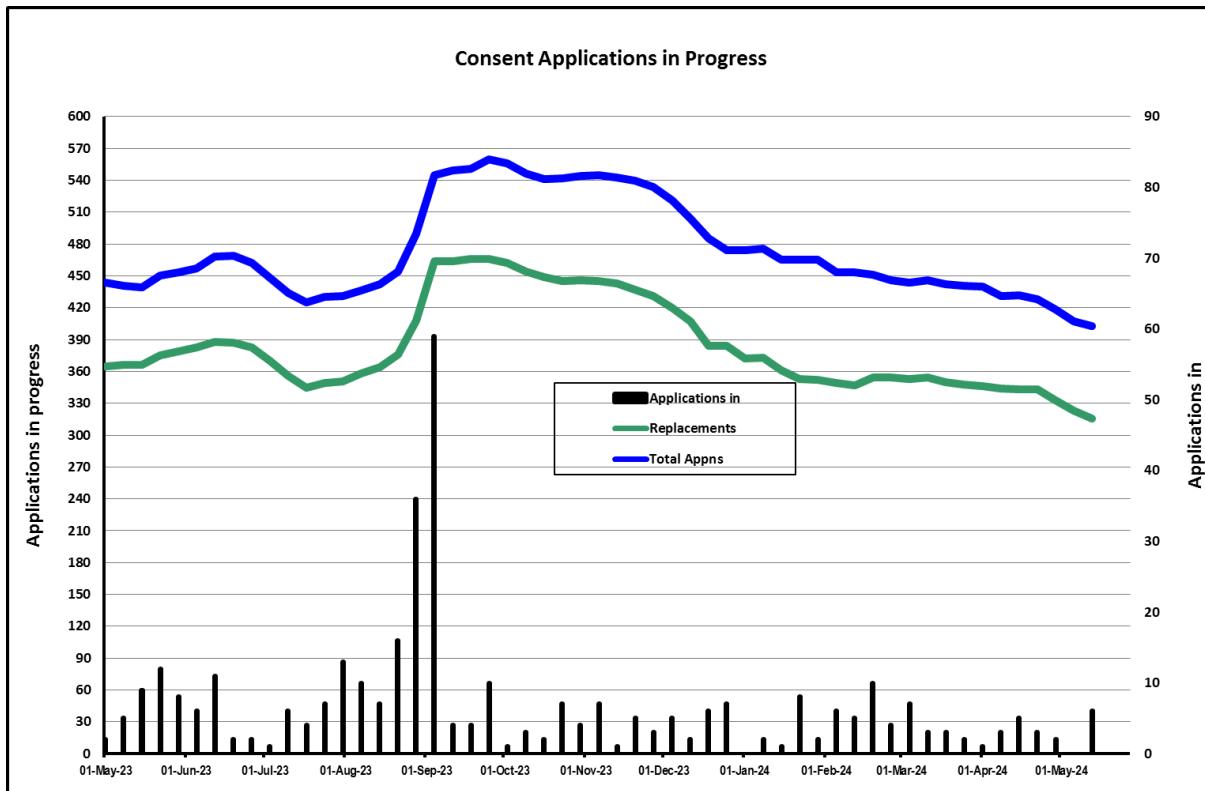
Conditions recommended:

- (a) 25 meters from any urupā and 150 meters from any marae, identified in accordance with Special Condition 12, in accordance with setback requirements in the RFWP.
- (b) Prior to the first discharge on a newly identified third-party farm, the consent holder shall consult with a representative of mana whenua to determine if there are any urupā and/or marae that require buffer or exclusion zones.

As this is a variation application, the Council's discretion is restricted to the change in effects associated with the condition change. Although technically beyond the scope of the variation application, the applicant agreed to include a setback distance from urupā and marae and consultation before discharging to new newly identified third-party farms.

Consent Processing Information

1) Applications in progress



2) Month Ending – Number of applications in progress

	July		Aug		Sept		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun	
	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R	Total	R
2023/2024	431	351	545	464	556	462	542	445	544	446	474	372	465	352	444	353	440	346	418	333	403	316		
2022/2023	540	479	520	453	490	430	499	435	482	417	459	391	431	342	448	371	448	364	444	365	452	379	462	383
2021/2022	310	274	310	277	276	246	258	235	311	280	367	313	354	304	403	350	423	372	439	390	466	406	542	480

R = Replacements

Note: May part month

3) Potential Hearings

Nil

4) Consents Issued (running totals)

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
2023-2024	39	49	57	75	114	178	212	240	250	282		
2022-2023	7	53	82	86	139	171	211	228	249	261	283	307
2021-2022	17	37	87	114	123	136	152	162	184	202	218	225

5) Breakdown of consents processed

	New	Replace	Change	Review	Totals
2023-2024 - to 30 April 2024	74	199	8	1	282
2022-2023 Total	65	227	10	5	307
2021-2022 Total	54	149	16	6	225

6) Types of consents issued - year to date comparison

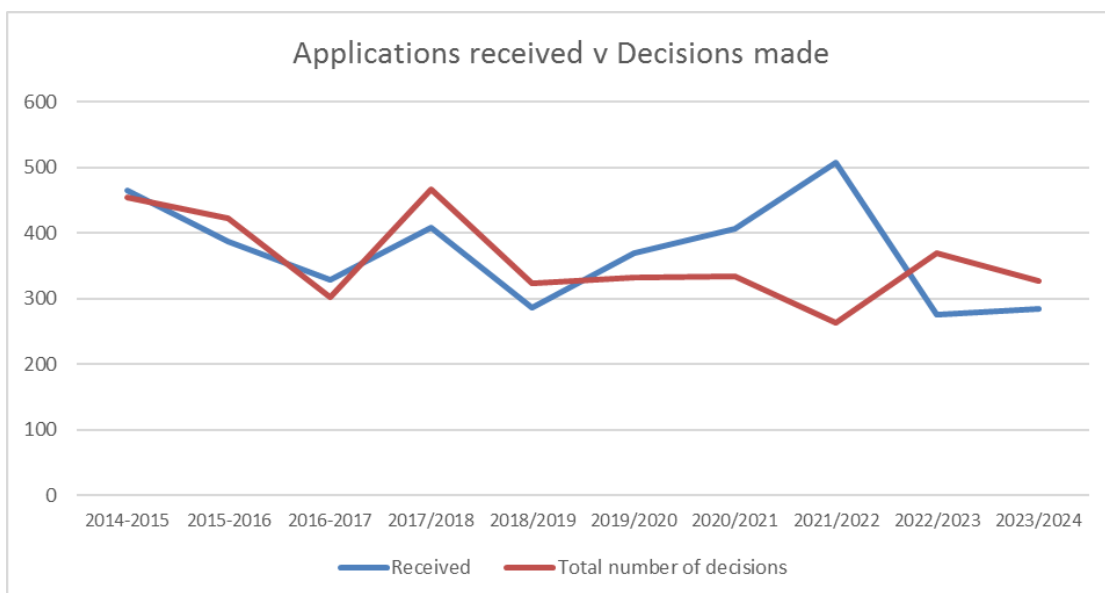
	Publically Notified						Total publically notified		Limited						Total Limited Notified		Non Notified						Total Non-notified		Grand Total
	Agricultural	Central/Local Government	Energy	Forestry	Other	%		Agricultural	Central/Local Government	Energy	Forestry	Other	%		Agricultural	Central/Local Government	Energy	Forestry	Other	%					
July 2021 to June 2022	0	0	8	0	0	3.6%	8	1	0	0	0	0	0.4%	1	132	36	18	3	27	96.0%	216	225			
July 2022 to June 2023	0	0	0	0	0	0.0%	0	1	1	0	0	0	0.0%	2	222	16	26	0	41	99.3%	305	307			
To 30 April 2024	0	0	0	0	0	0.0%	0	1	0	0	0	5	0.0%	6	162	34	56	3	21	97.9%	276	282			

7) Length of time to issue applications

	No of consents decision	Number of days decision made in			
		less than 40	40-90	90-200	200+
July	47	3	19	8	17
August	13	3	4	3	3
September	10	1	3	2	4
October	27	11	1	1	14
November	39	8	8	13	10
December	67	6	9	21	31
January	35	3	23	8	1
February	40	19	6	5	10
March	13	4	2	2	5
April	36	12	8	9	7
May					
June					
	327	70	83	72	102

Note: Decisions include issuing, withdrawing or returning applications

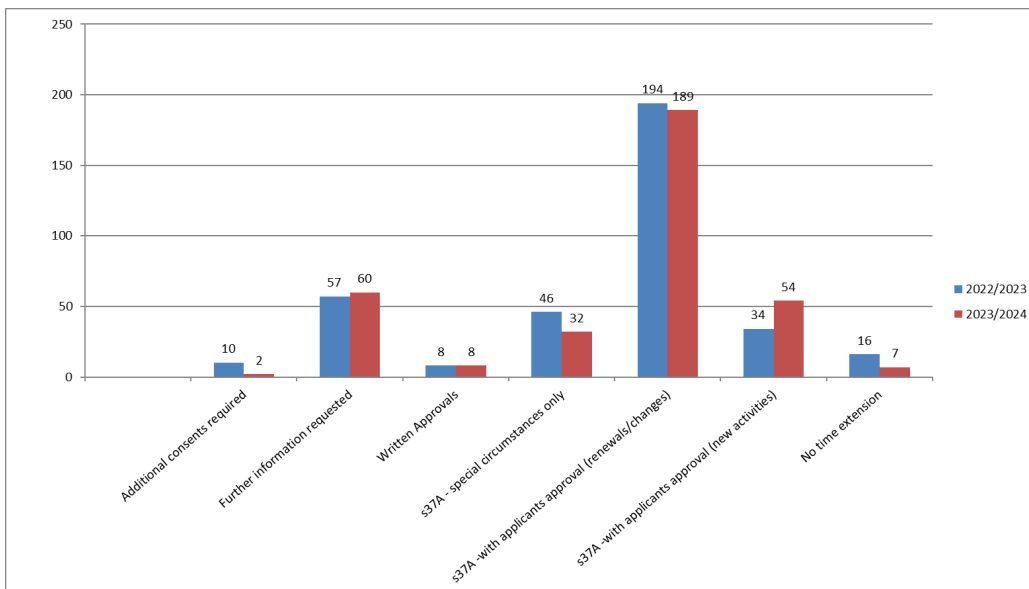
8) Applications received v Decisions made



9) Involvement with third parties for applications processed year to date

	Consultation/ Involved (number of parties)	Number of Affected Party Approvals (written)	Totals
Councils	6	0	6
DOC	11	1	12
Environmental/Recreational Groups	6	0	6
Fish & Game	15	1	16
Individuals/Neighbours/Landowners	109	34	143
Network Utilities	5	0	5
Non Govt Organisations	1	1	2
Other Govt Departments	5	0	5
Iwi/hapu	439	12	451
Totals - to 30 April 2024	597	49	646

10) Application processing time extensions used 2022/2023 versus 2023/2024



11) Consent type process

	Last 10 year average 2013 - 2022	July 2022 to June 2023	July 2023 to April 2024
Total consents granted	334	307	282
Publically Notified	9	0	0
Limited-notified	8	2	6
Non-notified	318	305	276
Applications submitted on (in opposition and to be heard)	12	2	6
Application Pre-hearing resolution (%)	6 82%	2 100%	6 100%
Hearings (no. of applications)	1 (6)	0 (0)	0 (0)
Appeals (no. of applications)	1 (6)	0 (0)	0 (0)
Total current consents	4679	4316	4327

12) Applications returned incomplete under Section 88

For the 2023-2024 financial year, 6 applications have been returned incomplete under S88 of the RMA for insufficient information. Four applications have since been resubmitted and accepted

13) Deemed Permitted Activities issued

Date Issued	DPA No	Holder	Activity	Plan	Rule
8-Apr-24	11236-1.0	Port Taranaki Limited	Disturb seabed/foreshore	CP	55
15-Apr-24	11238-1.0	James Robert Baker	Intensive Winter Grazing	NES - Freshwater (2020) - Regulations	29



Date: 11 June 2024

Subject: Incidents, Compliance Monitoring Non-Compliances and Enforcement Summary – 12 April 2024 to 16 May 2024

Author: M Churchill, Enforcement and Compliance Coordinator

Approved by: A D McLay, Director - Resource Management

Document: 3278013

Purpose

1. The purpose of this memorandum is to consider and receive the summary of the incidents, compliance monitoring non-compliances and enforcement for the period 12 April 2024 to 16 May 2024.

Executive summary

Incidents

2. There are fifty three (53) incidents reported.
3. Fifteen (15) of the incidents were found to be compliant and twenty two (22) were found to be non-compliant. Sixteen (16) of the incidents reported relate to non-compliances from previous periods (updates). The action taken on the incidents is set out for members' information.

Compliance monitoring non-compliance

4. There are twenty seven (27) compliance-monitoring non-compliances reported. Ten (10) of the compliance monitoring non-compliances reported are updates from previous periods.
5. Eight (8) of the non-compliances reported are as a result of the annual dairy inspection round.

Recommendations

That Taranaki Regional Council:

- a) receives this memorandum Incident, Compliance Monitoring Non-Compliances and Enforcement Summary – 12 April 2024 to 16 May 2024
- b) receives the summary of the incidents, compliance monitoring non-compliances and enforcement for the period from 12 April 2024 to 16 May 2024
- c) notes the action taken by staff acting under delegated authority
- d) adopts the recommendations therein.

Background

6. The annual inspection for farm dairy effluent monitoring programme commences in September each year and usually finishes around March, however follow up inspections and winter milking inspections are also carried out during the rest of the year.
7. We receive and respond to pollution events and public complaints throughout the year. Consent compliance monitoring undertaken can also identify non-compliance. This information is recorded in the IRIS database together with the results of investigations and any follow-up actions. Such incidents and non-compliances are publicly reported through the Consents and Regulatory Committee via the Incidents, Compliance Monitoring Non-compliances and Enforcement Report or the Annual Compliance Monitoring Reports.
8. Attached is the summary of the Incidents, Compliance Monitoring Non-compliances and Enforcement for the period from 12 April 2024 to 16 May 2024.
9. Staff have been delegated to undertake enforcement actions. The enforcement policy and procedures are consistently implemented and reported on.

Disclosure Restrictions

10. The incident register information presentation was reviewed in 2014-2015 to increase reader understanding in this complex area. The first section addresses compliant incidents and can be publicly discussed. The second section provides an update on non-compliant incidents from previous meetings and where an incident has been resolved it can be publicly discussed. The third and fourth sections provide information on non-compliant incidents and non-compliances found during compliance monitoring during the period that are still under investigation and staff are limited in terms of public disclosure of information, while the investigation is ongoing and enforcement responses have not been determined. The incident flow chart and definition of terms provide further operational detail.

Discussion

11. We respond to complaints received generally within four hours. This usually involves a site visit. Responses to complaints and non-compliances with rules in regional plans, resource consents and the Resource Management Act 1991 are recorded in the IRIS database. Where necessary, appropriate advisory or enforcement actions are undertaken. The latter may include issuing an inspection, abatement or infringement notice, or initiating a prosecution. Where an infringement notice or prosecution is possible, details of the information in the Incidents, Compliance Monitoring Non-compliances and Enforcement agenda item and staff comment will be restricted for legal disclosure reasons. Further information will be provided at a later and for prosecutions a detailed report will be provided for information purposes, in the confidential section of the agenda.
12. A summary of Incidents, Compliance Monitoring Non-compliances and Enforcement for the period 12 April 2024 to 16 May 2024 is attached. The 'compliant' incidents are presented first in a table and the 'non-compliant' incidents are presented after in a more detailed summary, followed by the compliance monitoring non-compliances.
13. Generally, incidents in the 'compliant' table have a recommendation of 'no further action'. However, an incident is considered 'compliant' until such time as a non-compliance is found. Therefore, occasionally an incident in the 'compliant' table will have a recommendation of 'investigation continuing', if an ongoing investigation is still underway to confirm compliance.
14. A series of graphs are also attached comparing the number of incidents between 2016/17 and 2021/22, and also showing how the incidents are tracking in 2021/22 in relation to environment type and compliance status. There is a graph showing the non-compliances found during compliance monitoring. There is also a graph showing enforcement action taken to date during 2021/22.

15. The data in the graphs for 2021/22 to date is showing that there are more incidents but less compliance monitoring non-compliances. Although in the first month of this period, there is limited data.

Decision-making considerations

16. 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

17. 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

18. 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

19. 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

20. 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

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

Appendices/Attachments

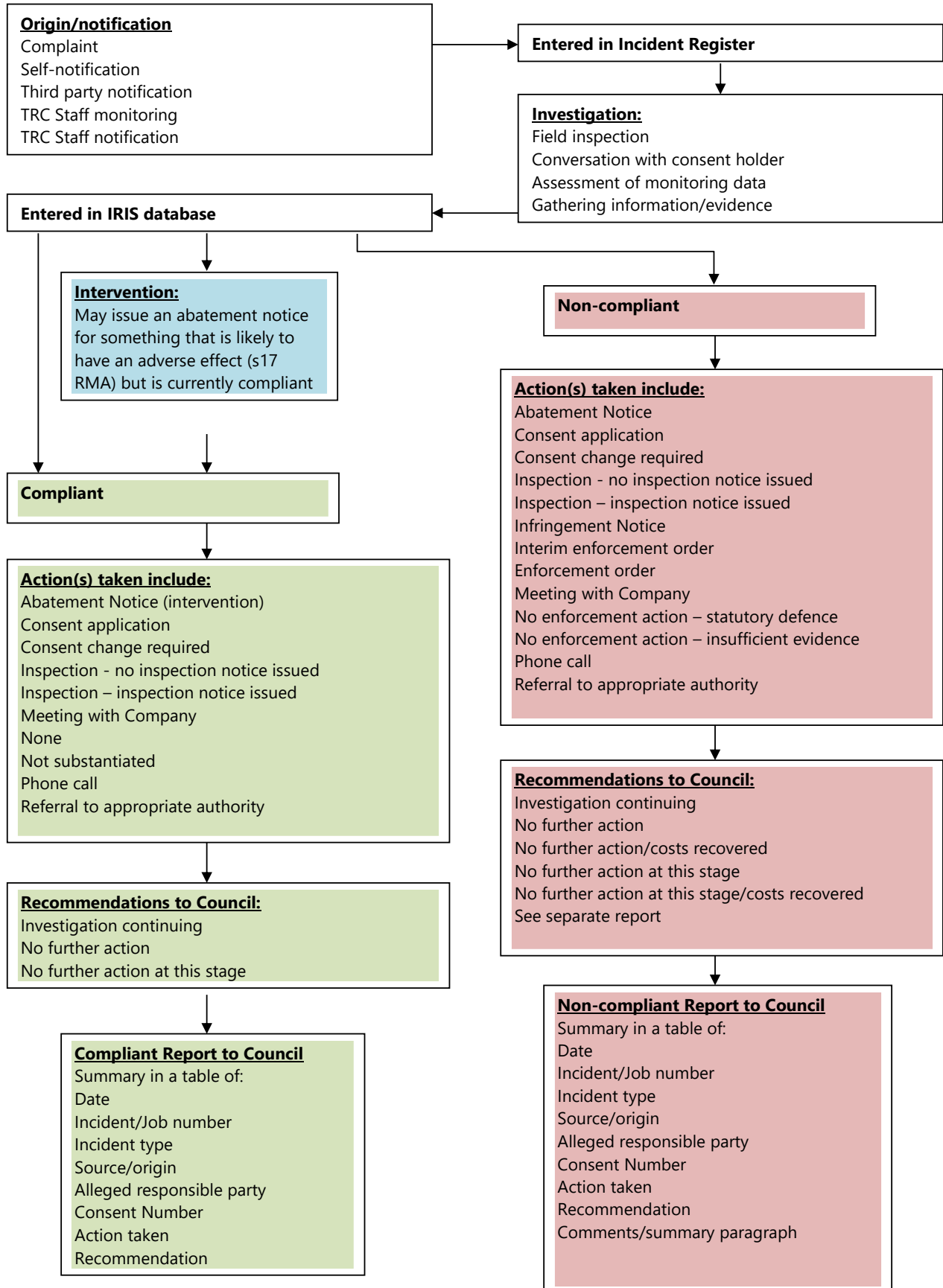
Document 1081324: [Incident flowchart and terms explained](#)

Document 3278009: [Incident and Enforcement Graphs to 31 May 2024](#)

Document 3277981: [Incidents, Compliance Monitoring and Enforcement Summary 12 April 2024 to 16 May 2024](#)

Incident flow chart

Doc # 1081324



Terms explained

Compliance rating

Compliant	After investigation the incident was found to be <u>compliant</u> with environmental standards or other regulations, permitted rules in a regional plan (e.g. RFWP, RAQP, RCP allowed), a resource consent and/or the Resource Management Act 1991.
Non-compliant	After investigation the incident was found to be <u>non-compliant</u> with environmental standards or other regulations, rules in a regional plan, a resource consent and/or the Resource Management Act 1991

Origin/Notification:

Complaint	Notification of incident received from public.
Self notification	Notification of incident received from the responsible party.
Third Party Notification	Notification of incident received from third party such as New Zealand Fire, District Council etc.
TRC Staff monitoring	Notification of incident found during routine compliance monitoring.
TRC Staff notification	Notification of incident found during unrelated monitoring/field work.

Action/s Taken:

14 day Letter	A letter was sent requesting an explanation for the non-compliance and why enforcement action should not be considered. The recipient is given 14 days to reply.
Abatement Notice	A notice was issued requiring something to be undertaken or something to cease to ensure compliance with Rules in the regional plans, resource consent or Resource Management Act 1991. Notice must be complied with or further enforcement action can be considered.
Consent application	A consent application has been received as a result of the investigation.
Consent change required	During the investigation it was found that a consent change was required.
Emergency Works	Emergency works was allowed under section 330 of the RMA. Often a subsequent resource consent is required.
Enforcement Order	An enforcement order has been issued by the Environment Court requiring action to be undertaken or something to cease. Notice must be complied with or further enforcement action can be considered.
Infringement Notice (\$xxx.xx)	An infringement notice was issued under Section 338(1)(a) of the Resource Management Act 1991 and Councils delegated authority.
Inspection Notice	An inspection was undertaken and a notice of advice/instruction was issued to landowner/alleged offender.
Inspection/no notice	An inspection was undertaken, however no inspection notice was issued as

issued	there was no alleged offender/landowner to issue one to (natural event, unsourced etc).
Interim Enforcement Order	An interim enforcement order has been issued by the Environment Court requiring action to be undertaken or something to cease. Notice must be complied with or further enforcement action can be considered.
Meeting with Company	A meeting was held with the Company to discuss the incident and ways to resolve any issues.
None	No action was required.
Not Substantiated	The incident could not be substantiated (i.e. it is not likely/possible/probable that the alleged incident could have taken place).
Phone call	A phone call was made to the alleged offender/authority.
Prosecution	A prosecution is being initiated for this incident.
Referral to Appropriate Authority	The incident was referred to the appropriate authority (District Council, Department of Conservation etc).

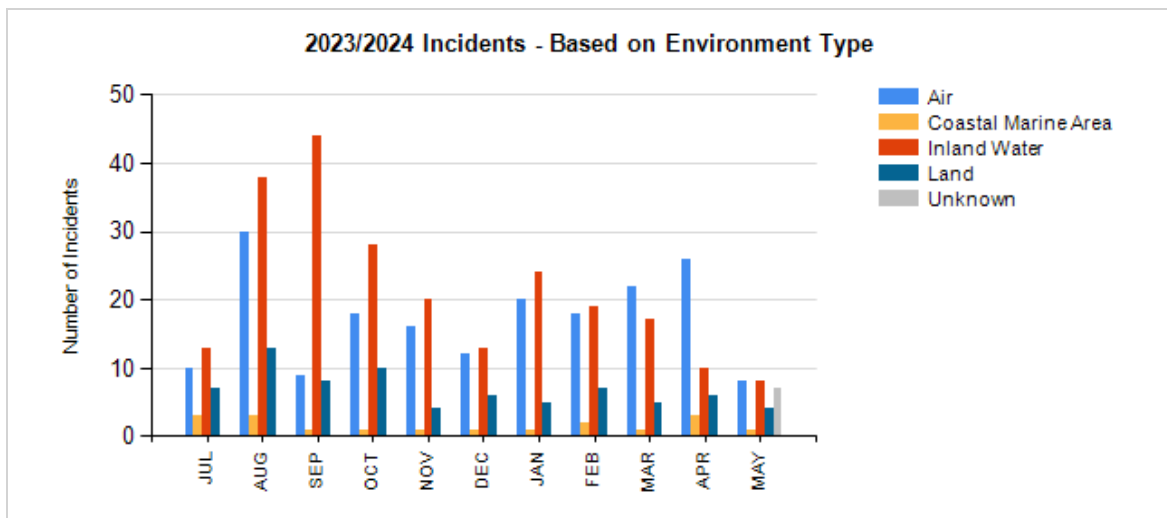
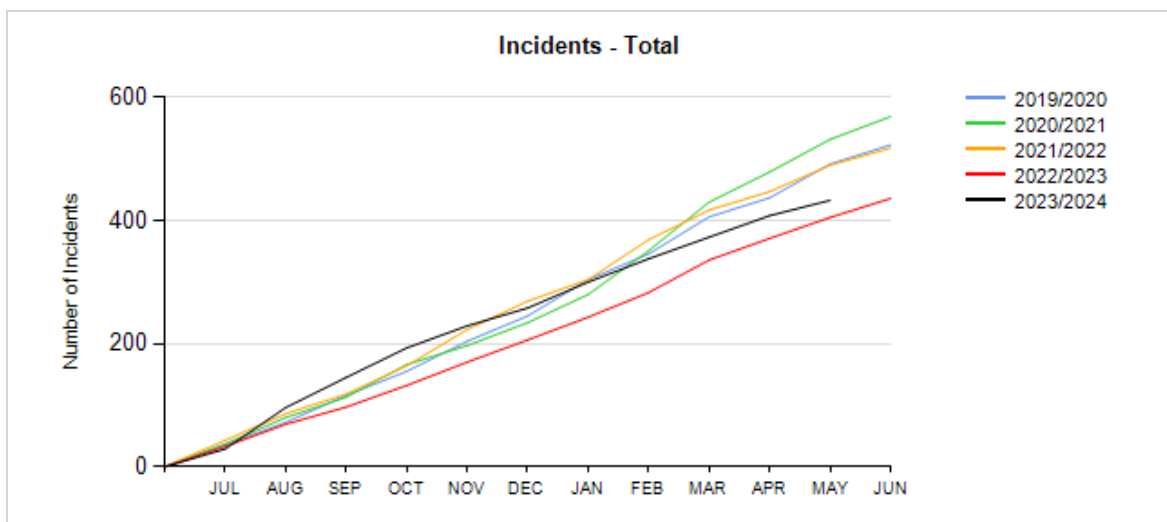
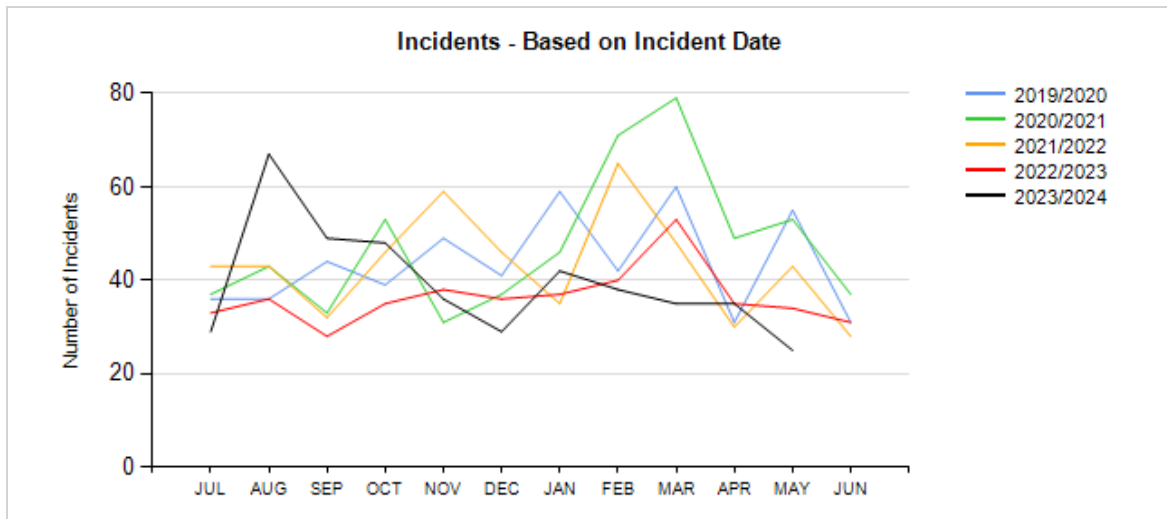
Recommendations to Council

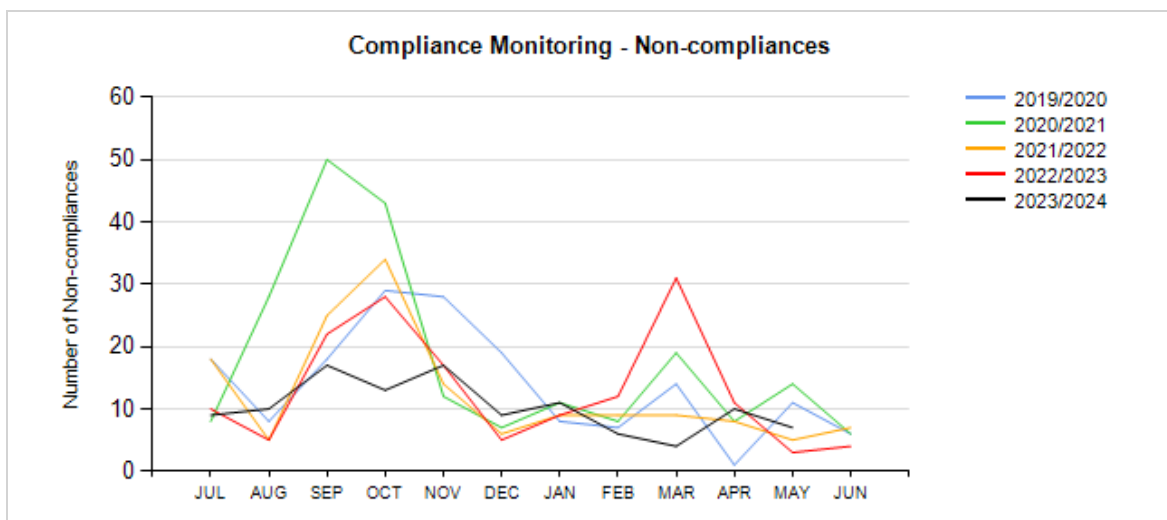
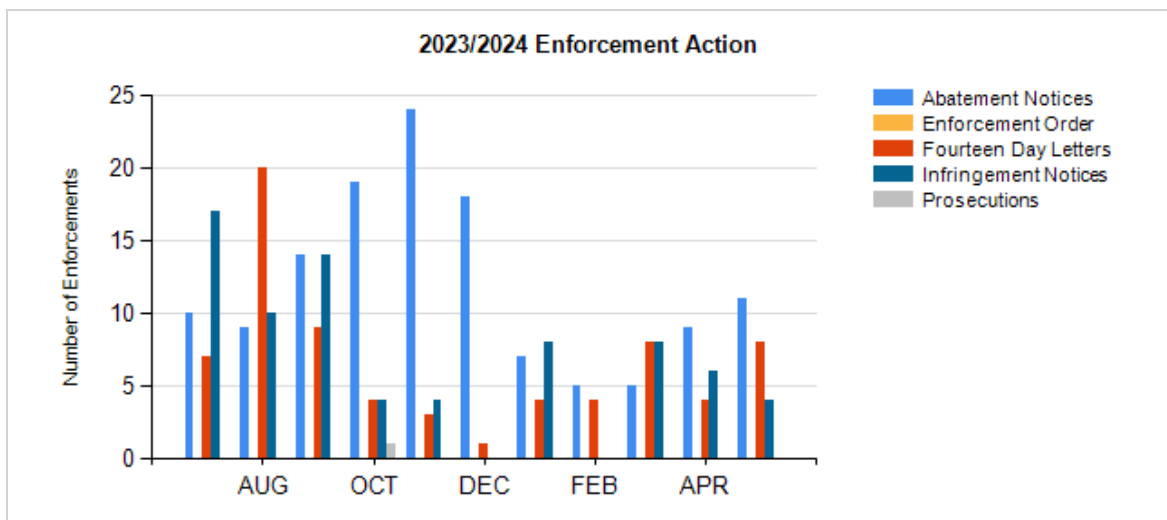
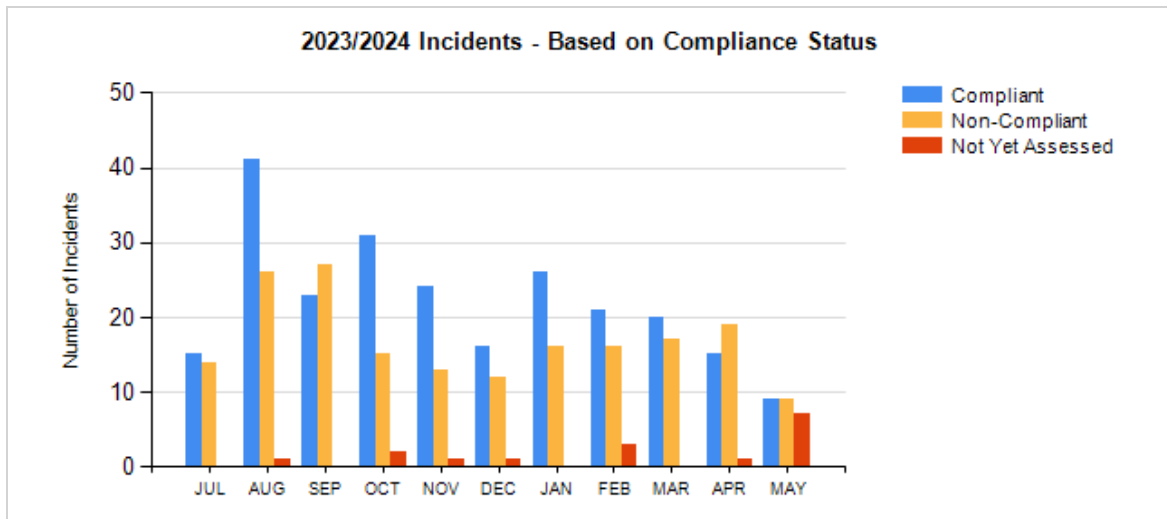
Investigation continuing	Outcome has not been finalised. Investigation is continuing on this incident, information/evidence still being gathered. Further action, including enforcement are being considered and therefore legally all information cannot be reported on this incident at this stage. These incidents will continue to be reported as updates in the following agendas.
No Further Action	Investigation is completed, any required enforcement action has been undertaken and no further action is required.
No Further Action At This Stage	Investigation is completed, any required enforcement action has been undertaken and further action may be required at a later date.
No Further Action/Costs Recovered	Investigation is completed, any required enforcement action has been undertaken and no further action is required. Costs will be recovered from the alleged offender for the investigation.
No further Action at this Stage/Costs Recovered	Investigation is completed, any required enforcement action has been undertaken and further action may be required at a later date (reinspection of Abatement Notice etc). Costs will be recovered from the alleged offender for the investigation.

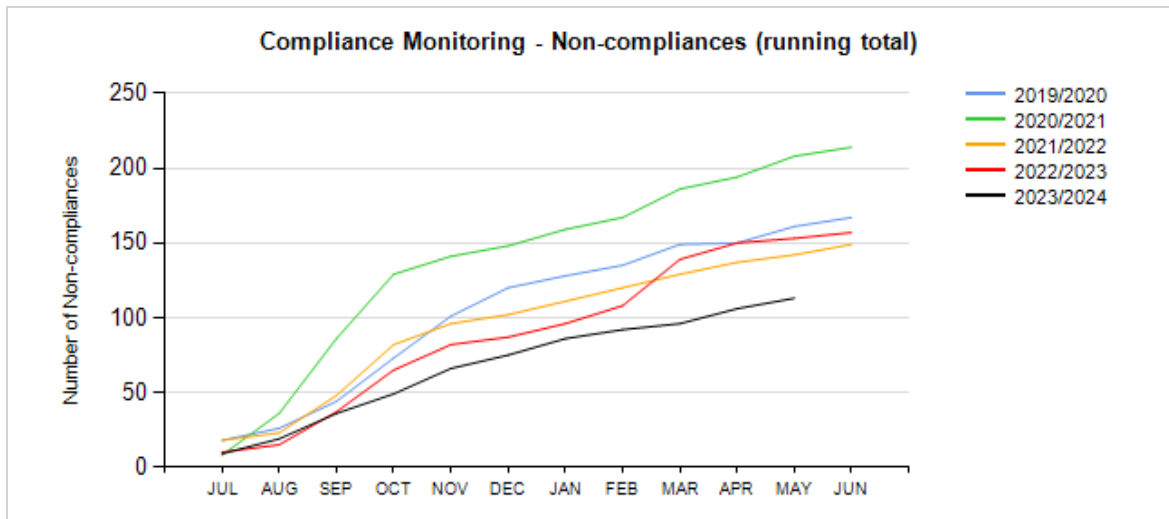
Defences under Sections 340 and 341 of the Resource Management Act 1991

Sometimes no enforcement action is undertaken against an alleged offender for a non-compliant incident as they have a defence under Section 340 of the Resource Management Act 1991 including reasons such as:

- the defendant can prove that he or she did not know, and could not reasonably be expected to have known that the offence was to be or was being committed, or
- that he or she took all reasonable steps to prevent the commission of the offence, or
- the action or event could not reasonably have been foreseen or been provided against by the defendant.







Compliant Incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Compliance Status	Recommendation
18 Apr 2024	330124-396 IN/49890	Alleged burning - Bishop Road, New Plymouth.	Complaint	RAQP Allowed	No Further Action
21 Apr 2024	330124-398 IN/49900	Alleged burning - Henwood Road, Bell Block.	Complaint	RAQP Allowed	No Further Action
22 Apr 2024	330124-400 IN/49920	Alleged odour - Mokau Road, Uruti.	Complaint	Consent Compliance	No Further Action
23 Apr 2024	330124-402 IN/49930	Alleged odour - Kaiپی Road, Egmont Village.	Complaint	RAQP Allowed	No Further Action
27 Apr 2024	330124-405 IN/49951	Alleged white foam in stream - Mimi Road, Uruti.	Complaint	Not Applicable/Natural Event	No Further Action
29 Apr 2024	330124-407 IN/49949	Alleged burning - Radnor Road, Midhirst.	Complaint	RAQP Allowed	No Further Action
29 Apr 2024	330124-410 IN/49956	Alleged burning - Mountain Road, Lepperton.	Complaint	RAQP Allowed	No Further Action
30 Apr 2024	330124-411 IN/49968	Alleged odour - Mokau Road, Uruti.	Complaint	Consent Compliance	No Further Action
1 May 2024	330124-412 IN/49969	Alleged burning - Airport Drive, Bell Block.	Complaint	RAQP Allowed	No Further Action
2 May 2024	330124-413 IN/50002	Alleged green stream - Tawa Street, Inglewood.	Complaint	RFPW Allowed	No Further Action

Compliant Incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Compliance Status	Recommendation
6 May 2024	330124-416 IN/50027	Alleged green stream - Rata Street, Inglewood.	Complaint	RAQP Allowed	No Further Action
10 May 2024	330124-420 IN/50056	Alleged odour - Sisson Terrace, Lepperton.	Complaint	RAQP Allowed	No Further Action
10 May 2024	330124-422 IN/50060	Alleged burning - Otaraoa Road, Tikorangi.	Complaint	RAQP Allowed	No Further Action
13 May 2024	330124-429 IN/50114	Alleged odour - Mokau Road, Uruti.	Complaint	Consent Compliance	No Further Action
16 May 2024	330124-426 IN/50098	Alleged dust complaint - Mould Street, Waitara.	Complaint	RAQP Allowed	No Further Action

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
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6 Oct 2023 Update	330124-156 IN/48531	Sewage discharge - Gregory Road, Rahotu.	Complaint	Unsourced (9768)			No Further Action
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Comments: A complaint was received regarding a potential sewage discharge into a stream at Gregory Road, Rahotu. An inspection found an unnamed tributary of the Rautini Stream to be odorous. Further investigation upstream found the school field at Rahotu Primary School was soggy in the area above the sewage treatment system which is located approximately 30 metres from the stream. Samples were taken upstream and downstream of the field. Sample results indicated that any contamination of the stream is likely further upstream of the previous sample sites. Further investigation found that the poor water quality may be a result of low flow conditions and diffuse discharges.

17 Jan 2024 Update	330124-285 IN/49162	Earthworks adjacent to the Mangawarawara Stream - Albert Road, Egmont Village.	Complaint	Greg Ross (76038)*Shane Henare (73187)		EAC-25630 - Abatement Notice*EAC-25651 - Explanation Requested - Letter*EAC-25653 - Explanation Requested - Letter*EAC-25799 - Infringement Notice (\$750)	No Further Action
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Comments: A complaint was received regarding sediment discharging into the Mangawarawara Stream at Albert Road, Egmont Village. An investigation found that earthworks had been undertaken within the immediate vicinity of an unnamed tributary of the Mangawarawara Stream with inappropriate erosion and sediment controls in place. Evidence of previous discharges of sediment to the tributary was observed. Abatement notices were issued requiring the installation of erosion and sediment controls to ensure compliance with rules in the Regional Freshwater Plan for Taranaki. Letters requiring explanation were also issued to the responsible parties. A response has been received from one of the parties. A reinspection found the responsible party was compliant with the Regional Fresh Water Plan for Taranaki.

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
29 Jan 2024 Update	330124-327 IN/49427	Breach of resource consent, stormwater outlet structure - Tukapa Street, New Plymouth.	Complaint	Smudgy Developments Limited (56784)	R2/10999-1.0	EAC-25673 - Abatement Notice	Investigation Continuing

Comments: A complaint was received regarding the construction of a stormwater detention pond associated with a new residential subdivision at Tukapa Street, New Plymouth. An investigation found that the structure had not been constructed in accordance with resource consent conditions and the associated design plans. An abatement notice has been issued to the responsible party requiring works to be carried out to ensure compliance with the resource consent. A re-inspection will take place after 30 May 2024.

16 Feb 2024 Update	330124-316 IN/49359	Odouress stream - Stafford Street, Waitara.	Complaint	Unsourced (9768)			No Further Action
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Comments: A complaint was received regarding an unnamed tributary of the Waitara River being odouress at Stafford Street, Waitara. An inspection found the waterway was slow moving and discoloured. No point source contamination could be identified, samples were taken and found to show a high level of Escherichia coli. Further samples have been taken which indicate that the elevated Escherichia coli concentrations were likely in result of low flow conditions during the summer months. (IN/48866 relates to the same matter).

29 Feb 2024 Update	330124-335 IN/49461	Dust - Hurlstone Drive, New Plymouth.	Complaint	Christopher Herd (22706)		EAC-25666 - Abatement Notice	Investigation Continuing
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Comments: Numerous complaints were received regarding dust discharging from an industrial section on Hurlstone Drive, New Plymouth. Investigation found dust was being discharged from areas of exposed earth within the development site in breach of rules in the Regional Air Quality Plan for Taranaki. A water truck was utilised to suppress the dust, however due to the size of the site the application of water to the exposed surface was insufficient to suppress further dust discharges. An abatement notice was sent to the responsible party. Further enforcement is currently being considered.

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
8 Mar 2024 Update	330124-346 IN/49587	Burning - Parakau Road, Bell Block.	Complaint	Christopher Herd (22706)		EAC-25742 - Infringement Notice (\$300)	No Further Action

Comments: A complaint was received regarding smoke discharging from a fire at Parakau Road, Bell Block. Inspection found that a controlled burn of vegetation had been carried out at a vacant section. Fire and Emergency New Zealand were advised of the burn. However, an inspection of the burn area found that unauthorised material had also been burnt at the site in contravention of rules in the Regional Air Quality Plan for Taranaki.

8 Mar 2024 Update	330124-345 IN/49591	Over application of Farm Dairy Effluent to land - Mountain Road, Tariki.	TRC Staff Notification	Jamie Craig (75700)*Sally Mantey (55276)	R2/2845-3.0	EAC-25699 - Explanation Requested - Letter*EAC-25701 - Explanation Requested - Letter*EAC-25735 - Infringement Notice (\$750)*EAC-25737 - Infringement Notice (\$750)	No Further Action/Costs Recovered
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Comments: During unrelated compliance monitoring, it was found that farm dairy effluent was being applied to land in contravention of resource consent conditions at Mountain Road, Tariki. An inspection found that a traveling irrigator was not travelling or rotating as designed, resulting in significant ponding of farm dairy effluent where it was likely to discharge to surface water if the activity continued or rain occurred. An abatement notice was issued and letters requesting explanations sent to both responsible parties. A re-inspection found that the abatement notice and resource consent was being complied with.

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
12 Mar 2024 Update	330124-359 IN/49653	Consent breach - Fonterra Whareroa - Hawera.	Self-Notification	Fonterra Limited (50606)	R2/4103-2.3	EAC-25697 - Explanation Requested - Letter	No Further Action/Costs Recovered

Comments: Self-notification was received regarding particulate emission concentrations being discharged to air in contravention of resource consent conditions at a milk processing facility at Whareroa Road, Hawera. Self-monitoring, as required by the resource consent, found that the particulate emission concentrations (180 mg/m3) being discharged to air were in contravention of resource consent conditions (150 mg/m3). A letter requesting an explanation was sent. A response was received and accepted.

14 Mar 2024 Update	330124-356 IN/49651	Cattle in stream - Mid Parihaka Road, Pungarehu.	Complaint	Ethan Kennett (76245)		EAC-25720 - Abatement Notice	No Further Action
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Comments: A complaint was received regarding stock being in the Waitotara Stream at Mid Parikhaka Road, Pungarehu. An inspection found a number of dairy support cattle had direct access to the stream with three animals being observed within the stream. An abatement notice has been issued to the responsible party requiring works to be undertaken to ensure provisions of the Resource Management Act 1991 are complied with. A re-inspection found that the abatement notice was being complied with. No further action.

20 Mar 2024 Update	330124-370 IN/49716	Sewage discharge - Weld Road, Oakura.	Complaint	Un sourced (9768)			Investigation Continuing
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Comments: A complaint was received regarding human waste in the Timaru Stream at Weld Road, Oakura. Investigation found that human sewage including toilet paper had been dumped in the shallow water within the Timaru Stream at a well utilised public swimming hole. The contaminants were removed by the officer at the time of inspection. On 22 March 2024, a second complaint was received concerning the same behavior. Inspection found that over the previous 12 hours further human sewage had been dumped at the same location. This consisted of solid material and further toilet paper. The location, volume and pattern of the sewage on the bed of the stream is consistent with it being thrown in from a bucket or similar open topped vessel. The contamination was again removed by the officer at the time of the inspection. Further water samples were taken. Signage was erected restricting swimming for 48 hours. Area enquiries were carried out and further investigation is being undertaken.

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
25 Mar 2024 Update	330124-366 IN/49690	Discoloured Stream - Kelly Street, Inglewood.	Complaint	Craig Corlett (76208)			No Further Action
<p>Comments: A complaint was received regarding an unnamed tributary of the Waiongana Stream running 'white' in colour at Kelly Street, Inglewood. An inspection found that the stream was no longer discoloured, however a stormwater drain containing water contaminated with paint was located. The discharge was traced back to a residential address where home decorating works were being undertaken. The responsible party acknowledged washing his paint brushes in a manner that resulted in the washing discharging into the roadside curb. The responsible party was advised of the effects of his actions and appropriate methods to dispose of paint washings in the future.</p>							
26 Mar 2024 Update	330124-418 IN/49743	Odour - Palmer Road, Kapuni.	Self-Notification	Ballance Agri-Nutrients (Kapuni) Limited (9706)	R2/4046-3		Investigation Continuing
<p>Comments: Self-notification was received regarding an ammonia discharge to air at the Ballance Agri-Nutrients facility at Palmer Road, Kapuni. An investigation found during a pressure test, a valve had failed to automatically reclose as expected. This resulted in a sudden flow of ammonia-rich reactor fluid into the facility's main vent system. The ammonia continued to vent off for some time after the emergency was abated, resulting in high concentrations of ammonia at the site boundary. Investigation continuing.</p>							
3 Apr 2024 Update	330124-381 IN/49755	Discoloured Stream - South Road, New Plymouth.	Complaint	Un sourced (9768)			No Further Action
<p>Comments: A complaint was received regarding the discolouration of the Herekawe Stream at Centennial Drive, New Plymouth. An investigation found there was distinctive brown discharge present within a stormwater pipe that discharges into the Stream. The discharge mixed within the stream causing a slight discolouration. Samples were taken and an inspection undertaken of the nearby tank farm facilities with all stormwater interceptors inspected and no unauthorised discharges detected. New Plymouth District Council have been advised and will check the stormwater pipes to determine if any stormwater pipe integrity issues could be leading to the discharge of sediment into the network. Sample results were negative for hydrocarbons. New Plymouth District Council's examination of the stormwater network revealed no cause of the discoloration. The water is now running clear and there is no further avenue for enquiry.</p>							

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
4 Apr 2024 Update	330124-383 IN/49775	Discharge to Stream - Collingwood Street, Eltham.	Self-Notification	Fonterra Co-Operative Group Limited (28692)	R2/1969-3	EAC-25717 - Abatement Notice*EAC-25728 - Explanation Requested - Letter*EAC-25780 - Infringement Notice (\$750)	No Further Action

Comments: Self notification was received regarding a discharge of contaminated storm water into an unnamed tributary of the Mangawharawhara Stream from a food processing facility at Collingwood Street, Eltham. An investigation found that a sheen/scum was present on the surface of the stream. This was similar to the contamination observed within the storm water system at the facility. Samples were taken and sorbent booms were deployed to contain and recover the sheen. An abatement notice and letter requesting an explanation were issued to the responsible party. A re-inspection found that the abatement notice was being complied with.

9 Apr 2024 Update	330124-385 IN/49814	Burning - Mawhitiwhiti Road, Normanby.	Complaint	Rex Radford (71775)			Investigation Continuing
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Comments: A complaint was received regarding white smoke discharging from a rural property at Mawhitiwhiti Road, Normanby. An investigation found that a fire had been lit on the property. An inspection of the fire found a number of unauthorised items being burnt, including but not limited to, paint tins, old tractor seat, aerosol cans, a mattress, bottles, curtain rail, metal framing and wood shavings. The responsible party was spoken to and advice and education provided. Further enforcement action is being considered.

Updates of Non-Compliant incidents from previous agendas

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
11 Apr 2024 Update	330124-388 IN/49832	Discharge to water - Mohakatino River, Mokau.	Third Party Notification	Fulton Hogan Limited (10144)			No Further Action/Costs Recovered

Comments: Third party notification was received regarding a motor vehicle crash at State Highway 3, Mohakatino. Inspection found that a road maintenance vehicle had crashed into a stream adjacent to the road. This resulted in approximately 300 litres of emulsified bitumen discharging into the stream and wider estuary. Council staff responded and deployed booms to recover the hydrocarbons from the water. Iwi were notified. Bitumen had solidified and settled on the stream bed and rocks within the estuary. Manual removal of bitumen was undertaken by council officers at the time of the spill. The responsible party has mobilised a team to recover the spilt hydrocarbons over the following weeks. This involves the manual removal of bitumen off rocks, streambed and the wider estuarine environment. Council officers are maintaining oversight of the clean up operation. Weekly inspections were undertaken once there was no further obvious recoverable bitumen within the estuary and wider marine environment. Clean up operations completed on 20 May 2024. The responsible party will cover all costs associated with the clean up operation.

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
15 Apr 2024	330124-390 IN/49856	Motor vehicle Crash - Waitotara River Road, Waitotara.	Complaint	Fulton Hogan Ltd (31792)			No Further Action
<p>Comments: Notification was received regarding a truck crash on Waitotara Valley Road, Waitotara. An investigation found that an empty tipper truck had rolled. The crash resulted in diesel discharging from the trucks fuel tank onto land and into an unnamed tributary of the Waitotara River. An absorbent boom and pads were placed across the tributary to recover any spilt diesel. The booms and associated equipment were subsequently removed and disposed of in the appropriate manner.</p>							
16 Apr 2024	330124-391 IN/49869	Burning - Frankley Road, New Plymouth.	Complaint	John Douglas McCullough (36083)			Investigation Continuing
<p>Comments: A complaint was received regarding smoke being discharged from a fire on a horticultural land block at Frankley Road, New Plymouth. An investigation found a large vegetation fire had been lit on the property resulting in thick black smoke discharging across a residential area of New Plymouth. The responsible party was spoken to and advised of the adverse effects on the community as a result of his activities. Further enforcement action is being considered.</p>							
16 Apr 2024	330124-393 IN/49871	Burning - Lepper Road Upper, Inglewood.	Complaint	Dennis Dravitzki (72297)			No Further Action
<p>Comments: A complaint was received regarding smoke discharging from a fire on Lepper Road, Inglewood. An inspection found that two piles of vegetation were being burnt on the property causing nuisance smoke to discharge beyond the boundary of the property. The responsible party was spoken to and agreed to extinguish the fire and for more favourable wind conditions before any further burning occurred. Education provided regarding the rules relating to burning activities at the site. No further action.</p>							

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
17 Apr 2024	330124-392 IN/49868	White foam - Waitaha Stream, Wills Road, Bell Block.	Complaint	Unsourced (9768)			No Further Action
<p>Comments: A complaint was received regarding white foam in the Waitaha Stream at Wills Road, Bell Block. An inspection found the foaming had dispersed and the remnants of remaining foam was minimal. An investigation of the Waitaha catchment failed to locate the source of the discharge and the responsible party could not be identified. No further action.</p>							
18 Apr 2024	330124-394 IN/49880	Hydrocarbon drum on beach - Coast Road, Warea.	Complaint	Unsourced (9768)			No Further Action
<p>Comments: A complaint was received regarding a 44 gallon drum of hydrocarbons that had washed ashore at Coast Road, Warea. An investigation located a steel drum which contained approximately 30 litres of a hydrocarbon based product (likely diesel). It was evident that the drum had been at sea for an extended period of time before coming ashore. The drum was removed from the beach and Intergroup Limited offered their assistance to dispose of the product in an appropriate manner. No further action.</p>							
19 Apr 2024	330124-395 IN/49882	Odour - Mokau Road, Uruti.	Complaint	Remediation (NZ) Limited (30679)	R2/5839-2		Investigation Continuing
<p>Comments: A complaint was received regarding odour discharging from the Remediation (NZ) Limited's composting facility at Mokau Road, Uruti. Investigation found that offensive and objectionable odour was being discharged beyond the boundary of the property in contravention of resource consent conditions and a previously issued abatement notice. Investigation continuing.</p>							
19 Apr 2024	330124-397 IN/49893	Burning - Bishop Road, New Plymouth.	Complaint	David & Noeline Sampson (34750)			No Further Action
<p>Comments: A complaint was received regarding smoke discharging from a property at Bishop Road, New Plymouth. An investigation found that piles of slash had been burnt at a lifestyle property resulting in the discharge of offensive smoke beyond the property boundary in contravention of rules in the Regional Air Quality Plan for Taranaki. The responsible party was advised to let the fire burn out and not add additional vegetation to the fire. No further action.</p>							

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
22 Apr 2024	330124-399 IN/49901	Hydrocarbon Spill - Heta Road, New Plymouth.	Complaint	Northpower (76302)			No Further Action
<p>Comments: Self notification was received regarding hydraulic oil discharging from a transformer onto the road and into the stormwater network at Heta Road, New Plymouth. An investigation found that a transformer was being transported when it tipped on the transporter resulting in damage to the unit and the subsequent discharge of hydraulic oil. The oil flowed into the stormwater network and was caught within a roadside sump. New Plymouth District Council contractors deployed absorbent material to soak up the spill from the road surface while the sump was sucked clean. An inspection of the Te Henui Stream found that no hydrocarbons had discharged from the stormwater network as a result of the spill.</p>							
23 Apr 2024	330124-401 IN/49922	Burning - Wallscourt Place, Normanby.	Complaint	Un sourced (9768)			No Further Action
<p>Comments: A complaint was received regarding a fire burning at Wallscourt Place, Normanby. An investigation found that an unknown party had dumped rubbish and set fire to it. The dumping had occurred on a business premises open to the public and used as a parking area for bulk cartage heavy motor vehicles. The property owner was contacted and utilised a front end loader to extinguish the fire. The responsible party could not be identified.</p>							
23 Apr 2024	330124-403 IN/49932	Odour - Mokau Road, Uruti.	Complaint	Remediation (NZ) Limited (30679)	R2/5839-2	EAC-25761 - Explanation Requested - Letter	Investigation Continuing
<p>Comments: A complaint was received regarding odour discharging from the Remediation (NZ) Limited's composting facility at Mokau Road, Uruti. Investigation found that offensive and objectionable odour was being discharged beyond the boundary of the property in contravention of resource consent conditions and a previously issued abatement notice. On site inspection discovered leachate was escaping from controls. Investigation continuing.</p>							

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
24 Apr 2024	330124-404 IN/49933	Green waste dumped in river - Alison Street, Opunake.	Complaint	Unsourced (9768)			No Further Action
<p>Comments: A complaint was received regarding green waste being dumped in the Hihiwera Stream at Allison Street, Opunake. An investigation found lawn clippings had been dumped on the bank of the Hihiwera Stream. No discharge of clippings or leachate to surface water was observed. The responsible party was unable to be identified. No further action.</p>							
29 Apr 2024	330124-406 IN/49948	Sewerage - Ngamoutu Road, New Plymouth.	Third Party Notification	New Plymouth District Council (9565)	R2/10406-1.0*R2/0882-4.1		No Further Action
<p>Comments: Self notification was received regarding a wastewater discharge from the New Plymouth District Council wastewater network at Ngamotu Road, New Plymouth. City Care personnel were in attendance and sandbags had been placed about the spill location to prevent any wastewater discharging into the stormwater networks. The blockage was cleaned and the area sanitised. No signage was required to be erected due to the spill being contained on site preventing any discharge to surface waters.</p>							
30 Apr 2024	330124-408 IN/49957	Diesel Spill - Victoria Street, Kaponga.	Complaint	Pickering Motors Limited (22672)			No Further Action
<p>Comments: A complaint was received regarding an oil spill at Victoria Street, Kaponga. An investigation found that a defective fuel filter on a bus had resulted in the discharge of diesel onto the road surface at three locations in Kaponga. There was no evidence that the spilt fuel had entered any stormwater networks. The responsible party applied sand to the road surface to recover the hydrocarbons. The bus was removed from service for repairs to be made. No further action.</p>							

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
30 Apr 2024	330124-409 IN/49958	Effluent discharge - Old South Road, Okato.	Complaint	Westown Haulage Limited (34187)			No Further Action
<p>Comments: A complaint was received regarding effluent discharging on to Old South Road, Okato. An investigation found that stock effluent had spilled from a cattle truck for an approximate 250metre stretch along Old South Road, Okato. The effluent spill was dry and showed no signs of entering stormwater drains. The cause of the spill was likely an over full effluent tank on the truck leading to an overflow of effluent from the cartage unit onto the road surface. The responsible party was contacted and a verbal warning was given. No further action.</p>							
2 May 2024	330124-414 IN/50008	Diesel Spill - Pembroke Road, Stratford.	Self-Notification	Spark NZ Trading Ltd (25757)*Unsourced (9768)			No Further Action
<p>Comments: Self notification was received regarding the discharge of diesel from a storage tank at Pembroke Road, Stratford. A inspection found that diesel had discharged to ground from a storage tank on the upper reaches of Pembroke Road within Te Papakura o Taranaki as a result of an unknown party breaking into the tank to steal the fuel. The owner of the tank undertook action to recover any spilt fuel and remove any contaminated material from the area. Testing was also undertaken to ensure all contaminated material had been removed from the site. The inspection found no evidence of the discharge of hydrocarbons to surface water. Ngaruahine iwi were advised of the spill. No further action.</p>							
3 May 2024	330124-415 IN/50015	Geotextile bag washing ashore - Opunake Beach, Opunake.	Complaint	Opunake Artificial Reef Trust (22852)			No Further Action
<p>Comments: A complaint was received regarding 'carpet' washing ashore on Opunake Beach, Opunake. An inspection confirmed that a large piece of geotextile material associated with the historic construction of an artificial surf reef within the Opunake Bay had washed onto the beach. The material was retrieved from the beach and disposed of by the officer at the time of the inspection.</p>							

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
7 May 2024	330124-417 IN/50034	Wastewater discharge - Gilmour Street, New Plymouth.	Self-Notification	Earthworks Taranaki (76310)	R2/0882-4.1*R2/10406-1.0	EAC-25777 - Explanation Requested - Letter	Investigation Continuing
<p>Comments: Self notification was received regarding the discharge of wastewater from the New Plymouth District Council wastewater reticulation network at Gilmour Street, New Plymouth. An inspection found that a manhole had been dislodged allowing debris to enter the network causing a blockage. The blockage resulted in the discharge of wastewater to land and into the Huatoki Stream via the stormwater network. The blockage was cleared and appropriate actions taken to ensure compliance with the contingency plan for wastewater discharges. The manhole was replaced and upgraded to ensure that it could not be dislodged. A letter requesting an explanation has been sent to the party responsible for the dislodgement of the manhole cover. Investigation continuing.</p>							
9 May 2024	330124-419 IN/50049	Burning - Victoria Street, Hawera.	Complaint	Jody Mosley (76323)*Mark Petrie (76156)			Investigation Continuing
<p>Comments: A complaint was received regarding backyard burning at Victoria Street, Hawera. An investigation found a 44 gallon steel drum at the rear of the property had embers smoldering in contravention of rules in the Regional Air Quality Plan for Taranaki. Further enforcement action is being considered.</p>							
11 May 2024	330124-421 IN/50065	Odour - Mokau Road, Uruti.	Complaint	Remediation (NZ) Limited (30679)	R2/5839-2		Investigation Continuing
<p>Comments: A complaint was received regarding odour discharging from the Remediation (NZ) Limited's composting facility at Mokau Road, Uruti. Investigation found that offensive and objectionable odour was being discharged beyond the boundary of the property in contravention of resource consent conditions and a previously issued abatement notice. Investigation continuing.</p>							

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
13 May 2024	330124-423 IN/50070	Earthworks with and within 10 metres of a wetland - Mokau Road, Uruti.	Complaint	Eilish Wilson (76320)*Stephen Wilson (76327)		EAC-25784 - Abatement Notice*EAC-25787 - Explanation Requested - Letter*EAC-25788 - Abatement Notice*EAC-25790 - Explanation Requested - Letter*EAC-25793 - Abatement Notice*EAC-25795 - Abatement Notice	Investigation Continuing

Comments: A complaint was received regarding a digger operating in a wetland at Mokau Road, Urenui. An investigation found a digger had cleaned out debris and vegetation from land drainage channels on the property. The Council wetland ecologist assessed the area and determined that a natural inland wetland was present on the property and some of the earthworks were within and within 10 metres of a natural inland wetland in contravention of Regulations within the Resource Management (National Environmental Standards for Freshwater) Regulations 2020. Abatement notices were issued to the responsible parties requiring all earthworks to cease. Letters requesting an explanation have been sent. Investigation continuing.

15 May 2024	330124-424 IN/50092	Earthworks within 10 metres of a wetland - Manawapou Road, Manutahi.	Complaint	Alastair Geary (16166)		EAC-25791 - Abatement Notice	Investigation Continuing
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Comments: A complaint was received regarding earthworks being undertaken in a wetland at Manawapou Road, Manutahi. An investigation found earthworks had been undertaken with vegetation being cleared within a 10 metre setback from a natural inland wetland in contravention of Regulations within the Resource Management (National Environmental Standards for Freshwater) Regulations 2020. Investigation continuing.

Non-compliant incidents for the period 12 Apr 2024 to 16 May 2024

Incident Date	Job Number IRIS ID	Incident Type	Source	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
15 May 2024	330124-425 IN/50103	Greywater discharge - Manawapou Road, Manutahi.	Complaint	Alastair Geary (16166)			Investigation Continuing

Comments: While attending an unrelated incident at Manawapou Road, Manutahi, an alkathene pipe was found to be running from a nearby dwelling house into a pit that showed evidence of a grey water discharge. The discharge was further piped and was found to be leaching to a nearby natural inland wetland in contravention of rules in the Regional Freshwater Plan for Taranaki. Samples were taken. Further investigation is being undertaken. (IN/50092 relates)

Updates of Compliance Monitoring – Non-compliances from previous agendas

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
21 Sep 2023 Update	332124-029 ENF-24119	Annual Inspection	Significant non-compliance	Mark Tobeck (32071)	R2/2967-2	EAC-25634 - Infringement Notice (\$750)*EAC-25397 - Abatement Notice*EAC-25396 - Explanation Requested - Letter	No Further Action/Costs Recovered

Comments: During analysis of samples (26 September 2023), taken during the annual dairy inspection round (21 September 2023), it was found that the farm dairy effluent oxidation pond disposal system was not operating within resource consent conditions at Opunake Road, Awatuna. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. Reinspection (6 October 2023) found that the abatement notice was not being complied with at the time of inspection. Further enforcement action was taken. Another reinspection (6 March 2024), found again, the farm dairy effluent system was not operating within resource consent conditions with a minor level of non-compliance detected. Reinspection (19 April 2024) to check for compliance with resource consent conditions was found to be compliant.

23 Jan 2024 Update	332124-098 ENF-24372	Compliance Monitoring Insp.	Non-compliance	Ferndene Group Limited (70308)	R2/10848-1.0	EAC-25722 - Abatement Notice	No Further Action At This Stage/Costs Recovered
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Comments: During routine compliance monitoring, it was found that resource consent conditions were not being complied with at a quarrying operation at Upland Road, Egmont Village. An independent monitoring programme that monitors the effects from taking groundwater for quarrying activities on the surrounding aquifer has not been implemented as required by resource consent conditions. An abatement notice has been issued requiring works to be undertaken to ensure compliance with resource consent conditions. A reinspection will be undertaken after 01 December 2024.

Updates of Compliance Monitoring – Non-compliances from previous agendas

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
30 Jan 2024 Update	332124-091 ENF-24339	Annual Inspection	Significant non-compliance	Te Awarua Farms Limited (17068)	R2/4357-3.0	EAC-25734 - Infringement Notice (\$750)*EAC-25649 - Abatement Notice	No Further Action At This Stage/Costs Recovered

Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Mountain Road, Midhurst. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. A re-inspection found that any unauthorised discharges have ceased, however an extension to the abatement notice has been provided to allow for the installation of a new sand trap and stormwater diversion. A further re-inspection will be undertaken after 1 June 2024.

22 Feb 2024 Update	332124-115 ENF-24407	Compliance Monitoring Insp.	Non-compliance	Fonterra Limited (50606)	R2/3907-3.0	EAC-25729 - Explanation Requested - Letter	No Further Action/Costs Recovered
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Comments: During routine compliance monitoring, it was found that resource consent conditions were not being complied with at a milk processing facility at Whareroa Road, Hawera. The oil and grease concentrations within the stormwater discharge (6 & 8 gm/m³) was found to be in exceedance of resource consent conditions (5 gm/m³). A letter requesting an explanation has been sent and a response received and accepted. Further monitoring has been undertaken and found that consent conditions are being complied with. No further action.

4 Mar 2024 Update	332104-107 ENF-24408	Chemical Sampling Survey	Non-compliance	Port Taranaki Limited (26226)	R2/0197-2.1	EAC-25730 - Explanation Requested - Letter	Investigation Continuing
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Comments: During analysis of stormwater samples (18 March 2024), taken during routine monitoring (04 March 2024), it was found that the stormwater discharge exceeded resource consent conditions and Abatement Notice (EAC-22662) which was issued as a result of a previous non-compliance at Port Taranaki, New Plymouth. A letter requesting explanation was sent and a response received. Further enforcement action is being considered.

Updates of Compliance Monitoring – Non-compliances from previous agendas

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
19 Mar 2024 Update	332124-109 ENF-24392	Compliance Monitoring Insp.	Non-compliance	New Plymouth District Council (9565)	R2/5205-2.1		Investigation Continuing
<p>Comments: During routine compliance monitoring it was found that resource consent conditions were not being complied with at the New Plymouth District Council crematorium at Junction Road, New Plymouth. The inspection found that during a cremation the secondary chamber temporarily drops in temperature below the consented limit of 850 degrees celsius. New Plymouth District Council have provided further information regarding the change in temperature and the monitoring officer is currently assessing the information provided. A follow-up inspection is scheduled for 30 May 2024 to observe the temperature during the cremation process and clarify if there is a non-compliance with the minimum temperature requirements. Investigation continuing.</p>							
20 Mar 2024 Update	332124-106 ENF-24386	Chemical Sampling Survey	Non-compliance	Regal NZ Trading Limited (74995)	PA/11121-1.0	EAC-25710 - Abatement Notice	No Further Action
<p>Comments: During analysis of stormwater samples (18 March 2024), taken during routine compliance monitoring (04 March 2024), it was found that the stock feed storage and distribution site was not operating within the Permitted Activity rules of the Regional Freshwater Plan for Taranaki at Ocean View Parade, New Plymouth. An abatement notice was issued requiring works to be undertaken to ensure compliance with the relevant rules in the Plan. A re-inspection found that the site was complying with the abatement notice, operating in accordance with permitted activity Rule 23 of the Regional Freshwater Plan for Taranaki.</p>							
27 Mar 2024 Update	332124-111 ENF-24393	Annual Inspection	Non-compliance	Troy Gestro (16974)	R2/3355-3.0	EAC-25715 - Abatement Notice	No Further Action/Costs Recovered
<p>Comments: During the annual dairy inspection round, it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Turuturu Road, Hawera. An abatement notice was issued requiring works to be undertaken to ensure resource consent conditions are complied with at all times. A re-inspection found that the abatement notice and resource consent conditions were being complied with. No further action.</p>							

Updates of Compliance Monitoring – Non-compliances from previous agendas

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
8 Apr 2024 Update	332124-114 ENF-24401	Dairy Non-compliant Re-inspection	Non-compliance	Melpaca Trusts (11046)	R2/1599-3		Investigation Continuing
<p>Comments: During the annual dairy inspection round, it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Norfolk Road, Inglewood. A letter notifying the responsible party of their compliance rating for the farm dairy effluent inspection was issued advising that resource consent conditions were not being complied with. A re-inspection on 17 January 2024 found that resource consent conditions were being complied with. A further follow up inspection on 8 April 2024 found farm dairy effluent was not being contained within the disposal system in contravention of resource consent conditions. Further enforcement action is being considered.</p>							
11 Apr 2024 Update	332124-116 ENF-24414	Dairy Non-compliant Re-inspection	Non-compliance	Brenden Hintz (10477)	R2/3628-3.0	EAC-25731 - Explanation Requested - Letter	No Further Action

Comments: During the annual dairy inspection round, it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Cardiff Road, Cardiff. An abatement notice was issued requiring works to be undertaken to ensure compliance with resource consent conditions. A re-inspection found that the resource consent was being complied with. A further inspection on 11 April 2024 found that resource consent conditions were not being complied with, however a servicing company was onsite upgrading the pumps within the effluent disposal system. A letter of explanation was sent and a response received which outlined the mechanical issues that were being experienced at the property resulting in insufficient pressure to effectively operate the travelling irrigator and the subsequent upgrades that have been undertaken to the effluent disposal system to ensure compliance is achieved and maintained. The explanation was accepted. No further action

Compliance Monitoring – Non-compliances for the period 12 Apr 2024 to 16 May 2024

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
12 Apr 2024	332124-078 ENF-24268	Chemical Sampling Survey	Non-compliance	Tegel Foods Limited (9994)	R2/2335-4.0	EAC-25569 - Abatement Notice	Investigation Continuing

Comments: During routine sampling (17 November 2023) associated with compliance monitoring, it was found that the stormwater discharge was in contravention of resource consent conditions at a feed mill at Paraiti Road, Bell Block. An abatement notice was issued requiring works to be undertaken to ensure compliance with the resource consent conditions. A reinspection and associated stormwater sampling (12 April 2024) found that the concentrations of contaminants within the stormwater discharge from site was still in exceedance of resource consent conditions and in contravention of the abatement notice. Further enforcement action is being considered.

15 Apr 2024	332124-117 ENF-24427	Annual Inspection	Non-compliance	Kent Helms (51945)*Kent Helms Family Trust (12606)	R2/1675-3	EAC-25747 - Abatement Notice	Investigation Continuing
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Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Mid Kahui Road, Rahotu. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. A re-inspection will be undertaken after 1 June 2024.

16 Apr 2024	332124-118 ENF-24428	Annual Inspection	Non-compliance	Gary Newsome (21026)*Wiremu Farm Trust (22295)	R2/1843-4.0	EAC-25748 - Abatement Notice	Investigation Continuing
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Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Wiremu Road, Rahotu. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. A re-inspection will be undertaken after 1 June 2024.

Compliance Monitoring – Non-compliances for the period 12 Apr 2024 to 16 May 2024

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
17 Apr 2024	332124-123 ENF-24422	Annual Inspection	Non-compliance	Michael Drought Family Trust (74242)	R2/1068-2	EAC-25743 - Abatement Notice	Investigation Continuing
<p>Comments: During the annual dairy inspection round, it was found that the oxidation pond treatment system was not operating within resource consent conditions at Arawhata Road, Opunake. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. Reinspection will be undertaken after 7 June 2024.</p>							
17 Apr 2024	332124-124 ENF-24437	Compliance Monitoring Insp.	Non-compliance	Remediation (NZ) Limited (30679)	R2/5838-2.2		Investigation Continuing
<p>Comments: During routine compliance monitoring it was found that resource consent conditions were not being complied with at a composting facility at Mokau Road, Uruti. Leachate was escaping from controls and best practice standards were not being complied with for odour management. Investigation ongoing.</p>							
18 Apr 2024	332124-125 ENF-24423	Annual Inspection	Non-compliance	Koru Farming Limited (28092)	R2/1094-3.1	EAC-25744 - Abatement Notice	No Further Action/Costs Recovered
<p>Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Airport Drive, New Plymouth. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. A re-inspection found that the abatement notice and resource consent conditions were being complied with. No further action.</p>							

Compliance Monitoring – Non-compliances for the period 12 Apr 2024 to 16 May 2024

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
18 Apr 2024	332124-119 ENF-24429	Annual Inspection	Non-compliance	Helms RJ Family Trust (10897)*Rohin & Donna Helms (27826)	R2/3343-2	EAC-25749 - Abatement Notice	Investigation Continuing

Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Opourapa Road, Rahotu. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. A re-inspection will be undertaken after 1 June 2024.

19 Apr 2024	332124-129 ENF-24457	Compliance Monitoring Insp.	Non-compliance	Remediation (NZ) Limited (30679)	R2/5838-2.2		Investigation Continuing
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Comments: While conducting an investigation regarding offensive and objectionable odour (IN/49882 relates) being detected beyond the property boundary at Remediation (NZ) Limited composting facility at Mokau Road, Uruti, it was discovered leachate from the main composting pad was escaping from ring drain controls with the potential to enter surface water. A storm water pipe leading to the solid settling pond was found to be blocked causing two sumps to over flow. Storm water contaminated with compost pad leachate had flowed into an adjacent drain which lead to an unnamed tributary of the Haehunga Stream. Investigation continuing.

22 Apr 2024	332124-121 ENF-24430	Annual Inspection	Non-compliance	Daniel H Hall (51646)*Nigel King (29462)	R2/3279-3.0	EAC-25768 - Explanation Requested - Letter*EAC-25762 - Explanation Requested - Letter	Investigation Continuing
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Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions and Abatement Notice, EAC-25241, which was issued as a result of a previous non-compliance at Awai Road, Tarurutangi. Reinspection found that the abatement notice and resource consent were being complied with at the time of inspection. A letter requesting an explanation was sent.

Compliance Monitoring – Non-compliances for the period 12 Apr 2024 to 16 May 2024

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
26 Apr 2024	332124-120 ENF-24426	Annual Inspection	Non-compliance	Kaiper Partnership (51670)*Kelvin Purdie (31688)*Rochelle Purdie (71473)	R2/2677-3.0	EAC-25757 - Abatement Notice*EAC-25756 - Abatement Notice*EAC-25752 - Abatement Notice No Enforcement Action - Other	No Further Action/Costs Recovered

Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at Richmond Road, Waiongana. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. A re-inspection found that the abatement notice and resource consent conditions were being complied with. No further action.

3 May 2024	332124-122 ENF-24439	Annual Inspection	Significant non-compliance	C A Myers Trust (75237)*Charlotte Myers (75238)*Tony Milham (76308)	R2/3812-2	EAC-25776 - Abatement Notice*EAC-25774 - Explanation Requested - Letter*EAC-25772 - Explanation Requested - Letter	Investigation Continuing
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Comments: During the annual dairy inspection round it was found that the farm dairy effluent disposal system was not operating within resource consent conditions at South Road, Hawera. An abatement notice was issued requiring works to be undertaken to the farm dairy effluent disposal system to ensure compliance with resource consent conditions. Re-inspection will be undertaken after 31 May 2024. A letter requesting explanation was sent.

3 May 2024	332124-126 ENF-24438	Compliance Monitoring Insp.	Non-compliance	Remediation (NZ) Limited (30679)	R2/5838-2.2		Investigation Continuing
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Comments: During routine compliance monitoring at a composting facility at Mokau Road, Uruti, it was discovered that the main composting pad ring drain did not have sufficient depth and was at risk of overflowing. It was also found that best practice standards for odour management were not being followed. During a follow up inspection on 13 May 2024, the facility was deemed to be compliant with consent conditions.

Compliance Monitoring – Non-compliances for the period 12 Apr 2024 to 16 May 2024

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
15 May 2024	332124-133 ENF-24467	Chemical Sampling Survey	Non-compliance	Taranaki Sawmills Limited (10015)	R2/2333-4.4		Investigation Continuing

Comments: During routine compliance monitoring, it was found that resource consent conditions were not being complied with at a wood processing facility at Hudson Road, Bell Block. An inspection found the total suspended solid concentration was measured at 167 g/m³ which exceeded the allowable parameters (100 g/m³) and was in contravention of resource consent conditions. A re-inspection found resource consent conditions were being complied with. Investigation continuing.

15 May 2024	332124-134 ENF-24466	Chemical Sampling Survey	Significant non-compliance	Intergroup Limited (50186)	R2/4776-2.0	EAC-25805 - Explanation Requested - Letter	Investigation Continuing
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Comments: During routine compliance monitoring, it was found that resource consent conditions were not being complied with at an industrial cleaning service provider at Hudson Road, Bell Block. An inspection found the total suspended solid concentration was measured at 270 g/m³ which exceeded the allowable parameters (100 g/m³) and was in contravention of resource consent conditions. A letter requesting explanation was sent, a response has not yet been received. Investigation continuing.

16 May 2024	332124-127 ENF-24448	Compliance Monitoring Insp.	Non-compliance	Taranaki Trucking Company Limited (10081)	R2/2184-3	EAC-25803 - Abatement Notice	Investigation Continuing
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Comments: During routine compliance monitoring, it was found that resource consent conditions were not being complied with at Wiremu Road, Opunake. An inspection found not all stormwater was being directed and was by-passing the sediment retention ponds, discharging directly to land. No shut off valves could be located at the settling pond system as required by resource consent conditions. An abatement notice was issued requiring works to be undertaken to ensure compliance with resource consent conditions. A re-inspection will be undertaken after 19 June 2024.

Compliance Monitoring – Non-compliances for the period 12 Apr 2024 to 16 May 2024

Inspection Date	Job Number IRIS ID	Inspection Type	Compliance Status	Alleged Responsible Party	Consent Number	Action Taken	Recommendation
16 May 2024	332124-131 ENF-24461	Compliance Monitoring Insp.	Significant non-compliance	NZL Forestry Group Limited (72030)	PA/20476-01		Investigation Continuing

Comments: During routine compliance monitoring it was found that the provisions of the Resource Management (National Environmental Standards for Commercial Forestry) Regulations 2017 were not being complied with at a forest harvesting operation at Waikare Road, Waverley. Inspection found the site, which had been not been operating since 7 November 2023, recommenced harvesting operations without providing the required notifications to this Council. Further inspection revealed forestry slash had been deposited within an unnamed tributary at the site. The material was immediately removed from the tributary. Further enforcement action is being considered.

16 May 2024	332124-132 ENF-24462	Compliance Monitoring Insp.	Non-compliance	Tree Awareness Management Limited (30257)	PA/20573-01		Investigation Continuing
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Comments: During routine compliance monitoring it was found that the provisions of the Resource Management (National Environmental Standards for Commercial Forestry) Regulations 2017 were not being complied with at a forest harvesting operation at Baker Road, Patea. Inspection found that slash had been deposited within an unnamed tributary at the site. The catchment is small and the tributary can be readily accessed by machine to remove the slash. A meeting was held onsite with the responsible party and the explanation provided was accepted. Works will be undertaken to remove the slash from the stream. A re-inspection will be undertaken to ascertain compliance with the relevant regulations once complete. Further enforcement action is being considered.



Date: 11 June 2024

Subject: SEM Hill/Coastal Sand Country Sustainable Land Use Report by Landcare Research Ltd.

Author: D Shearman, Land Services Manager – Land Management

Approved by: D Harrison, Director - Operations

Document: 3273126

Purpose

1. The purpose of this memorandum is to present the main findings of a report prepared for the Council by Landcare Research Ltd on sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country.

Executive summary

2. The primary means adopted by Council to address accelerated erosion and the loss of soil and its productive capacity is through its Sustainable Land Management Programme (SLMP). The key method of delivery is by developing Farm Environment Plans for landowners, providing information and advice, and the delivery of government grants to achieve sustainable land use change.
3. A target of 89% sustainability for the hill country has been set in the Regional Soil Plan for Taranaki. The Council monitors progress towards this on a five-yearly basis by monitoring sustainable land use at 25 representative sites in the hill country (7.2% of the total area) and the change in area of bare sand at 5 sites in the coastal sand country. This study is also part of the State of Environment monitoring programme.
4. Results from the latest 5 yearly reporting (2017-2022) period show there has been an increase in sustainability from 87% to 88.3% and no significant change in the area of bare sand. More importantly, since 1994 sustainable land use is continuing to increase over the long-term. In 1994, 83.9% of the monitoring area was used sustainably and by 2022, this has improved to 88.3%, which is an improvement in sustainable land use of 4.3% (+\ -2.9%). Over the long term, there has been a decrease in the area of bare sand by -3.2% at the four coastal sites.
5. There are several land use changes over this period that have contributed the most to an increase in sustainable land use, a slight decrease in the area of dairy farming on unsuitable land but the most significant decrease is in the area of meat and wool farming on marginal pastoral land by 2,269 hectares. Most of the pastoral land has either reverted to scrub (1,521 hectares) or planted in forestry (from 551 hectares to 1,339 hectares).
6. The Sustainable Land Management Programme continues to support and facilitate land use change across the majority of the eastern hill country and now has close to 80% coverage of farm plans with farm scale land use capability mapping. There is an opportunity to utilise this unique position to further

refine the study methodology and utilise modern technology like LiDAR to increase the robustness of the study results in the future.

Recommendations

That Taranaki Regional Council:

- a) receives the memorandum SEM Hill/Coastal Sand Country Sustainable Land use report by Landcare Research Ltd
- b) notes the increase in sustainability in the eastern hill country
- c) notes that Council continues with the current frequency and methodology of the study but is investigating using baseline map layers and new technology such as LiDAR.

Background

7. The primary means adopted by Council to address accelerated erosion and the loss of soil and its productive capacity is through its Sustainable Land Management Programme (SLMP). This Programme focusses on the preparation of 4 types of Farm Environmental Plans; Comprehensive and, Agroforestry Plans for the hill country, and, Conservation Plans and Riparian Management Plans for the intensively farmed areas of the ring plain and uplifted coastal marine terraces.
8. These plans are prepared in conjunction with landowners and are backed up by ongoing liaison, support, information and advisory services and the provision of planting material at cost for soil conservation and riparian purposes. Central government funding to treat and mitigate against hill country erosion is also administered and delivered to plan holders through the SLMP.
This scheme is called the South Taranaki and Regional Erosion Support Scheme (STRESS).
8. The Regional Soil Plan for Taranaki has a target to increase the area of privately owned land in the eastern hill country that is sustainably managed - ie: used within its physical land use capability- from 84% to 89%. In the last 20 years or so, Council has achieved nearly 80% farm plan coverage of the eastern hill country in private ownership and continued to liaise with plan holders to assist with the implementation of farm plan recommendations over time.
9. The SLMP also addresses the loss of soil in the coastal sand country through vegetation disturbance. The change in the area of bare sand at 4 representative coastal sites is also measured as part of this study and will be reported on separately but with less emphasis than the hill country.
10. The Council monitors progress towards these targets on roughly a five-yearly basis and it is the latest 5 yearly report from Landcare Research that is the subject of this memorandum.

Discussion

11. The Council contracted Landcare Research (NZ) Ltd to undertake repeat monitoring of 25 representative eastern Taranaki hill country and 4 coastal sites according to the approach designed and adopted in earlier monitoring studies undertaken between 1994 and 2017. The 25 hill country monitoring sites represent approximately 21,980 hectares of the hill country, which is around 7.2% of the SLMP's target area.
12. Council also monitors the implementation of its own farm plan recommendations within the study area- noting that there are some properties within the monitoring sites that don't have farm plans prepared by Council. The Council supplied Landcare Research with high-resolution digital photographs re-flown in 2022. The last aerial photograph survey was completed in 2017 in line with Council's 5-yearly State of the Environment Monitoring cycle.
13. The results of the 2022 re-survey are positive for this Council and the SLMP. The report notes that between 2017 and 2022, overall land-use sustainability increased to from 87% to 88.3% at the 25-site

hill country monitoring area, which is an increase in sustainability of 1.3%. Although the increase is not statistically significant ($\pm 1.3\%$), it should be considered in context with the long-term increases since 1994 and the regional soil plan's objective of achieving 89% sustainable land use.

14. The main land use change during this most recent period is the transition from meat and wool farming on marginal pastoral land to scrub through reversion (252 ha). The STRESS scheme provides grants to encourage this land use change and the study results are consistent with land use change across all land under the SLMP.
15. Conversely, the area of plantation forestry (regarded as a more sustainable land use than meat and wool farming on marginal land) decreased by 6.1% or 43 hectares. However, it should also be noted that there has been a significant period of harvesting activity completed during this monitoring period as the "wall of wood" - established from 1990 plantings onwards - has come on-stream.
16. The majority of forestry harvesting has been offset by replanting and any permanent changes in land use away from forestry should be picked up during the next monitoring period. Moreover, where production forestry had been inappropriately planted and harvested, reversion to native scrub (or planting with mānuka) is promoted through the STRESS scheme. Additionally, meat and wool farming with trees (wide-spaced poplar and willows) has increased from 87 ha to 158 ha which could be attributed to the increase in new properties brought into the SLMP and the regular contact with planholders, promoting this treatment.
17. More importantly, sustainable land use is continuing to increase over the long-term. In 1994, 83.9% of the monitoring area was used sustainably and by 2022, this has improved to 88.3%, which is an improvement in sustainability of 4.3% ($\pm 2.9\%$). There are several land use changes over this period that have contributed the most to an increase in sustainable land use.
18. There has been a slight decrease in the area of dairy farming on unsuitable land but the most significant decrease is in the area of meat and wool farming on marginal land by 2,269 hectares. The reversion of marginal pastoral land to scrub by 1,521 hectares and an increase in plantation forestry from 551 hectares to 1,339 hectares (having declined from a peak of 1,395 ha in 2012) are the most significant changes.
19. This is a very positive and encouraging result over the entire monitoring period at the 25 hill country sites. Particularly given that there have been many outside market and government policy influences affecting land use change decisions.
20. For example, good returns for meat and wool have at times stimulated new scrub clearance for pastoral farming and conversely, high production forestry returns compared to meat and wool have encouraged the planting of forests on land formerly under pasture. Additionally, government funding for forestry such as the afforestation grant scheme (AGS) has stimulated more forestry for carbon sequestration/environmental benefits.
21. The government's carbon schemes have encouraged the conversion of both pasture and scrub to forestry in order to earn carbon credits when entered into the Emissions Trading Scheme. More recently, mānuka honey returns have also been a catalyst for both reversion and the establishment of mānuka forestry. All these influencing factors can play a significant role in stimulating both positive and negative landuse sustainability change. However, it is often the information and advice from Land Management Officers through farm plans that helps influence the planholders' decisions on what the most sustainable land use should be.
22. Overall, the Council has made good progress in its efforts to manage the issue of accelerated erosion in the eastern Taranaki hill country by increasing sustainable land use.
23. In summary for the hill country, further improvements in land use sustainability will be required to meet the Council's current Regional Soil Plan (RSP) target of 89% sustainability. The RSP will be soon be replaced by the Land and Water Plan (LWP) which is likely to set attributes for sediment levels in waterways. Sustainable land use is a proxy for stable soils and should continue to be promoted through Council's SLMP.

24. The former Labour government implemented a Freshwater Farm Plan System and the current Coalition government has paused and reviewed it. Current indications are that the Freshwater Farm Plan system will be kept but the role of existing Farm Environmental Plans should also be recognised and incorporated into the new system.
25. This is a good basis for optimism as Taranaki is in a unique situation by having the highest percentage of GIS-based, farm environmental plan coverage on privately owned hill country in the lower and central north island. LCR has also identified an opportunity to utilise this uniqueness and modify the monitoring methodology by using farm-scale land use capability information when analysing land use against land type. Large-scale LUC information will reduce the margin of error and the results would be more robust. Supplementary approaches in methodology due to technical advances like LiDAR could also strengthen the analysis, for example, slope. Council already has LiDAR but would have to investigate the extra cost of re-setting the mapping baselines.
26. Between 2017 and 2022, there was no significant change across 3 of the 4 coastal sand country study sites. One site showed a significant increase in the area of bare sand due to natural changes such as fore dune retreat and naturally occurring blowouts.
27. Overall, from 1994 to 2022, the total area of bare sand decreased from 12.9% (+/- 1.0%) to 9.7% (+/- 1.0%), a change of -3.2% (+/-1.5%). The Landcare Research study is complemented with Council's own study of the area of bare sand. Council's study covers the entire region and compares the area of bare sand digitised on each aerial photo series. The Council's data is currently being analysed for SEM reporting but the previous iterations, support the Landcare study's conclusion of an overall decrease in the area of bare sand.

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. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum.

Community considerations

31. 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

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

Appendices/Attachments

Document 3253945: [Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2022 resurvey by Landcare Research. March 2024](#)

Document 3275832: [PowerPoint – Sustainable land-use SEM monitoring.](#)



Manaaki Whenua
Landcare Research

Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2022 resurvey

Prepared for: Taranaki Regional Council

March 2024



Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2022 resurvey

Contract Report: LC4410

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Disclaimer

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Contents

Definitions of terms and expressions.....	v
Summary.....	vii
1 Introduction and background.....	1
2 Objectives.....	1
3 Methodology.....	2
3.1 Aerial imagery.....	2
3.2 Monitoring sites and sampling errors.....	2
3.3 Vegetation and land-use analytical methods: eastern hill country (for 2017 and 2022) .	4
3.4 Coastal sand country analytical methods.....	6
4 Results and discussion.....	7
4.1 Eastern hill country.....	7
4.2 Coastal sand country.....	17
5 Summary.....	19
5.1 Eastern hill country.....	19
5.2 Coastal sand country.....	23
5.3 Recommendations.....	24
6 Acknowledgements.....	24
7 References.....	25
Appendix 1 – Aerial imagery and monitoring sites.....	27
Appendix 2 – Vegetation and land-use analysis methodology used in previous hill country monitoring (to 2012).....	31
Appendix 3 – Hill country vegetation, land use, and land-use sustainability data for all monitoring periods, 1994–2022.....	37
Appendix 4 – Coastal sand country monitoring data for all monitoring periods, 1994–2022.....	67

Definitions of terms and expressions

The terms and expressions highlighted below have specific meanings for the purposes of the present study and report.

Accelerated erosion: movement of regolith and/or soil at rates more rapid than natural erosion rates, and due to human influence. The most important human activity promoting accelerated erosion in the eastern hill country and coastal sand country of Taranaki is vegetation clearance. Accelerated erosion is comprehensively reviewed for Taranaki by Hicks (1998).

Area of interest (coastal sand country sites): the area of sand dunes and sand flats within the chosen sand country monitoring sites, as defined by visual interpretation of the extent of the sand dune and sand flat land.

Coastal sand country: land adjacent to the coast, influenced by wind-blown sand, forming sand dunes and sand flats.

Eastern Taranaki hill country: hill country (most slopes between 16 and 25 degrees) and steep land (most slopes >25 degrees) east of the predominantly flat terraces and Taranaki ring plain, excluding Department of Conservation land. The eastern Taranaki hill country, as represented in each of the 25 monitoring sites, may contain flat to undulating river valley terraces and rolling land, but these land types cover just 15% of the total monitoring area.

Eastern Taranaki hill country monitoring site: a quasi-rectangular area of approximately 900 ha, bounded by sides approximately 3 km × 3 km, originally centred on a regular grid at intersections on the New Zealand Map Grid (NZMG) eastings and northings, drawn at 10 km intervals. From 2007 onwards, following the shift from unrectified imagery projected in NZMG to orthorectified imagery projected in the New Zealand Transverse Mercator (NZTM) projection, the boundary of each site is defined by the NZTM coordinates of its four corner points. See Table A1.2 in Appendix 1.

Pasture with trees: as in Jessen et al. (2000), this expression refers to 'close-planted woodlots of pine or other commercial timber species, interspersed with pasture for animal grazing, or rows of commercial timber species with pasture for animal grazing between the rows' (both are forms of agro-forestry). This expression was broadened in 2000 and subsequently to include areas planted with soil conservation trees (including presently non-commercial trees such as poplar). Trees should be a well-integrated and deliberate part of the farming system for the 'pasture with trees' sustainable land-use class. The 'meat and wool farming with trees' land-use class equates conceptually with the 'pasture with trees' sustainable land-use class.

Physically sustainable or unsustainable land use:

- Physically sustainable land use means 'this land use on the specified area carries a moderate or lower risk of accelerated erosion in the long-term' (Jessen et al. 2000). Physically unsustainable land use means 'this land use on the specified area of land carries a severe or higher risk of accelerated erosion in the long-term' (Jessen et al.

2000). This interpretation brings the concept of sustainability back to the issue of accelerated erosion, which the Taranaki Regional Council is in part addressing with its monitoring programme. The sustainability of land use is detected and measured by spatially overlaying the sustainable land-use class with the actual land use; for example, if the land use 'meat and wool farming' is located on the 'Forestry' sustainable land-use class, the land use is assessed as being physically unsustainable,

- Where the words 'sustainable' or 'unsustainable' are used in the present report, they should be interpreted as being preceded by the word 'potentially'. Clearly, land management that reduces a significant risk of accelerated erosion would improve the physical sustainability of that land use, and the reverse might also be true. An assumption of 'good average' land management is made for the sustainability assessments (this is the same standard assumption made when assessing land-use capability in New Zealand). 'Good average' is considered the better side of average for the region, but not necessarily extraordinary.

Physically sustainable land-use classes: land-use classes defined and described for Taranaki in Blaschke, Eyles et al. (1992). They are made up of land uses linked to specified land-use capability units from the Taranaki/Manawatu Regional New Zealand Land Resource Inventory (NZLRI) classification (Fletcher 1987), and the linkages are listed in Appendix 1 of Blaschke, Eyles et al. (1992), and in Appendix 2 of O'Leary et al. (1996). The classes represent the most intensive land use that may be sustainably applied on that land. Because the classes are linked to the spatial database of the NZLRI, they can be represented in map form.

The land-use classes were mapped for each of the 25 eastern Taranaki hill country monitoring sites for 1994 by O'Leary et al. (1996), for 2000 by Jessen et al. (2000), for 2007 by Betts and Lynn (2008), and for 2012 by Betts (2013) and 2017 by Betts (2018). The present study compares land-use classes mapped for the year 2022 against these.

Sampling error (or random error): the statistical error associated with sampling a proportion of the population (in this case, the land-use sustainability changes over 25 eastern hill country sites, or bare ground over a minimum of 4,000 dot grid points in the sand country) and not the whole population. An estimate is written as $X \pm Y$, where X is the estimated value and Y is the sampling error. The true or population value of X lies between $X - Y$ and $X + Y$. In this report a 95% level of confidence is used for totals. It is important to specify the sampling error when using the results of this monitoring study to make defensible statements for the entire area of the eastern hill country or sand country.

Summary

Project and client

Manaaki Whenua – Landcare Research (MWLR) was contracted by Taranaki Regional Council (TRC) to carry out a survey of land-use sustainability on 25 hill country sites, each c. 900 ha, in eastern Taranaki, and to monitor bare sand areas on four coastal sand country sites, for 2022. This was a repeat of the monitoring work carried out for TRC by MWLR for 2017, which was reported in 'Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2017 resurvey' (Betts 2018).

As with the 2017 and previous reports, this project addresses the monitoring requirements associated with managing the accelerated erosion issue in the following two areas of concern identified in the Regional Soil Plan for Taranaki, which became operational in 2001:

- accelerated erosion as a result of vegetation clearance in the eastern hill country
- accelerated erosion by wind on the coastal terraces as a result of vegetation disturbance.

Objectives

The objectives were as follows.

- To undertake repeat monitoring of 25 eastern Taranaki hill country sites according to the approach adopted in 2017 and previous surveys (details in main report).
- To undertake repeat monitoring of four coastal sand country sites according to the approach adopted in 2017 and previous surveys (details in main report).
- To document the methods used and results obtained in this report and retain all records as GIS data layers in ArcGIS, and associated spreadsheets and documentation, for retrieval and use in future monitoring.

Results

Eastern hill country

Vegetation

From 2017 to 2022, the main vegetation cover changes were as follows.

- A decrease in the total area under pasture from 10,001 ha (45.5%) to 9,856 ha (44.8%).
- A nett change from pasture to scrub: 250 ha of pasture reverted to scrub, while 196 ha of scrub was sprayed or cleared for pasture.
- Maize cropping continued to rotate through pasture land at some of the sites, decreasing overall during the latest period to 29 ha. Fifty-five hectares of cropping land went to pasture, while 9 ha of pasture went to cropping.

- Of the 1,384 ha of plantation forestry land mapped in 2017, 157 ha was subsequently cleared and converted to pasture, while at the same time another 129 ha of pasture land elsewhere was converted to plantation forestry. Some of the plantation forestry that had been cleared also went to scrub (45 ha) or weeds (12 ha), while 40 ha of scrub and 1 ha of weeds were converted to plantation forestry. The nett result was a small decrease by 2022 in the total area of plantation forestry, to 1339 ha.
- Twenty-six hectares of weeds were cleared for pasture, while another 33 ha reverted to scrub.
- Pole plantings almost doubled in area, with the largest increases recorded on land formerly mapped as pasture (68 ha) followed by scrub (7 ha).

Over the entire 1994–2022 monitoring period, the main vegetation cover changes were as follows.

- Pasture decreased from 10,772 ha (49.1%) to 9,856 ha (44.8%), with 1,142 ha going to scrub and 660 ha to plantation forest. Pole plantings were established on 141 ha of pasture while another 109 ha of pasture reverted to weeds.
- Cropping increased from nil in 1994 to 29 ha in 2017, almost all of which took place on land that was formerly under pasture. This is interpreted as mainly maize cropping for fodder.
- Plantation forestry increased overall by 811 ha to 1,339 ha (6.2%), coming mostly from pasture (660 ha) and scrub (394 ha). Over the same period, 142 ha of plantation forestry was harvested and converted to pasture, while another 84 ha of harvested plantation forestry reverted to scrub.
- Scrub decreased slightly overall by a nett 137 ha to 6,763 ha (30.8%) in 2022. This mainly comprised clearance for pasture (978 ha) and conversion to plantation forest (394 ha), offset mainly by 1,142 ha of reversion from pasture to scrub.
- The areas mapped as weeds in 1994 were mostly cleared for pasture by 2022 (28 ha of 37 ha), while 109 ha of pasture and 76 ha of scrub (generally cleared and subsequently abandoned) in 1994 became weeds.

Land use

From 2017 to 2022, the main land-use changes were as follows.

- An *apparent* decrease in the area of dairy farming, from 903 ha (4.1%) to 437 ha (2.0%). This relates to the ancillary information that was used to guide the distinction between dairying and meat and wool farming as noted in the results section. This mainly affected Sites 3, 7 and 20. Apart from these sites, only very minor changes were recorded in dairying overall.
- The area of meat and wool farming recorded *apparent* increases at Sites 3, 7 and 20 due to revisions out of the dairying class. Apart from these sites, the area of meat and wool farming decreased by 250 ha.
- Revegetated meat and wool farmland (i.e. reversion to scrub) increased by 252 ha.
- The area of horticulture/cash cropping decreased from 75 ha (0.2%) to 26 ha (0.1%), interpreted as the ongoing rotation of seasonal maize plantings to support intensive dairy farming.

- A slight drop in the overall area of plantation forestry (down by 43 ha to 1,339 ha or 6.1%). The largest decreases were at Sites 7 (47 ha), 8 (54 ha) and 11 (69 ha), with the largest gains being made at Sites 14 (18 ha) and 21 (104 ha).
- Meat and wool farming with trees was mapped for 158 ha (0.7%) of the monitoring area in 2022, a substantial increase from 2017 (which recorded a total of 87 ha or 0.4%). Most of this increase was recorded at Sites 9 (11 ha), 12 (10 ha) and 18 (25 ha) with small increases (< 10 ha) recorded on 16 other sites. One site (Site 22) recorded a small decrease of 0.8 ha in this class.

From 1994 to 2022, the main changes in land-use were as follows.

- A slight decrease in the area of dairy farming, from 540 ha (2.5%) to 437 ha (2.0%). Increases at Sites 2, 3, 9 and 24 were offset by decreases at Sites 20 and 21.
- The area of meat and wool farming decreased significantly from 11,849 ha (53.9%) to 9,580 ha (43.6%). This land-use class increased at Sites 20 and 22 but decreased at all other sites. The largest decrease was at Site 23 (367 ha), and the largest increase was at Site 20 (172 ha).
- Revegetated meat and wool farming (reversion to scrub) increased by 1,521 ha, from 5,293 ha (24.1%) to 6,814 ha (31.0%). Site 22 recorded an overall decrease of 136 ha, but all other sites showed increases. The largest increases were recorded at Sites 6 (152 ha), 17 (184 ha) and 23 (135 ha).
- Plantation forestry increased from 551 ha (2.5%) to 1,339 ha (6.1%), having declined slightly from a peak of 1,395 ha (6.4%) in 2012.

Physical sustainability of land use

Sustainability trend for all 25 sites

Between 2017 and 2022 overall land-use sustainability increased, though the increase was not statistically significant (+1.3 ± 1.3% to an overall 88.3% sustainable). The reversion of meat and wool farming land to scrub has been the largest contributor to land-use sustainability improvements, with the total area of reversion increasing by 252 ha from 2017 to 2022. The overall area of plantation forestry has remained close to unchanged, and has been since 2012, as the harvesting of mature blocks has more or less offset new plantings in the same locations or elsewhere. Unsustainable dairying fell to 116 ha (27% of all dairying or 0.5% of the overall monitoring area), partly as a result of the dairying land-use class being revised in 2022 as noted in the Results section of this Summary.

For the entire 1994-2022 monitoring period, overall land-use sustainability increased by 4.3% ± 2.9%, from 83.9% in 1994 to 88.3% in 2022. In 1994, meat and wool farming made up 11,849 ha (53.9%) of the monitoring area, with 29.3% (3,472 ha) of that area being physically unsustainable. By 2000, meat and wool farming occupied 51.1% (11,223 ha) of the monitoring area, and 28.7% (3,223 ha) of that area was regarded as physically unsustainable. From 2000 to 2007, meat and wool farming fell further to 45.1% (9,917 ha), and, of that, 26.8% (2,656 ha) was physically unsustainable. From 2007 to 2012, meat and wool farming continued to decrease in total area to 9,521 ha, but the overall sustainability figure was unchanged at 26.8% unsustainable. From 2012 to 2017, the total area of meat

and wool farming decreased again to 9,339 ha (42.5%), of which the proportion of unsustainable land use remained more or less the same at 26.9%.

By 2022, while the area of meat and wool farming had increased slightly, the proportion of this class deemed unsustainable had fallen further to 24.8%.

The area of land that had reverted to scrub increased by 1485 ha overall between 1994 and 2022. Within this overall change, 490 ha of scrub in 1994 was cleared for meat and wool farming by 2022, while 1895 ha of meat and wool farming land in 1994 had reverted to scrub. The total area of unsustainable meat and wool farming recorded in 1994 decreased by 1094 ha, or around one third, by 2022.

Similarly to 2017, around a quarter of the area (24%) of physically sustainable meat and wool farming in 2022 occurs on the 'Pasture with trees' (PT) sustainable land-use class. This comprises mostly land-use capability Class 6 land, which carries a moderate risk of accelerated erosion, and, although meat and wool farming are deemed physically sustainable on this sustainable land-use class, continued targeted pole planting would further improve land management on these areas (Betts 2013, 2018).

The meat and wool farming land that is considered physically unsustainable occurs on sustainable land-use classes 'Forestry' (FO) and 'Protection' (PR), which has a severe to very severe risk of accelerated erosion. We reiterate the previous suggestion (Jessen et al. (2000), Betts and Lynn (2008) and Betts (2013)) that converting this land to plantation forestry or revegetated meat and wool farming represents 'low hanging fruit' for rapid land-use sustainability gains in the eastern hill country. Conversely, the spraying or clearance of scrub vegetation on erosion-prone land can quickly counteract hard-won sustainability gains made elsewhere.

Long-term sustainability trend for 17 sites (since early 1950s)

As previously discussed in Betts (2013), over the longer term (from the early 1950s to 1994) land-use sustainability decreased from 90.0% to 87.3% ($-2.7\% \pm 0.8\%$), based on long-term monitoring by O'Leary et al. (1996) of the 17 monitoring sites that had available historical data. Most of the decrease in sustainability happened before the early 1980s, and the last decade of the pre-1994 period showed little change in sustainability. By 2000, land-use sustainability on these 17 sites had marginally improved to 88.5% ($+1.2\% \pm 0.9\%$), and improved further, though not significantly, by 2007 ($+1.5\% \pm 2.1\%$, to 90.0%).

From 2007 to 2012 overall land-use sustainability for these 17 sites decreased slightly, but, again, the change was not significant ($-0.8\% \pm 1.5\%$, to 89.2%).

From 2012 to 2017, another slight but statistically insignificant sustainability decrease was recorded ($-0.4\% \pm 1.0\%$, to 88.8%).

Between 2017 and 2022, land-use sustainability increased slightly but insignificantly (by $1.2 \pm 1.8\%$).

The overall sustainability gain for these 17 sites for 1994-2022 is positive but remains statistically insignificant, at $2.8\% \pm 3.0\%$.

Overall, the greatest risk of accelerated erosion in the eastern hill country remains on the steeper slopes. While scrub regeneration and pole planting on the more vulnerable land have gradually improved land-use sustainability, and are likely to continue to do so, the opportunity remains to further, and reasonably rapidly, improve land-use sustainability by reducing the rate of spraying and/or clearance of established or regenerating scrub; and to increase the rate of afforestation, on the most vulnerable sustainable land-use classes.

Coastal sand country

From 2017 to 2022, the area of bare sand at Sites A, B and C recorded insignificant changes ($-0.4\% \pm 1.0\%$ at Site A, $-0.3\% \pm 0.5\%$ at Site B, $+0.5\% \pm 0.5\%$ at Site C) with a significant change of $+3.2\% \pm 1.5\%$ at Site D. Natural changes (foredune retreat, naturally occurring blowouts of unstable dunes, dune sheet transgression) account for most of the changes noted, particularly at Site D, although land management could be improved in some areas by excluding stock and vehicles from vulnerable areas, particularly at Sites A and B. Large-scale development at Sites B (land farming), C (works associated with the Waipipi wind farm) and D (development of irrigated dairying) don't presently appear to show any significant risk of aeolian erosion.

Overall, from 1994 to 2022, bare sand changes were $+2.2\% \pm 0.5\%$ at Site A, $-2.1\% \pm 0.5\%$ at Site B, $+0.5\% \pm 0.5\%$ at Site C and $-3.2\% \pm 1.5\%$ at Site D.

Recommendations

Based on the findings of this report, we suggest the following actions.

- Achieve the 'lowest hanging fruit' for future land-use sustainability gains in the eastern hill country by allowing unsustainable meat and wool farming land to revert to scrub, and/or afforestation.
- Similarly, minimising the spraying and/or clearance of scrub on steep hill country for meat and wool farming would lower reductions in land-use sustainability resulting from this practice.
- Ongoing targeted pole planting should continue and will improve land-use sustainability where poles are planted – bearing in mind that the poles can take some years to become effective. However, the areal gains in land-use sustainability from pole planting are relatively small compared to the gains offered by scrub reversion or afforestation.
- The coastal sand country sites are, on the whole, being sustainably managed, with potential improvements to be made at Sites A and B by fencing off vulnerable dune crests from stock.
- This monitoring programme should continue at approximately 5-yearly intervals, and, in future, be undertaken with the use of farm-scale Land Use Capability (LUC) mapping data covering the hill country sites (as is currently being undertaken by TRC) which will improve the resolution of land-use sustainability analyses. At the same time, the monitoring methodology used in this and previous reports should be reviewed and alternative approaches sought to enable technological advances such as LiDAR slope information to improve data quality and spatial resolution in the future. This may require some resetting of mapping 'baselines'.

1 Introduction and background

Section 35 of the Resource Management Act imposes a duty on local authorities to gather information, to monitor, and to keep records. The approach of the Taranaki Regional Council (TRC) to monitoring is to undertake monitoring programmes that reflect significant regional issues. Issue 1 in Section 4 of the Regional Soil Plan for Taranaki addresses accelerated erosion resulting from inappropriate land management practices and focuses on the eastern hill country and coastal terraces. The methods TRC currently use to address Issue 1 include giving general advice and promoting its importance, providing sustainable land management planning services, enforcement if necessary, and research and monitoring. This ongoing project addresses the monitoring requirement associated with the management of this issue.

TRC established baseline information about vegetation cover, land-use and physical land-use sustainability in the region's eastern hill country in 1994 (O'Leary et al. 1996). Monitoring was repeated for TRC in 2000 (Jessen et al. 2000) as part of TRC's assessment of their management of Issue 1. At this time the monitoring programme was expanded to include the coastal sand country. The 2000 monitoring project made use of two pre-existing methods: (1) O'Leary et al. (1996) in the eastern hill country; and (2) as developed by Stephens & Dymond (1999) in the coastal sand country.

Following the acquisition of further regional aerial photography in 2007, monitoring was repeated (Betts & Lynn 2008), with the methodology undergoing some modification to accommodate improvements in aerial imagery resolution and a concurrent shift to industry-standard orthorectified imagery. This was repeated in 2012 (Betts 2013) and in 2017 (Betts 2018).

TRC requested Manaaki Whenua Landcare Research to measure and report on changes from 2017 to 2022 in vegetation cover and land use on the hill country sites, and changes in bare sand cover on the coastal sand country sites. The methods described in Betts (2013) and Betts (2018) were repeated in the current study.

2 Objectives

The objectives were as follows.

- To repeat monitoring of 25 eastern Taranaki hill country sites using the approach adopted by O'Leary et al. (1996) and O'Leary & Stephens (1996), and as revised in Jessen et al. (2000) including refinements to the methodology as described by Betts and Lynn (2008) The present study takes the information reported in Betts (2018) and determines changes to vegetation cover, land-use, and physical land-use sustainability from 2017 to 2022 (the latest monitoring period), and from 1994 to 2022 (the total monitoring period).
- To undertake monitoring of four coastal sand country sites using the Stephens & Dymond (1999) approach as modified by Jessen et al. (2000). The present study

determines changes to the area of bare sand from 2017 to 2022 and from 1994 to 2022 overall.

- To document results and archive records as GIS data layers in ArcGIS and associated spreadsheets for retrieval and-use in future monitoring.

3 Methodology

3.1 Aerial imagery

The 2022 imagery used in this study was supplied by TRC as high-resolution orthorectified digital images with a resolution of 0.25m/pixel using the New Zealand Transverse Mercator (NZTM) projection.

Full details of the imagery used in 1994, 2000, 2007, 2012, 2017 and the present study are summarised in Table A1.1 in Appendix 1.

3.2 Monitoring sites and sampling errors

Figure 1 shows the locations of the 25 hill country monitoring sites and the four coastal sand country monitoring sites.

Taranaki monitoring sites: Eastern hill country and coastal sand country

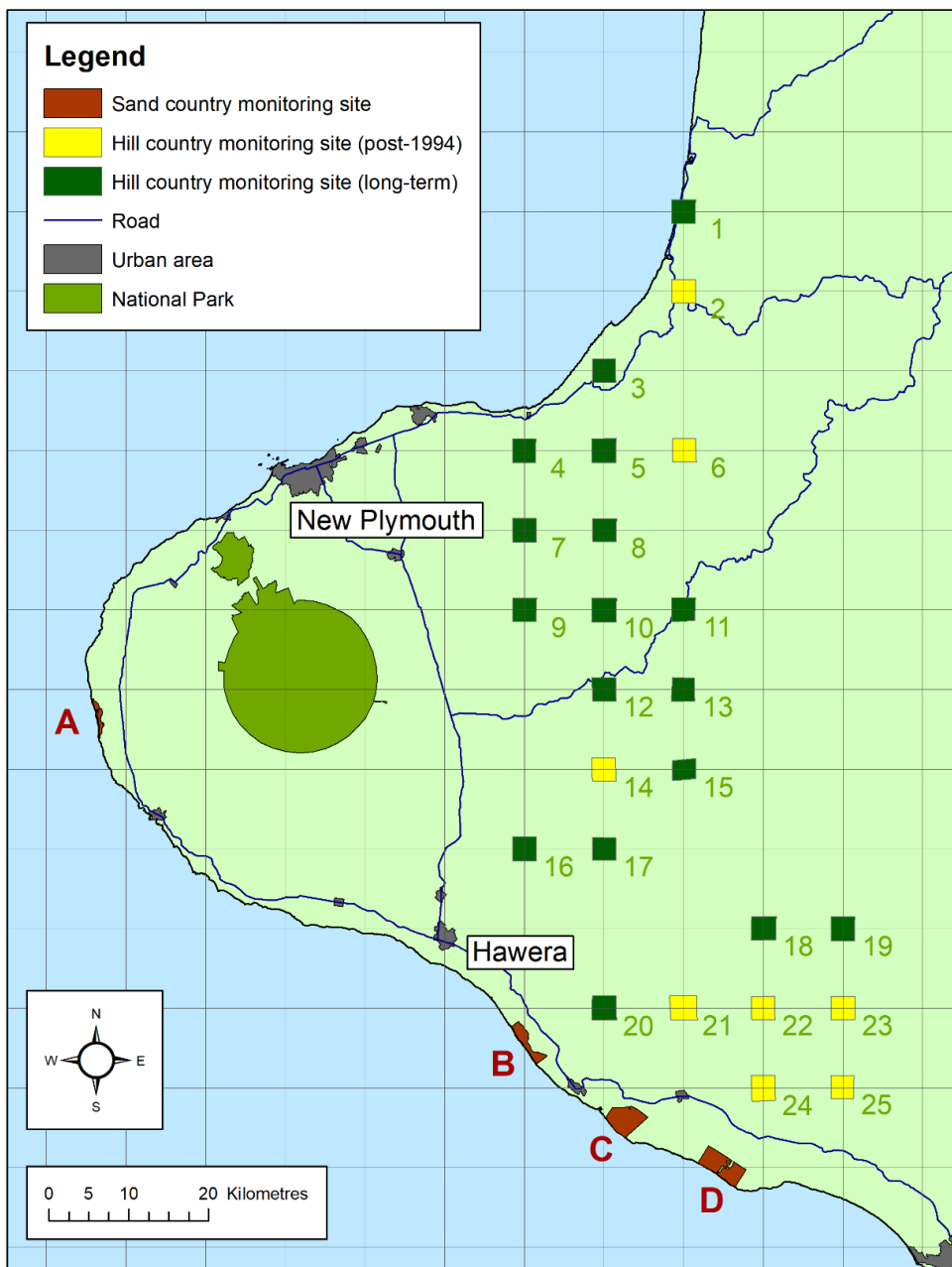


Figure 1. Taranaki State of Environment land-use monitoring sites: Eastern hill country and coastal sand country.

3.2.1 Eastern hill country

Each hill country site was originally defined as a 3 km × 3 km square (900 ha) (Jessen et al. 2000). The site boundaries were adjusted slightly in 2007 to accommodate a post-2000 move to orthorectified imagery, as detailed in Betts & Lynn (2008). The total area of eastern hill country sampled over the 25 sites is 21,981 ha.

Full details of the hill country sites with their original nominal and revised areas are given in Table A1.2 in Appendix 1.

3.2.2 Coastal sand country

The four coastal sand country sites were chosen by TRC to be representative of coastal Taranaki. The sites are widely separated (from near Cape Egmont in the north, to north of Whanganui in the south – see Figure 1), capturing the range of conditions along the coast. The area of each site is variable, as is the 'area of interest' defined in each site. The 'area of interest' roughly represents the extent of sand dunes within each site where monitoring was carried out.

As with the hill country, the boundaries for the four sand country sites were redefined in 2007 following the move to orthorectified imagery, although the relatively low topography of these sites meant site boundary distortion due to relief displacement was negligible (Betts & Lynn 2008).

Site boundaries were adjusted slightly again in 2022 to account for streambank and/or shoreline erosion. Sand country monitoring site details are described in Table A1.3 in Appendix 1.

Sampling (random) errors due to the sampling method used to estimate bare sand extent are between ±0.5% and ±1.5%. A description of how these errors are calculated using the sand country sampling strategy can be found in Dymond et al. (2001).

3.3 Vegetation and land-use analytical methods: eastern hill country (for 2017 and 2022)

The method used for the hill country monitoring in this study was originally developed by Stephens et al. (1995), comprehensively documented in O'Leary et al. (1996), and explained further in O'Leary & Stephens (1996). The physically sustainable land-use classes against which the mapped land uses were compared in previous monitoring (Jessen et al. 2000; Betts & Lynn 2008; Betts 2013, 2018) were originally established for Taranaki in a study by Blaschke, Eyles et al. (1992).

The methodology used from 1994 to 2012 is described in full in Appendix 2.

For 2017 and 2022 the methodology used for vegetation and land-use analysis was much the same as that used for 2012, with the addition of a new vegetation class, 'pole plantings' (Table A2.1 in Appendix 2), to represent areas of hill country where soil conservation plantings (poplar poles) are present. This new vegetation class corresponds

to the land-use class 'Meat and wool farming with trees' (Table A2.2 in Appendix 2) and is deemed sustainable on sustainable land-use classes PT, GR, DY, CC and IH (Table A2.3 in Appendix 2), whereas meat and wool farming without pole plantings is deemed unsustainable on land-use class PT. This recognises the strong positive effect that space-planted trees have on hill slope stability compared with unplanted slopes (e.g. Douglas et al. 2013; Spiekermann et al. 2022).

The rationale for this is to ensure that efforts to improve the sustainability of land use through conservation plantings are properly captured in the mapping, where poplar plantings have previously not been isolated from surrounding pasture.

TRC supplied MWLR with a GIS data layer outlining the locations of pole plantings to assist with the identification of pole plantings on the 2017 and 2022 imagery. Pole plantings identified by this data layer were mapped where poplars were visible on the imagery, but they were not mapped if they were not visible. Also, all sites were examined closely throughout (usually at a scale of 1:1000) for any other plantings not identified by TRC's shapefile, and these were included in the mapping where clusters of poplars could clearly be seen. Isolated, single poplar trees were generally not mapped.

The rationale for mapping poplars only where they were visible is a proxy for their current effectiveness as a soil conservation measure: if they were not visible, then they were considered to be either too small to be seen (and therefore too small to yet have any significant stabilising effect), or to not have become established. This is a deliberately conservative approach that is intended to capture pole plantings only when they are considered to have become established and therefore effective from a soil conservation perspective, which is about 10 to 15 years after planting or when stem diameter at breast height (DBH) reaches 30 cm (Douglas et al. 2013; Phillips et al. 2020).

It is also noted that if pole plantings are established on sustainable land-use classes FO and PR, then, while their presence on pasture will offer some soil conservation benefits, the resulting land-use class ('Meat and wool farming with trees') will still be regarded as unsustainable. Similarly, only the immediate areas surrounding pole plantings are mapped in this class, because their slope-stabilising effect diminishes with distance from the nearest tree and is usually minimal beyond about 10-20 m (see Figure 5 in Hawley & Dymond 1988; and Spiekermann et al. 2022).

The methodology used to analyse changes in vegetation cover, land use and land-use sustainability for these sites results in low random (sampling) errors (between $\pm 1.3\%$ and $\pm 3.0\%$ for 2022) for the sustainability change data when assessed over the 25 sites for the eastern Taranaki hill country. Detailed information about the calculation of errors according to this sampling strategy can be found in Dymond et al. (2001).

3.4 Coastal sand country analytical methods

The method originally established by Stephens & Dymond (1999) and used in modified form by Jessen et al. (2000), Betts and Lynn (2008), Betts (2013) and Betts (2018), was repeated in this study with some further modification as outlined below.

This method generates low sampling (random) errors of between $\pm 0.5\%$ and $\pm 1.5\%$ (depending on site area), contributing to defensible comparative datasets produced from each monitoring episode. The low errors result from a high number of observation points (a minimum of 4,000) used at each site. More information about error estimates using this sampling strategy may be found in Dymond et al. (2001).

The method used in the present study, based on the method previously used, is summarised below.

- Digital aerial imagery for 2022, supplied by TRC, was added as new layers to the GIS files used in 2017.
- GIS files containing the 'area of interest' (AOI) (i.e. the sand country as originally delineated by Jessen et al. (2000)) within each monitoring site were retrieved from archive. After overlaying them on the 2022 imagery, it was deemed necessary to adjust some of the AOI boundaries on account of streambank and/or shoreline erosion. The revised AOI areas are reported in Table A1.3 in Appendix 1.
- The AOI areas were then used to re-determine the required sample point spacing for a regular 'virtual grid' to achieve a minimum of 4,000 sample points within each AOI.
- Using ArcGIS, a point shapefile containing a regular dot grid was then created for each site, with the grid spacing set as above to achieve the required number of sample points.
- For each site in turn, the dot grid shapefile was overlaid onto the aerial imagery and the sampling points were manually coded to identify those points that landed on bare sand on the imagery. This approach was also used in 2017, replacing the "virtual dot grid" method used previously.
- This variation on the previously used method provides not only a quantitative estimate of the total area of bare sand at each site at a point in time, but also enables the overlaying of mapping from different monitoring episodes to reveal the spatial nature of these changes.

4 Results and discussion

In this section, areal data are presented in hectares and rounded to the nearest hectare directly from the relevant tabular data except in Section 4.2 where figures are given to one decimal place on account of the smaller areas involved. Percentages and error limits are given to one decimal place.

Complete datasets describing vegetation, land use, and land-use sustainability for all monitoring periods from 1994 to 2022 are provided in Tables A3.1 to A3.27 in Appendix 3. Bare sand monitoring data for the coastal sand country sites is given in Tables A4.1 to A4.4 in Appendix 4.

The discussion below focuses on the latest monitoring period (2017–2022) and the overall monitoring period (1994–2022).

4.1 Eastern hill country

4.1.1 Vegetation cover by site

Table A3.1 in Appendix 3 sets out, for each site, the vegetation cover classes mapped for 1994 (O’Leary et al. 1996), 2000 (Jessen et al. 2000), 2007 (Betts & Lynn 2008), 2012 (Betts 2013), 2017 (Betts 2018) and 2022 (this study). Details of vegetation changes between 1994 and 2017 have previously been described in Betts & Lynn (2008), Betts (2013) and Betts (2018).

Changes between 2017 and 2022

From 2017 to 2022, vegetation cover changes are summarised as follows.

- The total area under pasture decreased from 10,001 ha (45.5%) to 9,856 ha (44.8%), resuming the long-term decrease in the area under pasture that had reversed between 2012 and 2017.
- The area mapped as ‘Crops’, (almost entirely maize cropping) decreased from 75 ha (0.3%) to 29 ha (0.1%). This is considered insignificant in the context of the regular rotation of maize cropping around farms from one season to the next.
- Plantation forestry decreased from 1,384 ha (6.3%) to 1,339 ha (6.1%),
- Tall scrub (>3 m) decreased very slightly from 2,592 ha (11.8%) to 2,584 ha (11.8%), but short scrub (<3 m) increased over the same period from 4,097 ha (18.6%) to 4,179 ha (19.0%).
- Alongside the increase in short scrub, land mapped as ‘Weeds’ increased from 114 ha (0.5%) to 211 ha (1.0%).
- Land identified as having ‘Pole plantings’ increased from 87 ha (0.4%) to 158 ha (0.7%).

Overall changes between 1994 and 2022

From 1994 to 2022, the most notable changes in vegetation cover were as listed below.

- A decrease in the area under pasture, from 10,772 ha (49.0%) to 9,856 ha (44.8%).
- Cropping (almost all of which is interpreted as maize); this was not mapped in 1994 or 2000, but was present from 2007 onwards, covering 29 ha (0.1%) in 2022.
- Plantation forestry increased from 528 ha (2.4%) to 1,339 ha (6.1%), peaking at 1,384 ha (6.3%) in 2012 and 2017 before decreasing slightly.
- Indigenous forest cover decreased by 142 ha from 3,380 ha (15.4%) to 3,224 ha (14.7%).
- Tall and short scrub together covered 6,877 ha (31.3%) in 1994, decreasing to 6,763 ha (30.8%) in 2022.
- The area under weeds increased from 37 ha (0.2%) in 1994 to 211 ha (1.0%) in 2022.

4.1.2 Vegetation change analysis

Tables A3.2 to A3.7 in Appendix 3 summarise the changes in vegetation cover mapped between 1994 (O'Leary et al. 1996), 2000 (Jessen et al. 2000), 2007 (Betts & Lynn 2008), 2012 (Betts 2013), 2017 (Betts 2018) and 2022 (this study), respectively. Analyses of vegetation changes between 1994 and 2017 have previously been given in Betts & Lynn (2008), Betts (2013) and Betts (2018).

The most significant changes from 2017 to 2022, and overall from 1994 to 2022, are as shown below.

Change analysis, 2017–2022 (Table A3.6)

- There was a nett change from pasture to scrub: 250 ha of pasture reverted to scrub, while 196 ha of scrub was sprayed or cleared for pasture.
- Maize cropping continued to rotate through pasture land at some of the sites, decreasing overall during the latest period. Within this decrease, 55 ha of cropping land went to pasture, while 9 ha of pasture went to cropping.
- Of the 1,384 ha of plantation forestry land mapped in 2017, 157 ha was subsequently cleared and converted to pasture, while at the same time another 129 ha of pasture land elsewhere was converted to plantation forestry. Some of the plantation forestry that had been cleared also went to scrub (45 ha) or weeds (12 ha), while 40 ha of scrub and 1 ha of weeds were converted to plantation forestry.
- Twenty-six hectares of weeds were cleared for pasture, while another 33 ha reverted to scrub.
- Pole plantings almost doubled in area, from 87 ha to 158 ha, with the largest increases recorded on land formerly mapped as pasture (68 ha) followed by scrub (7 ha).

Overall change analysis, 1994–2022 (Table A3.7)

- Pasture decreased from 10,772 ha (49.1%) to 9,856 ha (44.8%), with 1,142 ha going to scrub and 660 ha to plantation forest. Pole plantings were established on 141 ha of pasture while another 109 ha of pasture reverted to weeds,
- Cropping increased from nil in 1994 to 29 ha in 2017, almost all of which took place on land that was formerly under pasture. We interpret this as mainly maize cropping for fodder.
- Plantation forestry increased overall by 811 ha, from 528 ha to 1,339 ha, coming mostly from pasture (660 ha) and scrub (394 ha). Over the same period, 142 ha of plantation forestry was harvested and converted to pasture, while another 84 ha of harvested plantation forestry reverted to scrub.
- Scrub decreased slightly overall by a nett 137 ha to 6,763 ha (30.8%) in 2022. This mainly comprised clearance for pasture (978 ha) and conversion to plantation forest (394 ha), offset mainly by 1,142 ha of reversion from pasture to scrub.
- The areas mapped as weeds in 1994 were mostly cleared for pasture (28 ha of 37 ha) while 109 ha of pasture and 76 ha of scrub (generally cleared and subsequently abandoned) in 1994 became weeds by 2022.

4.1.3 Land use by site

Table A3.8 in Appendix 3 sets out, for each site, the land-use classes mapped for 1994 (O’Leary et al. 1996), 2000 (Jessen et al. 2000), 2007 (Betts & Lynn 2008), 2012 (Betts 2013), 2017 (Betts 2018) and 2022 (this study). Details of land-use changes between 1994 and 2017 have previously been described in Betts & Lynn (2008), Betts (2013) and Betts (2018).

Changes between 2017 and 2022

Note: *Following an examination of dairy consent and farm boundary information supplied for 2022 by TRC, it became apparent that the equivalent information received in 2017 (which was used to help distinguish dairying from meat and wool farming) had been incomplete and led to dairying being misrepresented at some sites for 2017. In consultation with TRC, it was agreed that the mapping should remain based on the best available information at the time (in the current case, TRC’s 2022 dairy consent and farm boundary information), even though it would suggest that some land-use changes had occurred in the periods prior to and after 2017 where in fact no significant change had occurred. This concerns the ‘Dairying’ and ‘Meat and wool farming’ classes at Sites 3, 7 and 20 and has negligible or no effect on the other land-use classes or sites.*

The main changes between 2017 and 2022 are shown below.

- An *apparent* decrease in the area of dairy farming, from 903 ha (4.1%) to 437 ha (2.0%). This relates to the note above concerning the ancillary information that was used to guide the distinction between dairying and meat and wool farming. This mainly affected Sites 3, 7 and 20. Apart from these sites, only very minor changes were recorded in dairying overall.

- Concurrently with the note for dairying, the area of meat and wool farming recorded *apparent* increases at Sites 3, 7 and 20 due to revisions out of the dairying class. Apart from these sites, meat and wool farming decreased by 250 ha.
- Revegetated meat and wool farmland (i.e., reversion to scrub) increased by 252 ha.
- The area of horticulture/cash cropping decreased from 75 ha (0.2%) to 26 ha (0.1%). Some maize in the process of harvesting at the time of image capture was deemed to have reverted to the surrounding farming type (dairying or meat and wool farming).
- A slight drop in the overall area of plantation forestry (down by 43 ha to 1339 ha or 6.1%). The largest decreases were at Sites 7 (47 ha), 8 (54 ha) and 11 (69 ha), with the largest gains being made at Sites 14 (18 ha) and 21 (104 ha).
- Meat and wool farming with trees was mapped for 158 ha (0.7%) of the monitoring area in 2022, a significant increase from 2017 (which recorded a total of 87 ha or 0.4%). Most of this increase was recorded at Sites 9 (11 ha), 12 (10 ha) and 19 (25 ha) with small increases (<10 ha) recorded on 16 other sites. One site (Site 22) recorded a small decrease of 0.8 ha in this class.

Overall changes between 1994 and 2022

From 1994 to 2022, the main changes in land use were as follows.

- A slight decrease in the area of dairy farming, from 540 ha (2.5%) to 437 ha (2.0%). Increases at Sites 2, 3, 9 and 24 were offset by decreases at Sites 20 and 21.
- The area of meat and wool farming decreased significantly from 11,849 ha (53.9%) to 9,580 ha (43.6%). This land-use class increased at Sites 20 and 22 but decreased at all other sites. The largest decrease was at Site 23 (367 ha), and the largest increase was at Site 20 (172 ha).
- Revegetated meat and wool farming (reversion to scrub) increased by 1,521 ha, from 5,293 ha (24.1%) to 6,814 ha (31.0%). Site 22 recorded an overall decrease of 136 ha, but all other sites showed increases. The largest increases were recorded at Sites 6 (152 ha), 17 (184 ha) and 23 (135 ha).
- Plantation forestry increased from 551 ha (2.5%) to 1,339 ha (6.1%), having declined slightly from a peak of 1,395 ha (6.4%) in 2012.

4.1.4 Land-use change analysis

Tables A3.9 to A3.14 in Appendix 3 summarise the changes in land use mapped between 1994 (O'Leary et al. 1996), 2000 (Jessen et al. 2000), 2007 (Betts & Lynn 2008), 2012 (Betts 2013), 2017 (Betts 2018) and 2022 (this study). Analysis of land-use changes between 1994 and 2017 have previously been described in Betts & Lynn (2008), Betts (2013) and Betts (2018).

The most significant changes from 2017 and 2022, and overall from 1994 to 2022, are as follows.

Change analysis, 2017–2022 (Table A3.13)

As for the previous two monitoring periods (Betts 2018), most land-use changes in the 2017–2022 period were small overall, with the main changes being in the dairying, meat & wool farming, and revegetated meat & wool farming classes. (Refer to the note in Section 4.1.3 above regarding the dairying land-use class which had been overestimated in 2017.)

The main land-use changes between 2017 and 2022 were as follows.

- Of the 75 ha of horticulture/cash cropping (i.e. maize cropping) mapped in 2017, 55 ha had reverted to the surrounding land-use class (i.e. meat and wool farming or dairying) in 2022, reflecting the rotation of maize cropping from season to season.
- Dairying decreased significantly from 903 ha (4.1%) to 437 ha (2.0%), partly as a result of the revision to the dairying land-use class at a handful of sites as noted above. Most of these changes went to the meat and wool farming class.
- Of the 9,339 ha mapped as meat and wool farming in 2017, 446 ha went to revegetated meat and wool farming (reversion to scrub) and 123 ha to plantation forestry with a further 69 ha going to pole plantings. An apparent land-use change of 454 ha from dairying to meat and wool farming was influenced by the post-2017 revision to dairying as discussed above. However, an additional 251 ha of scrub (revegetated meat and wool farming) was cleared or sprayed for meat and wool farming, and 124 ha of plantation forestry land was cleared for meat and wool farming.
- 40 ha of scrub was converted to plantation forestry.

Overall change analysis, 1994–2022 (Table A3.14)

The most notable land-use changes between 1994 and 2022 were as follows.

- Meat and wool farming decreased by 2,261 ha, from 11,849 ha in 1994 to 9,580 ha in 2022; 1,896 ha of meat and wool farmland in 1994 reverted to scrub, while 490 ha of scrub was cleared or sprayed for meat and wool farming.
- Eight hundred and thirty six hectares of meat and wool farmland was converted to plantation forestry, while 105 ha of plantation forestry was harvested and converted to meat and wool farming.
- Sixty-seven hectares of indigenous forest was cleared for meat and wool farming, while another 289 ha became revegetated meat and wool farming, mostly as a consequence of forest clearance followed by abandonment and reversion to scrub.
- Two hundred and fifty-eight hectares of meat and wool farmland were converted to dairying, while 331 ha of dairy land went to meat and wool farmland.

4.1.5 Physical sustainability of land use

Tables A3.15 to A3.20 in Appendix 3 give the area of each land use considered to be physically sustainable (and unsustainable) for each site, for each monitoring date, according to the sustainability definitions listed under 'Definitions of terms and expressions' above and the physically sustainable land-use classes in Table A2.3. As in

previous iterations of this monitoring programme, the sustainability data were extracted by overlaying the mapped land uses for 1994, 2000, 2007, 2012, 2017 and 2022 onto a spatial layer containing the physically sustainable land-uses spatial database (Blaschke, Eyles et al. 1992) using ArcGIS. Because the sustainable land-use classes were set to reflect the accelerated erosion issue (Issue 1 in Section 4 of TRC's 2001 Regional Soil Plan for Taranaki), the cause of any potential unsustainability of land use recorded would be the higher susceptibility for soil slip erosion on much of the steeper (specifically, where slopes are >28°) grassland in the eastern hill country (Blaschke, Trustrum et al. 1992; Trustrum & Blaschke 1992; DeRose et al. 1993).

For the reporting of land-use sustainability as at 1994 and the changes up to 1994, O'Leary et al. (1996) used data from 17, not 25, sites. The 1996 study omitted Sites 2, 6, 14, and 21 to 25 because these had no pre-1994 land-use and vegetation data, and their main objective was to obtain information about changes in land-use sustainability before 1994. The omitted Sites 2, 6, and 14 are scattered in the northern and central parts of the eastern Taranaki hill country (see Figure 1), and Sites 21–25 form a block in the southern part.

While data for the 17 sites were necessary for measuring changes up to 1994, using only the 17 sites as a measure of sustainability as at 1994 is less appropriate due to an increase in sampling error and poorer eastern Taranaki hill country representation, all else being equal. The 17-site sustainability data as at 1994 were used by TRC to set a baseline for sustainability targets, largely as a result of this figure being emphasised in the 1996 report, and it not being picked up as unsatisfactory in a later report prepared for TRC (Stephens & Harmsworth 1999).

For completeness, the present study gives sustainability change data for both the current 25-site dataset (Tables A3.21 and A3.22 in Appendix 3) and the smaller 17-site dataset (Tables A3.23 and A3.24 in Appendix 3). Given that the use of data from 25 sites gives the most representative measure of sustainability changes since 1994, the following discussion concentrates on the full dataset in Tables A3.21 and A3.22. Long-term (i.e. since pre-1994) sustainability changes with respect to the 17 sites used by O'Leary et al. (1996) are discussed separately below in the subsection headed 'Long-term changes in physical land-use sustainability (pre-1994–2022) – considering the 17 sites from O'Leary et al. (1996)'.

This section assesses land-use sustainability for 2022 and discusses changes in this over the 2017–2022 and 1994–2022 periods. Changes in land-use sustainability for previous monitoring episodes are also briefly reviewed here (refer to Betts & Lynn (2008), Betts (2013) and Betts (2018) for full discussions).

Physical land-use sustainability as at 1994 (Table A3.15)

In 1994 sustainable land uses made up 18,451 ha (83.9%) of the total monitoring area, while unsustainable land uses accounted for 3,529 ha (16.1%). Unsustainable land use was almost all in the meat and wool farming land-use class (3,472 ha, or 98.4% of land use deemed unsustainable), with the remainder coming from small areas of dairying (38 ha), plantation forestry (10 ha), and meat and wool farming with trees (10 ha).

Physical land-use sustainability, 1994-2000 (Tables A3.15 and A3.16)

By 2000 the area of sustainable land use had increased by $1.1\% \pm 0.7\%$ to 18,689 ha (85.0% of the total monitoring area), while unsustainable land uses made up 3,291 ha (15.0%). As in 1994, unsustainable land use was predominantly meat and wool farming (3,223 ha, or 97.9% of land use deemed unsustainable), with the remainder coming from dairying (36 ha), plantation forestry (15 ha), meat and wool farming with trees (10 ha), and cropping (8 ha). Most of the improvement in land-use sustainability resulted from the reduction of the total area of meat and wool farming from 11,849 ha to 11,223 ha, and the increase in plantation forestry from 551 ha to 879 ha.

Many movements toward sustainability on a site-by-site basis were within the margin for error (changes of 10 ha or less were considered to be insignificant). Nevertheless, four sites (3, 8, 17, and 23) were definitely being used more sustainably in 2000 than in 1994, and Sites 10, 19, 24, and 25 were probably being used more sustainably. While Sites 19 and 23 were more sustainably used by 2000 than in 1994, their total areas of unsustainable land use, along with that of Site 14, were still relatively large by 2000.

Physical land-use sustainability, 2000-2007 (Tables A3.16 and A3.17)

From 2000 to 2007 the area of sustainable land use increased further, by $2.4\% \pm 1.5\%$, to 19,218 ha (87.4% of the total monitoring area), while unsustainable land uses totalled 2,763 ha (12.6%). Continuing the previous trend, meat and wool farming made up most of the unsustainably managed land (2,656 ha, or 96.1% of unsustainably managed land), while the contribution from dairying doubled to 74 ha (2.7% of unsustainably managed land). The remainder came from plantation forestry (20 ha), cropping (10 ha), and meat and wool farming with trees (3 ha).

As occurred between 1994 and 2000, the majority of the improvement in land-use sustainability came from a reduction in area of meat and wool farming and an increase in the area under plantation forestry (an increase of 154 ha, from 879 ha to 1,033 ha). An increase in the area of revegetated meat and wool farming land (by 1,186 ha, from 5,594 ha to 6,780 ha) was also recorded.

Most sites again recorded insignificant changes in sustainability of less than 10 ha. Of those that showed improved sustainability, Sites 6, 9, 10, 14, 17, 19, 23 and 25 were definitely being used more sustainably in 2007 than in 2000, while Sites 5, 20, 21 and 24 were probably being used more sustainably. Sites 3 and 22, however, appear to have been used less sustainably in 2007 than in 2000.

Overall, 2000 to 2007 recorded a greater rate of movement towards sustainable land use than that which occurred between 1994 and 2000, and an increased number of sites showed significant improvements in sustainability of land use.

Physical land-use sustainability, 2007–2012 (Tables A3.17 and A3.18)

By 2012 sustainable land uses made up 19,149 ha (87.1%) of the total monitoring area, while unsustainable land uses accounted for 2,832 ha (12.9%). These totals were little changed from 2007 (an overall change of $-0.3\% \pm 2.1\%$). As in 2007, the meat and wool farming land-use class again accounted for most of the unsustainably managed land (2,548 ha, or 90% of unsustainably managed land in 2012), with an increased contribution from dairying (223 ha, up from 74 ha in 2007). Unsustainable plantation forestry (43 ha) and cropping (17 ha) made up the remainder.

Of the 25 sites, three (Sites 10, 23, and 25) were being used more sustainably by 2012 than in 2007. Six sites showed decreases in land-use sustainability: Sites 7, 9, and 22 were definitely being used less sustainably, and Sites 2, 3, and 19 were probably being used less sustainably. The remaining 16 sites showed no significant change (sustainability changes < 10 ha).

Physical land-use sustainability, 2012–2017 (Tables A3.18 and A3.19)

By 2017, 19,110 ha (86.9% of the total monitoring area) was sustainably managed, with 2,871 ha (13.1%) unsustainably managed. These totals were little changed from 2012 (a slight but insignificant change of $-0.2\% \pm 1.1\%$). As in previous monitoring periods, unsustainable meat and wool farming accounted for most of the unsustainably managed land (2,509 ha, or 87.4% of unsustainably managed land). Unsustainable dairying increased to 287 ha (10% of unsustainably managed land). Of the other unsustainable land uses, plantation forestry made up 37 ha, with 12 ha coming from cropping and 25 ha from meat and wool farming with trees.

Four sites (Sites 14, 17, 22 and 23) were definitely being used more sustainably in 2017 than in 2012, while a further five sites (Sites 3, 19, 20, 21 and 25) were being used less sustainably by 2017. The remaining sites showed insignificant changes in sustainable land use of less than 10 ha.

Physical land-use sustainability, 2017–2022 (Tables A3.19 and A3.20)

The total area of sustainable land use stood at 19,400 ha (88.3% of the monitoring area) by 2022, with the area of unsustainable land use coming in at 2,580 ha (11.7%). The greatest proportion of unsustainable land use continued to be meat and wool farming (2,378 ha or 92% of unsustainable land use), although the actual area of unsustainable meat and wool farming reduced by around 131 ha since 2017. Most of the remaining unsustainable land use was dairying (116 ha), plantation forestry (42 ha) or meat and wool farming with trees (41 ha).

Changes in physical land-use sustainability, 2017–2022 (Tables A3.21 and A3.22)

The total area of sustainable land-use increased by 291 ha from 2017 to 2022, although the proportional increase was just inside the margin of error ($+1.3 \pm 1.3\%$). Positive contributions to sustainability came from a decrease in unsustainable dairying (by 171 ha) and unsustainable meat and wool farming (131 ha). However, it needs to be noted that some of the apparent change in unsustainable dairying has resulted from the revision of the dairying land-use class as discussed above.

Nine sites (Sites 3, 6, 7, 10, 17, 20, 21, 24 and 25) were definitely being used more sustainably, while only one site (Site 22) was being used less sustainably. The remaining 15 sites showed insignificant changes of less than 10 ha.

Sustainability of key land-use classes

Table A3.25, Table A3.26 and Table A3.27 in Appendix 3 provide a detailed view of the past and present sustainability of meat and wool farming, dairying and plantation forestry respectively over the 25 monitoring sites.

Table A3.25 shows that the proportion of meat and wool farming that was considered unsustainable (occurring on sustainable land-use classes FO and PR) improved from 29.3% in 1994 to 28.7% 2000, then again to 26.8% in 2007, but then remained little changed through to 2012 (26.8%) and 2017 (26.9%). From 2017 to 2022, the area of unsustainable meat and wool farming decreased by 131 ha, and the proportion of unsustainable meat and wool farming also decreased (from 26.9% to 24.8%), indicating that moves away from meat and wool farming were happening more on sustainable land-use classes FO and PR than on other classes.

Table 3.26 shows that proportion of dairying that was considered unsustainable (occurring on sustainable land-use classes GR, PT, FO and PR) showed little change between 1994 (7.0%) and 2000 (6.7%) but then increased to 13.1% by 2007, 28.0% by 2012 and 31.8% by 2017. From 2017 to 2022, unsustainable dairying dropped to 26.6%, which largely reflects revisions to the dairying land-use class, at Sites 3 and 20 in particular, for 2022. Dairy land recorded at Site 7 in 2017 appears to have converted to meat and wool farming in 2022 as indicated by TRC dairy consent and farm boundary information. As previously, most unsustainable dairying occurs on sustainable land-use class GR (drystock grazing).

Plantation forestry increased from a total of 551 ha (2.5% of the monitoring area) in 1994 to 1,339 ha (6.2%) by 2022. This is an important contributor to land-use sustainability, as plantation forestry is one means by which the issue of accelerated erosion can actively be addressed in susceptible hill country catchments. Plantation forestry is regarded as sustainable on all sustainable land-use classes except for PR (Protection). Table A3.27 shows that the majority of plantation forestry is physically sustainable at all dates, with only 42 ha (3.1% of all plantation forestry) considered unsustainable as of 2022. Site 19 contains the most unsustainable plantation forestry (19 ha).

Changes in physical land-use sustainability, 1994–2022

From 1994 to 2022 overall land-use sustainability over the 25 sites improved by $4.3\% \pm 2.9\%$, from 83.9% in 1994 to 88.3% in 2022 (Tables A3.21 and A3.22). Tables A3.15 and A3.20 show that the main drivers of this change were a reduction in the area of unsustainable meat and wool farming (down by a nett 1094 ha), offset mainly by increases in unsustainable dairying (up by 78 ha), a 32 ha nett increase in unsustainable plantation forestry, and a 31 ha nett increase in unsustainable meat and wool farming with trees.

Fourteen of the 25 monitoring sites (Sites 4, 6, 8, 10, 13, 14, 16, 17, 19, 20, 21, 23, 24 and 25) were recorded increases in land-use sustainability between 1994 and 2022. Two sites (Sites 9 and 22) recorded decreases in land-use sustainability. The remaining nine sites (Sites 1, 2, 3, 5, 7, 11, 12, 15 and 18) recorded insignificant changes (<10 ha).

Long-term changes in physical land-use sustainability (pre-1994–2022) – considering the 17 sites from O’Leary et al. (1996)

As reported previously in Jessen et al. (2000), Betts & Lynn (2008), Betts (2013) and Betts (2018), pre-1994 sustainability data from O’Leary et al. (1996) is considered here in two parts: *long term* (mostly from the early to mid-1970s, and a few sites from the 1950s); and *short term* (from the early 1980s, roughly a decade before 1994). Both use the 17 sites listed in Tables A3.23 and A3.24 in Appendix 3, as these sites had available historical primary data (aerial photography) for assessing land cover / land use.

In the *long term*, from early 1950s–1970s to 1994, O’Leary et al. (1996) found sustainability for the 17 sites decreased from 90.0% to 87.3% ($-2.7\% \pm 0.8\%$). The main cause of this decline was a decrease in the area of physically sustainable meat and wool farming, associated with the clearing of steep land and a consequent large reduction in the area of revegetated meat and wool farming. In the *short term*, from the early 1980s to 1994 the proportion of sustainable to unsustainable land uses remained unchanged, although the area of unsustainable meat and wool farming land had declined.

Land-use sustainability improved, albeit insignificantly, from 87.3% in 1994 to 88.5% ($+1.2\% \pm 0.9\%$) over the 17 sites by 2000. A further improvement was noted between 2000 and 2007 to 90.0% ($+1.5\% \pm 2.1\%$), although again it was not statistically significant. From 2007 to 2012 land-use sustainability *decreased* slightly (a change of $-0.8\% \pm 1.5\%$) to 89.2%, although again the quantum of change was statistically insignificant. From 2012 to 2017 a further slight decrease in land-use sustainability was recorded, from 89.2% to 88.8% (a change of $-0.4\% \pm 1.0\%$).

Between 2017 and 2022 land-use sustainability increased by $1.2\% \pm 1.8\%$ to 90.0% (Tables A3.23 and A3.24), a positive but statistically insignificant increase.

The overall sustainability change from 1994 to 2022 over the 17 sites was a nett improvement of $+2.8\% \pm 3.0\%$, which is positive but again statistically insignificant.

4.2 Coastal sand country

4.2.1 Site A: Egmont

See Table A4.1, Appendix 4. Bare sand decreased overall from 8.6 ha ($4.1\% \pm 0.5\%$) in 2017 to 7.6 ha ($3.7\% \pm 0.5\%$) in 2022 although the change was not statistically significant ($-0.4 \pm 0.5\%$). The following observations are noted below.

- Two small sand sheets in the north of the site have shown little net change with the northernmost one (1665800 E, 5646500 N) showing some signs of stabilisation in parts due to the spread of sand-binding dune vegetation. The other one at (1666200 E, 5645800 N), just north of the Pungaereere Stream, is covered with extensive vehicle tracks which suggests that dune vegetation may be slower to recover here due to ongoing disturbance by vehicles.
- Between Pungaereere Stream and Okahu Stream, particularly north of the unnamed stream at about (1666500 E, 5644950 N), a number of bare sand areas have expanded since 2017. They appear to be largely unfenced and are accessible to stock and vehicles.
- Vehicle tracks remain present through the dunes immediately behind the beach at the end of Lower Kahui Road (1666000 E, 5646170 N), and also at the end of Manihi Road, extending along the coast from around (1666600, 5643320) to the southern end of the site. The area with tracks at the end of Kahui Road remains more or less stable, while the tracks near the end of Manihi Road show some minor development of bare sand in places.
- The foredune has been further eroded by wave action since 2017 and remains scarped along most of the site. It has not suffered significant aeolian erosion so far but will continue to be vulnerable to future, natural blowout development, depending on climatic conditions, vegetation recovery and/or any disturbance by vehicles.
- Three developing blowout dunes in the foredune at the end of Manihi Road, at (1666580 E, 5643050 N), (1666600 E, 5642980 N) and (1666610 E, 5642840 N), noted in 2017, have all expanded in area. They are considered a natural process but are probably being exacerbated by vehicle tracks and foredune retreat.

In the long term the proportion of bare sand at this site has increased significantly overall, from $1.5\% \pm 0.5\%$ in 1994 to $3.7\% \pm 0.5\%$ in 2022.

4.2.2 Site B: Hāwera

See Table A4.2, Appendix 4. Bare sand decreased overall from 9.7 ha ($1.7\% \pm 0.5\%$) in 2017 to 7.9 ha ($1.4\% \pm 0.5\%$), as the previously reported recontouring and conversion of dune land to irrigated pasture continued. The change was not statistically significant ($-0.3\% \pm 0.5\%$). The main points of note are as follows.

- The largest patch of bare sand is a newly contoured area at (1719900 E, 5605400 N), which appears to be being used for the disposal of oil and gas drilling mud (known as 'land farming'). It is expected that, once a topsoil cover is reinstated, this will revert to pasture with a minimal risk of wind erosion.

- Adjacent to this area on its eastern side is a small network of dirt bike tracks which will be vulnerable to wind erosion under prolonged dry, windy conditions.
- The tracking, thought to be caused by dirt bikes, observed near the clifftops in 2017 has mostly revegetated and appears no longer to be used.
- The area of bare sand at approximately 1720400 E, 5603070 N, noted in 2017, has an established grass cover in 2022 and does not currently pose an erosion risk.
- Most of the shallow deflation hollows observed in 2017 have either revegetated with pasture grasses (e.g., at 1719820 E, 5604870 N) or filled with water presumably as a result of an elevated water table at the time of image capture (e.g. at 1719950 E, 5604790 N).
- Small areas of bare sand caused by wind erosion persist along the very exposed cliff edges and are interpreted as a natural, ongoing process.

From 1994 to 2022 the total area of bare sand at this site has reduced significantly from $3.5\% \pm 0.5\%$ to $1.4\% \pm 0.5\%$, mostly as a result of the ongoing recontouring and conversion of dune land to irrigated pastoral farmland.

4.2.3 Site C: Pātea

See Table A4.3, Appendix 4. Bare sand increased slightly overall from 43.9 ha ($3.6\% \pm 0.5\%$) in 2017 to 49.4 ha ($4.1\% \pm 0.5\%$) in 2022, a statistically insignificant change of $+0.5\% \pm 0.5\%$. The following changes were noted.

- The most obvious change at this site is the development of the Waipipi wind farm and the construction of 19 wind turbines inside the study area. Earthworks associated with these turbines have led to some new sand exposures on newly recontoured/levelled dune terrain but these are expected to be temporary. Examples can be seen at (1731900 E, 5594600 N), (1731400 E, 5593750 N), (1732200 E, 5593500 N) and (1732750 E, 5594150 N).
- The cultivated area visible at around (1731750 E, 5594260 N) in 2017 had a full pasture cover in 2022 with no significant bare sand recorded.
- The bare sand area behind the foredune between about (1730640 E, 5593970 N) and (1731870 E, 5592650 N), is little changed overall with some areas becoming stabilised by dune vegetation (e.g. at (1731350 E, 5593250 N)) and others more active (e.g., at the southern corner of the site). This area appears to be fenced off from stock so the changes seen here are probably natural, or exacerbated by rabbits.

There was no significant nett long-term change in the total area of bare sand at this site, which changed by $+0.5\% \pm 0.5\%$ from $3.6\% \pm 0.5\%$ in 1994 to $4.1\% \pm 0.5\%$ in 2022.

4.2.4 Site D: Wanganui

See Table A4.4, Appendix 4. Bare sand increased overall by around half, from 85.3 ha ($6.5\% \pm 1.0\%$) in 2017 to 125.1 ha ($9.7\% \pm 1.0\%$) in 2022, a significant change of $+3.2 \pm 1.5\%$. The main changes recorded are as follows.

- The area of intensive dairy farm development including new irrigation noted at the northwest end of the site in 2017 remain stable with no sign of wind erosion.

- The large sand sheet immediately north-west of the mouth of the Waitōtara River has expanded eastward with new lobes of bare sand encroaching on dune vegetation. A nearby smaller sand sheet adjacent to the Waitōtara River, at (1744400 E, 5588100 N) has also spread eastwards and has reached the river channel. These appear to be natural changes.
- South-east of the mouth of the Waitōtara River, some new small bare sand patches on pasture have appeared but there is no sign of any significant wind erosion. This area appears to be fenced off and ungrazed, and rabbits may be causing of vegetation loss in this area.
- A small active lobe in the dune field at (1744660 E, 5587220 N) has continued to migrate eastward.

From 1994 to 2022 the total area of bare sand decreased from $12.9 \pm 1.0\%$ to $9.7 \pm 1.0\%$, a change of $-3.2\% \pm 1.5\%$.

5 Summary

5.1 Eastern hill country

5.1.1 Vegetation

From 2017 to 2022, the main vegetation cover changes were as follows.

- A decrease in the total area under pasture from 10,001 ha (45.5% of the monitoring area) to 9,856 ha (44.8%).
- A nett change from pasture to scrub: 250 ha of pasture reverted to scrub, while 196 ha of scrub was sprayed or cleared for pasture.
- Maize cropping continued to rotate through pasture land at some of the sites, decreasing overall during the latest period to 29 ha. Fifty-five hectares of cropping land went to pasture, while 9 ha of pasture went to cropping.
- Of the 1,384 ha of plantation forestry land mapped in 2017, 157 ha was subsequently cleared and converted to pasture, while at the same time another 129 ha of pasture land elsewhere was converted to plantation forestry. Some of the plantation forestry that had been cleared also went to scrub (45 ha) or weeds (12 ha), while 40 ha of scrub and 1 ha of weeds were converted to plantation forestry. The nett result was a small decrease by 2022 in the total area of plantation forestry, to 1339 ha.
- Twenty-six hectares of weeds were cleared for pasture, while another 33 ha reverted to scrub.
- Pole plantings almost doubled in area, with the largest increases recorded on land formerly mapped as pasture (68 ha) followed by scrub (7 ha).

Over the entire 1994–2022 monitoring period, the main vegetation cover changes were as follows.

- Pasture decreased from 10,772 ha (49.1%) to 9,856 ha (44.8%), with 1,142 ha going to scrub and 660 ha to plantation forest. Pole plantings were established on 141 ha of pasture while another 109 ha of pasture reverted to weeds.
- Cropping increased from nil in 1994 to 29 ha in 2022, almost all of which took place on land that was formerly under pasture. This is interpreted as mainly maize cropping for fodder.
- Plantation forestry increased overall by 811 ha to 13329 ha (6.1%), coming mostly from pasture (660 ha) and scrub (394 ha). Over the same period, 142 ha of plantation forestry was harvested and converted to pasture, while another 84 ha of harvested plantation forestry reverted to scrub.
- Scrub decreased slightly overall by a nett 137 ha to 6,763 ha (30.8%) in 2022. This mainly comprised clearance for pasture (978 ha) and conversion to plantation forest (394 ha), offset mainly by 1,142 ha of reversion from pasture to scrub.
- The areas mapped as weeds in 1994 were mostly cleared for pasture by 2022 (28 ha of 37 ha), while 109 ha of pasture and 76 ha of scrub (generally cleared and subsequently abandoned) in 1994, became weeds by 2022.

5.1.2 Land use

The main changes between 2017 and 2022 were as follows.

- An *apparent* decrease in the area of dairy farming, from 903 ha (4.1% of the monitoring area) to 437 ha (2.0%). This relates to the note (see Section 4.1.3) concerning the ancillary information that was used to guide the distinction between 'dairying' and 'meat and wool farming'. This mainly affected Sites 3, 7 and 20. Outside these sites, only very minor changes were recorded in dairying overall.
- Concurrently with the note for dairying, the area of meat and wool farming recorded *apparent* increases at Sites 3, 7 and 20 due to revisions out of the dairying class. Apart from these sites, the area of meat and wool farming decreased by 250 ha.
- Revegetated meat and wool farmland (i.e. reversion to scrub) increased by 252 ha,
- The area of horticulture/cash cropping decreased from 75 ha (0.2%) to 26 ha (0.1%), interpreted as the ongoing rotation of seasonal maize plantings to support intensive dairy farming.
- A slight drop in the overall area of plantation forestry (down by 43 ha to 1,339 ha or 6.1%). The largest decreases were at Sites 7 (47 ha), 8 (54 ha) and 11 (69 ha), with the largest gains being made at Sites 14 (18 ha) and 21 (104 ha).
- Meat and wool farming with trees was mapped for 158 ha (0.7%) of the monitoring area in 2022, a substantial increase from 2017 (which recorded a total of 87 ha or 0.4%). Most of this increase was recorded at Sites 9 (11 ha), 12 (10 ha) and 18 (25 ha) with small increases (<10 ha) recorded on 16 other sites. One site (Site 22) recorded a small decrease of 0.8 ha in this class.

From 1994 to 2022, the main changes in land use were as follows.

- A slight decrease in the area of dairy farming, from 540 ha (2.5%) to 437 ha (2.0%). Increases at Sites 2, 3, 9 and 24 were offset by decreases at Sites 20 and 21.

- The area of meat and wool farming decreased significantly from 11,849 ha (53.9%) to 9,580 ha (43.6%). This land-use class increased at Sites 20 and 22 but decreased at all other sites. The largest decrease was at Site 23 (367 ha), and the largest increase was at Site 20 (172 ha).
- Revegetated meat and wool farming (reversion to scrub) increased by 1,521 ha, from 5293 ha (24.1%) to 6,814 ha (31.0%). Site 22 recorded an overall decrease of 136 ha, but all other sites showed increases. The largest increases were recorded at Sites 6 (152 ha), 17 (184 ha) and 23 (135 ha).
- Plantation forestry increased from 551 ha (2.5%) to 1,339 ha (6.1%), having declined slightly from a peak of 1,395 ha (6.4%) in 2012.

5.1.3 Physical sustainability of land use

For all 25 sites, since 1994

Between 2017 and 2022: Overall land-use sustainability increased, though the increase was not statistically significant ($+1.3\% \pm 1.3\%$ to an overall 88.3% sustainable). The reversion of meat and wool farming land to scrub has been the largest contributor to land-use sustainability improvements, with the total area of reversion increasing by 252 ha from 2017 to 2022. The overall area of plantation forestry has remained close to unchanged since 2012, as the harvesting of mature blocks has more or less offset new plantings in the same locations or elsewhere. Unsustainable dairying fell to 116 ha (27% of all dairying or 0.5% of the overall monitoring area), partly as a result of the dairying land-use class being revised in 2022, as noted in Section 4.1.3.

For the entire 1994–2022 monitoring period: Overall land-use sustainability increased by $4.3\% \pm 2.9\%$, from 83.9% in 1994 to 88.3% in 2022. In 1994, meat and wool farming made up 11,849 ha (53.9%) of the monitoring area, with 29.3% (3,472 ha) of that area being physically unsustainable. By 2000, meat and wool farming occupied 51.1% (11,223 ha) of the monitoring area, and 28.7% (3,223 ha) of that area was regarded as physically unsustainable. From 2000 to 2007, the meat and wool farming total area fell further to 45.1% (9,917 ha), and, of that, 26.8% (2,656 ha) was physically unsustainable. From 2007 to 2012, meat and wool farming continued to decrease in total area (to 9,521 ha) but the overall sustainability figure was unchanged at 26.8% unsustainable. From 2012 to 2017, the total area of meat and wool farming decreased again to 9,339 ha (42.5%), of which the proportion of unsustainable land use remained more or less the same at 26.9%. By 2022, while the area of meat and wool farming had increased slightly, the proportion of this class deemed unsustainable had fallen further to 24.8%.

The area of land that had reverted to scrub increased by 1,485 ha overall between 1994 and 2022. Within this overall change, 490 ha of scrub in 1994 was cleared for meat and wool farming by 2022, while 1,895 ha of meat and wool farming land in 1994 had reverted to scrub. The total area of unsustainable meat and wool farming recorded in 1994 decreased by 1,094 ha, or around one-third, by 2022.

Similarly to 2017, around a quarter of the area (24%) of physically sustainable meat and wool farming in 2022 occurs on the 'Pasture with trees' (PT) sustainable land-use class.

This comprises mostly Land Use Capability Class 6 land, which carries a moderate risk of accelerated erosion. Although meat and wool farming are deemed physically sustainable on this sustainable land-use class, continued targeted pole planting would further improve land management on these areas (Betts 2013, 2018).

Most of the unsustainable dairying in 2022 occurs on the sustainable land-use class 'Drystock grazing' (GR), although the actual area involved is small.

The meat and wool farming land that is considered physically unsustainable occurs on the sustainable land-use classes 'Forestry' (FO) and 'Protection' (PR), both of which have a severe to very severe risk of accelerated erosion. We reiterate the previous suggestions (Jessen et al. (2000; Betts & Lynn 2008; Betts 2013) that converting this land to plantation forestry or allowing it to revert to scrub represents 'low hanging fruit' for rapid land-use sustainability gains in the eastern hill country. Conversely, the spraying or clearance of scrub vegetation on erosion-prone land can quickly counteract hard-won sustainability gains made elsewhere.

Long-term sustainability trends for 17 sites (since early 1950s)

As previously discussed in Betts (2013), over the longer term (from the early 1950s to 1994) land-use sustainability decreased from 90.0% to 87.3% ($-2.7\% \pm 0.8\%$), based on long-term monitoring by O'Leary et al. (1996) of the 17 monitoring sites that had available historical data. Most of the decrease in sustainability happened before the early 1980s, and the last decade of the pre-1994 period showed little change in sustainability. By 2000, land-use sustainability on these 17 sites had marginally improved to 88.5% ($+1.2\% \pm 0.9\%$), and improved further, though not significantly, by 2007 ($+1.5\% \pm 2.1\%$, to 90.0%).

From 2007 to 2012 overall land-use sustainability for these 17 sites decreased slightly, but, again, the change was not significant ($-0.8\% \pm 1.5\%$, to 89.2%).

From 2012 to 2017, another slight but statistically insignificant sustainability decrease was recorded ($-0.4\% \pm 1.0\%$, to 88.8%).

Between 2017 and 2022, land-use sustainability increased slightly but insignificantly (by $1.2\% \pm 1.8\%$).

The overall sustainability gain for these 17 sites for 1994–2022 is positive but remains statistically inconclusive, at $2.8\% \pm 3.0\%$.

Overall, the greatest risk of accelerated erosion in the eastern hill country remains on the steeper slopes. While scrub regeneration and pole planting on the more vulnerable land have gradually improved land-use sustainability, and are likely to continue to do so, there remains the opportunity to further improve land-use sustainability by reducing the rate of spraying and/or clearance of established or regenerating scrub; and to increase the rate of afforestation, on the most vulnerable sustainable land-use classes.

5.2 Coastal sand country

Changes for each period from 1994 through to 2017 are summarised here from Betts (2018) for completeness.

From 1994 to 2000, the area of bare sand increased at Sites A ($+1.5\% \pm 0.5\%$) and B ($+1.2\% \pm 0.5\%$), remained unchanged at Site C ($+0.3\% \pm 0.5\%$), and decreased at Site D ($-1.9\% \pm 1.5\%$). Management issues (tracking and treading damage) were identified as possible causes for the increases at Sites A and B, while afforestation at Site D helped reduce the bare sand count there (Jessen et al. 2000).

From 2000 to 2007, a slight increase in bare sand was recorded at Site A ($+0.8\% \pm 0.5\%$), with no significant change recorded at any of the other sites. Most of the changes noted after 2000, albeit insignificant, appeared to be related to natural causes (blowouts of unstable dunes near the beach) rather than land management issues, although tracking may have contributed to the slight increase recorded at Site A (Betts 2008).

Between 2007 and 2012 the area of bare sand increased by $2.9\% \pm 1.0\%$ at Site A, did not change significantly at Site B, increased slightly by $1.0\% \pm 0.5\%$ at Site C and decreased by $2.7\% \pm 1.5\%$ at Site D. The increase at Site A is thought to be mainly natural, although sand sheet development coinciding with a track in the southern part of the site suggests possible track erosion; and grazing pressure and/or stock treading may be causing some destabilisation of pasture-covered dunes in the northern part of the site. A dune stabilisation programme was noted at Site D, which appears to have been successful in stabilising a former sand sheet covering approximately 17 ha (Betts 2013).

From 2012 to 2017, all four sites showed significant decreases in their proportions of bare sand. Changes were $-2.6\% \pm 1.0\%$ at Site A, $-2.4\% \pm 0.5\%$ at Site B, $-1.4\% \pm 0.5\%$ at Site C and $-2.0\% \pm 1.5\%$ at Site D. Worthy of note were some small areas of vehicle tracking (particularly at Sites A and B), and some areas of apparently natural deflation along the coastal margins at all four sites, but none of these appeared to suffer significant degradation. There was a clear distinction between vulnerable areas that had and had not been fenced-off from stock at Site A, where most fenced-off areas (mostly dune crests) tended to stabilise whereas many of those not fenced-off remained exposed. The intensification of farming at Sites B, C and D (including dune recontouring, re-sowing and the establishment of irrigation) significantly reduced the overall incidence of bare sand at these sites. Areas of freshly tilled land at these sites were viewed as temporary exposures.

Pine plantations at Sites C and D that were destroyed by a storm in March 2012 were regarded as potentially vulnerable to deflation, depending on how these areas were subsequently managed (Betts 2013). By 2017, these had either been converted back to pasture or replanted and they had remained stable.

From 2017 to 2022, Sites A, B and C recorded only insignificant changes ($-0.4\% \pm 1.0\%$ at Site A, $-0.3\% \pm 0.5\%$ at Site B, $+0.5\% \pm 0.5\%$ at Site C) with a significant change of $+3.2\% \pm 1.5\%$ at Site D. Natural changes (foredune retreat, naturally occurring blowouts of unstable dunes, dune sheet transgression) account for most of the changes noted, particularly at Site D, although land management could be improved in some areas by excluding stock and vehicles from vulnerable areas, particularly at Sites A and B. Large-

scale development at Sites B (land farming), C (works associated with the Waipipi wind farm) and D (development of irrigated dairying) don't presently appear to show any significant risk of aeolian erosion.

Overall, from 1994 to 2022, bare sand changes were $+2.2\% \pm 0.5\%$ at Site A, $-2.1\% \pm 0.5\%$ at Site B, $+0.5\% \pm 0.5\%$ at Site C and $-3.2\% \pm 1.5\%$ at Site D.

5.3 Recommendations

Based on the findings of this report, we suggest the following actions.

- Achieve the 'lowest hanging fruit' for future land-use sustainability gains in the eastern hill country by allowing unsustainable meat and wool farming land to revert to scrub, and/or afforestation.
- Similarly, minimising the spraying and/or clearance of scrub on steep hill country for meat and wool farming would lower reductions in land-use sustainability resulting from this practice.
- Ongoing targeted pole planting should continue and will improve land-use sustainability where poles are planted – bearing in mind that the poles can take some years to become effective. However, the areal gains in land-use sustainability from pole planting are relatively small compared to the gains offered by scrub reversion or afforestation.
- The coastal sand country sites are, on the whole, being sustainably managed: potential improvements could be made at Sites A and B by fencing off vulnerable dune crests from stock.
- This monitoring programme should continue at approximately 5-yearly intervals, and, in future, be undertaken with the use of farm-scale Land Use Capability (LUC) mapping data covering the hill country sites (as is currently being undertaken by TRC) which will improve the resolution of land-use sustainability analyses. At the same time, the monitoring methodology used in this and previous reports should be reviewed and alternative approaches sought to enable technological advances such as LiDAR slope information to improve data quality and spatial resolution in the future. This may require some resetting of mapping 'baselines'.

6 Acknowledgements

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7 References

- Betts HD 2018. Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2017 re-survey. Landcare Research contract report LC3357 for Taranaki Regional Council.
- Betts HD 2013. Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2012 re-survey. Landcare Research contract report LC1502 for Taranaki Regional Council.
- Betts HD, Lynn IH 2008. Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country – 2007 re-survey. Landcare Research contract report LC0708/116 for Taranaki Regional Council.
- Blaschke PM, Eyles GO, DeRose RC, Hicks DL 1992. Physically sustainable land-uses in the Taranaki Region. DSIR Land Resources contract report: 92/27.
- Blaschke PM, Trustrum NA, DeRose RC 1992. Ecosystem processes and sustainable land-use in New Zealand steeplands. *Agriculture, Ecosystems and Environment* 41: 153–178.
- DeRose RC, Trustrum NA, Blaschke PM 1993. Post-deforestation soil loss from steepland hillslopes in Taranaki, New Zealand. *Earth Surface Processes and Landforms* 18: 131–144.
- DeRose RC, Trustrum NA, Thomson NA, Roberts AHC 1995. Effect of landslide erosion on Taranaki hill pasture production and composition. *New Zealand Journal of Agricultural Research* 38: 457–471.
- Douglas GB, McIvor IR, Manderson AK, Koolaard JP, Todd M, Braaksma S, et al. 2013. Reducing shallow landslide occurrence in pastoral hill country using wide spaced trees. *Land Degradation and Development* 24: 103–114.
- Dymond JR, Bogue A, Loseen D 2001. Monitoring land at regional and national scales and the role of remote sensing. *International Journal of Applied Earth Observation and Geoinformation* 3: 162–175.
- Fletcher JR 1987. Land-use capability classification of the Taranaki Manawatu region: a bulletin to accompany the New Zealand Land Resource Inventory worksheets. *Water & Soil Miscellaneous Publication* 110.
- Hawley JG, Dymond JR 1988. How much do trees reduce landsliding? *Journal of Soil and Water Conservation* 43(6): 495–498.
- Hicks DL 1998. Soil erosion in Taranaki: a summary of research findings. An unpublished report for Taranaki Regional Council, September 1998. Orewa, Ecological Research Associates (NZ) Inc.
- Jessen MR, Betts HD, Sutherland A, Willoughby EJ 2000. Sustainable land-use monitoring in the eastern Taranaki hill country and coastal sand country. Landcare Research contract report LC9900/125 for Taranaki Regional Council.
- O’Leary SM, Stephens PR 1996. A guide to the use of a new technique for monitoring sustainable land-use in the North Island hill country. Landcare Research contract report LC9697/002 for Taranaki Regional Council.

- O'Leary SM, Stephens PR, Willoughby EJ, DeRose RC, Gibb RG, White MF, Sutherland A 1996. Land-use monitoring in the eastern Taranaki hill country. Landcare Research contract report LC9596/134 for Taranaki Regional Council.
- Phillips CJ, Basher L, Spiekermann RI 2020. Biophysical performance of erosion and sediment control techniques in New Zealand: a review. Landcare Research contract report LC3761 for the Ministry of Business, Innovation and Employment.
- Spiekermann RI, Smith HG, McColl S, Burkitt L, Fuller IC 2022. Quantifying effectiveness of trees for landslide erosion control. *Geomorphology* 396, 107993. <https://doi.org/10.1016/j.geomorph.2021.107993>.
- Stephens PR, Dymond JR 1999. Design of a monitoring system for bare sand changes and coastal erosion in Taranaki. Landcare Research contract report LC9899/056 for Taranaki Regional Council.
- Stephens PR, Harmsworth GR 1999. Regional Soil Plan for Taranaki: assessment of anticipated environmental results and methods of implementation. Landcare Research contract report LC 9899/91 for Taranaki Regional Council.
- Stephens PR, White MF, Willoughby EJ, Newsome PFJ 1995. Land-use monitoring in the Taranaki Region: a pilot project for the Taranaki Regional Council. Landcare Research contract report LC 9495/96 for Taranaki Regional Council.
- Trustrum NA, Blaschke PM 1992. Managing hill country erosion. *New Zealand Farmer, Farm Progress*, June 10: 45–47.

Appendix 1 – Aerial imagery and monitoring sites

Table A1.1. Details of imagery used in 1994, 2000, 2007, 2012, 2017 and the present study

Date of imagery	Source of imagery	Images supplied as	Digital image resolution (m/pixel)	Orthorectified?	Map projection
1994	Aerial Surveys Ltd, Nelson (contracted by Landcare Research)	Contact prints	3.00	No	New Zealand Map Grid
2000	Aerial Surveys Ltd, Nelson (contracted by Landcare Research)	Contact prints	1.00	No	New Zealand Map Grid
2007	Taranaki Regional Council	High-resolution digital images	0.75	Yes	New Zealand Transverse Mercator
2012	Taranaki Regional Council	High-resolution digital images	0.40	Yes	New Zealand Transverse Mercator
2017	Taranaki Regional Council	High-resolution digital images	0.30	Yes	New Zealand Transverse Mercator
2022 (present)	Taranaki Regional Council	High-resolution digital images	0.25	Yes	New Zealand Transverse Mercator

Table A1.2. Locations and dimensions of the 25 hill country monitoring sites

Site	NZTM coordinates (Easting, Northing)				Actual site area (hectares)	Nominal site area (hectares)	Difference (%)
	NW corner	NE corner	SE corner	SW corner			
1	1738379, 5709781	1741366, 5709791	1741307, 5706792	1738382, 5706781	886.62	900.00	-1.49
2	1738384, 5699768	1741363, 5699736	1741392, 5696783	1738366, 5696795	889.63	900.00	-1.15
3	1728397, 5689757	1731304, 5689801	1731343, 5686805	1728399, 5686795	871.56	900.00	-3.16
4	1718383, 5679760	1721319, 5679701	1721305, 5676747	1718418, 5676743	869.20	900.00	-3.42
5	1728388, 5679711	1731409, 5679809	1731381, 5676745	1728356, 5676739	912.19	900.00	1.35
6	1738474, 5679786	1741388, 5679787	1741481, 5676841	1738495, 5676833	870.13	900.00	-3.32
7	1718422, 5669799	1721419, 5669718	1721413, 5666766	1718434, 5666771	893.40	900.00	-0.73
8	1728449, 5669702	1731457, 5669741	1731442, 5666791	1728467, 5666786	877.41	900.00	-2.51
9	1718455, 5659733	1721445, 5659779	1721368, 5656793	1718402, 5656809	879.90	900.00	-2.23
10	1728394, 5659711	1731457, 5659718	1731403, 5656748	1728410, 5656717	902.91	900.00	0.32
11	1738431, 5659787	1741381, 5659767	1741296, 5656927	1738411, 5656778	852.88	900.00	-5.24
12	1728405, 5649777	1731407, 5649763	1731419, 5646802	1728486, 5646834	875.90	900.00	-2.68
13	1738516, 5649799	1741268, 5649719	1741298, 5646886	1738374, 5646785	829.63	900.00	-7.82
14	1728404, 5639689	1731310, 5639686	1731433, 5636766	1728435, 5636813	855.30	900.00	-4.97
15	1738538, 5639363	1741402, 5639628	1741394, 5637114	1738472, 5636844	727.03	900.00	-19.22
16	1718402, 5629720	1721433, 5629733	1721425, 5626737	1718432, 5626740	899.99	900.00	0.00
17	1728443, 5629723	1731373, 5629651	1731387, 5626830	1728451, 5626790	843.81	900.00	-6.24
18	1748456, 5619717	1751536, 5619823	1751508, 5616879	1748433, 5616779	904.83	900.00	0.54
19	1758460, 5619811	1761444, 5619757	1761380, 5616675	1758427, 5616799	904.93	900.00	0.55
20	1728446, 5609779	1731449, 5609780	1731492, 5606739	1728437, 5606752	918.99	900.00	2.11

Site	NZTM coordinates (Easting, Northing)				Actual site area (hectares)	Nominal site area (hectares)	Difference (%)
	NW corner	NE corner	SE corner	SW corner			
21	1738162, 5609877	1741578, 5609810	1741650, 5606765	1738340, 5606794	1,029.82	900.00	14.42
22	1748428, 5609715	1751337, 5609785	1751407, 5606838	1748490, 5606815	851.92	900.00	-5.34
23	1758456, 5609737	1761441, 5609774	1761425, 5606867	1758462, 5606833	864.08	900.00	-3.99
24	1748427, 5599830	1751412, 5599853	1751489, 5596755	1748540, 5596585	941.90	900.00	4.66
25	1758430, 5599837	1761339, 5599798	1761277, 5596958	1758443, 5596919	826.70	900.00	-8.14
Total					21,980.67	22,500.00	-2.31

NZTM = New Zealand Transverse Mercator projection.

Table A1.3. Locations and dimensions of the four coastal sand country monitoring sites

Site	NZTM coordinates of site		Original sand area within site (hectares)	Sand area reported on for 2022 (hectares)	Difference (%)
	Easting	Northing			
A (Egmont)	1665481	5646976	209.9	207.5	-1.2
	1666467	5642055			
	1667845	5642330			
	1666840	5647242			
B (Hāwera)	1718094	5605782	580.7	579.7	-0.2
	1719654	5606903			
	1722962	5602365			
	1721346	5601194			
C (Pātea)	1731018	5595764	1,228.3	1,210.4	-1.2
	1733653	5595940			
	1735458	5594576			
	1732440	5591920			
	1730379	5593549			
	1730259	5594704			
D (Wanganui)	1743100	5591028	1,320.3	1,292.6	-2.1
	1741661	5588776			
	1746335	5585725			
	1747791	5588006			

Appendix 2 – Vegetation and land-use analysis methodology used in previous hill country monitoring (to 2012)

A2.1 Review of methodology used in 1994 and 2000

The method used for the hill country monitoring in this study was piloted by Stephens et al. (1995), comprehensively documented in O’Leary et al. (1996), and explained further in O’Leary and Stephens (1996). The physically sustainable land-use classes against which the 1994 and 2000 land-uses were compared in Jessen et al. (2000) were originally established for Taranaki in a study by Blaschke, Eyles et al. (1992).

After consultation with TRC, Jessen et al. (2000) modified this method for the 2000 monitoring episode, such that the interpretation of the ‘Pasture with trees’ (PT) sustainable land-use class was different to that used in O’Leary et al. (1996). The 2000 study considered meat and wool farming on this sustainable land-use class to be physically sustainable (although improved land management, such as more planting of trees, would normally be needed), whereas the O’Leary et al. (1996) study considered this land-use/sustainable land-use class association to be physically unsustainable.

The revised interpretation by Jessen et al. (2000) was arrived at after considering advice in Hicks (1998), closer consideration of modern research findings (Blaschke, Trustrum et al. 1992; Trustrum & Blaschke 1992; DeRose et al. 1993, 1995), and by considering TRC’s own view (post-1996) of the PT sustainable land-use class.

Consequently, the O’Leary et al. (1996) sustainability-change data were recalculated for the 2000 study, and the revised interpretation of the PT sustainable land-use class was used from then on.

The earlier monitoring carried out in 1994 and 2000 used aerial photography, which was processed by Landcare Research as follows.

- Photographs were scanned on a desktop scanner at a resolution of 400 dots per inch (dpi) for the 1994 photographs, and at 1,200 dpi for the 2000 photographs.
- The scanned images were rectified to NZMG using a second-order polynomial transformation. Orthorectification was not carried out in 1994 or 2000 because of the considerably higher cost and time required using the resources available at the time (relating particularly to limitations on computing power and software capability).
- The imagery was then resampled to a ground pixel size of 3 m (for the 1994 photography) and 1 m (for the 2000 photography).
- The resampled images were produced as hard copy base maps at a scale of 1:5,750, and vegetation and land-use classes (see Tables A2.1 and A2.2 below) were delineated manually on transparent overlays.
- The vegetation and land-use classes were digitised from the transparent overlays using ARC/INFO GIS software to create ARC/INFO coverages of vegetation and land-use for each site for 1994 and 2000. These digital coverages were then overlaid, changes between 1994 and 2000 were calculated, and the results were tabulated.

- To assess land-use sustainability, the land-use classes were compared against physically sustainable land-use classes (Table A2.3, held as a spatial coverage for Taranaki and established by Blaschke, Eyles et al. (1992), and as reinterpreted at 1:27,500 scale by O’Leary et al. (1996)). Movements either towards or away from sustainability were measured/analysed and tabulated.

Table A2.1. Vegetation classes mapped and links to corresponding land-use classes (see Table A2.2)

Mapped vegetation class	Corresponding land-use class (see Table A2.2)	Explanatory notes
Pasture	Dairy farming <i>or</i> Meat and wool farming	Dairy farmland was distinguished from meat and wool farmland by visual inspection of aerial imagery in conjunction with Fonterra, and dairy farm boundary and consent information provided by TRC. Steepland areas within properties identified as dairy farms are mapped as meat and wool farmland.
Crops	Intensive horticulture/cash cropping	Includes maize cropping as this may be harvested and exported offsite.
Plantation forest	Plantation forestry	
Indigenous forest	Indigenous forest	
Indigenous scrub spp. >3 m (older scrub in earlier studies)	Meat and wool farming <i>or</i> Dairy farming	If the land was adjacent to or surrounded by revegetated meat and wool farmland, indigenous forest or plantation forestry, and did not appear to be accessible to stock, the corresponding land-use was ‘revegetated meat and wool farmland’.
Indigenous scrub spp. <3 m (inferred as young scrub)	<i>or</i> Revegetated meat and wool farming (once farmed but now abandoned and reverting to scrub)	If the land was adjacent to or surrounded by meat and wool farmland (or dairy farmland), was small in area and appeared to be accessible to stock, the corresponding land-use was also ‘meat and wool farmland’ or ‘dairy farming’ as appropriate.
Weeds (rush, fern, gorse, etc.)		If the vegetation was sprayed, the land-use was interpreted as ‘meat and wool farmland’ or ‘dairy farming’ as appropriate.
Pole plantings (2017 onwards)	Meat and wool farming with trees	This was identified from aerial imagery using pole planting location information supplied by TRC as a guide, and included plantings visible but not previously identified and not included in TRC guidance. However, if plantings were not visible where TRC guidance suggested they were present, they were not mapped.
River/other water body	Water	Changes in this class included streambank or shoreline changes, or new/decommissioned stock ponds.

Table A2.2. Land-use classes mapped and links to sustainable land-use classes (see Table A2.3.)

Mapped land-use class	Equivalent sustainable land-use class (see Table A2.3)	LUC units on which land-use class is sustainable
Horticulture/cash cropping (lumped together, as both are rare in the hill country)	Intensive horticulture (IH), cash cropping (CC)	1c1, 2c2, 2c3, 2e1, 2w1, 2w2, 3e2
Dairy farming	Dairying (DY)	3c4, 3e6, 3w1, 3w2, 3w5, 4e2, 4e3, 4e7, 4w1
Meat and wool farming (alternative names in earlier studies include drystock grazing and sheep and beef farming)	Drystock grazing (GR)	4e8, 4w2, 5c1, 6e1, 6e6
Revegetated meat and wool farming (once farmed but now abandoned and reverting to scrub)	Forestry (FO)	7e3, 7e9, 7e11, 7e14, 7e15, 7e17, 7e18, 7e20
Plantation forestry	Forestry (FO)	7e3, 7e9, 7e11, 7e14, 7e15, 7e17, 7e18, 7e20
Meat and wool farming with trees	Pasture with trees (PT)	6e3, 6e10, 6e11, 6e12, 6e14, 6e17, 6e20, 6e21, 6e23, 7e1
Indigenous forest (protection)	Protection (PR)	8e3
Water	Not linked	Not linked

Table A2.3. Physically sustainable land-use classes for Taranaki

Sustainable land-use class	Most intensive sustainable land-use	Range of sustainable land-uses						
IH	Intensive horticulture	Intensive horticulture	Cash cropping	Dairying	Drystock grazing	Pasture with trees	Forestry	Protection
CC	Cash cropping		Cash cropping	Dairying	Drystock grazing	Pasture with trees	Forestry	Protection
DY	Dairying			Dairying	Drystock grazing	Pasture with trees	Forestry	Protection
GR	Drystock grazing (Meat and wool farming)				Drystock grazing	Pasture with trees	Forestry	Protection
PT	Pasture with trees (Meat and wool farming)					Pasture with trees	Forestry	Protection
FO	Forestry						Forestry	Protection
PR	Protection							Protection

Note on the use of this table: Taranaki has been categorised and mapped into these sustainable land-use classes by Blaschke, Eyles et al. (1992). The land-use classes mapped in the present study (see Table A2.2) have been compared with these sustainable land-use classes to determine if the mapped land-uses are physically sustainable. Using GIS, land-use data layers for each monitoring episode have been overlain onto sustainable land-use classes, and the areas where the mapped land-use corresponds (or not) to physical sustainability for that land-use have been recorded. An example of unsustainability is where the land-use 'meat and wool farming' is mapped on sustainable land-use class 'Forestry' (FO), because, from this table, the only physically sustainable land-uses for this class are 'Forestry' and 'Protection'.

Source: Blaschke, Eyles et al. (1992).

A2.2 Methodology used in 2007

The same conceptual framework defining land cover, land-use, and land-use sustainability was used in 2007 as was used in 1994 and 2000. However, the 1994 and 2000 studies were based on interpretations of aerial photographs, while the 2007 imagery was supplied in digital form by TRC, requiring additional steps to be undertaken to arrive at valid and robust comparisons with the earlier imagery on account of the factors listed below.

- The 2007 imagery was orthorectified to remove relief displacement (related to topography) and other distortion effects.
- The 2007 imagery was of higher resolution (0.75 m/pixel) than imagery used in 1994 and 2000, enabling a higher-resolution interpretation of vegetation and land-use classes than was previously possible.
- The 2007 imagery was projected onto the New Zealand Transverse Mercator projection (NZTM), which superseded the older New Zealand Map Grid (NZMG) onto which the 1994 and 2000 imagery had been projected.

Given that the use of orthorectified imagery has become the standard in recent years, as has the use of NZTM, the mapping layers from 1994 and 2000 were converted from NZMG into NZTM.

Because the 1994 and 2000 imagery was not orthorectified, it contained slight distortions relating to topography and camera/lens geometry that were not removed when the images were rectified to NZMG. As a result, the hill country monitoring site boundaries, while representing regular 900 ha squares on the 1994 and 2000 imagery, did not in fact represent regular 900 ha squares on the ground.

The vegetation and land-use data layers generated from the 1994 and 2000 imagery therefore contained the same distortions as the imagery from which they were derived, and also did not represent 900 ha squares on the ground. When this issue became apparent, MWLR and the Taranaki Regional Council (TRC) agreed that the actual area on the ground should be reported on rather than the nominal 900 ha area for each site. Although this approach means each site boundary was distorted slightly, it ensured that each subsequent monitoring episode would continue to compare like with like, because the same area on the ground would be reported on each time. The alternative approach, which would have been to re-establish the 900 ha square boundary for each site, would have meant that areas lying outside the site boundaries in 1994 and 2000 might have been included in subsequent studies and would have skewed the results.

Consequently, the hill country site boundaries were re-established on the 2007 imagery by visually transferring the four corner points for each site from the 2000 imagery onto the 2007 imagery and extracting the new NZTM coordinates of these corner points. The area of each site changed slightly as a result: changes ranged from -19.2% to +14.4%, with an average change of -2.3%. The total area surveyed in the 25 sites was recalculated at 21,981 ha, compared with the original 22,500 ha. (Refer to Table A1.2 in Appendix 1 for full details.)

To provide valid and robust comparisons of vegetation and land-use from 1994 and 2000 to 2007, the ARC/INFO vegetation and land-use coverages for 1994 and 2000 were transformed to fit the re-established study area boundaries on the 2007 imagery. The 1994 and 2000 vegetation, land-use and land-use sustainability data were then recalculated and reviewed in the 2007 report (Betts & Lynn 2008).

A2.3 Methodology used in 2012

The 2012 study used the modified methodology above, summarised as follows.

Digital aerial imagery for 2012, supplied by TRC, was added as new layers to the GIS files used in 2007.

Vegetation and land-use classes, as described in Tables A2.1 and A2.2, were mapped on-screen, using existing mapping from 2007 as a guide to consistent interpretation. Vegetation and land-use mapping for 2012 was saved as shapefiles in ArcGIS.

To assist with distinguishing between land-used for dairying and use for meat and wool farming, additional shapefiles containing information on dairying consents and milk suppliers to Fonterra were obtained from TRC, along with property boundary information downloaded from Land Information New Zealand (LINZ). These data layers were overlaid onto the aerial imagery to identify and isolate dairy farm boundaries. Some farms comprise mixed land-uses within a single property (for example, mixed dairying and drystock grazing): within these boundaries, land that was clearly being used for dairying was delineated visually, with steeper land being classified as meat and wool farmland unless there was clear evidence that this land was also being used for dairying.

Then, as was done in 2007, the land cover and land-use layers for 2012 were overlaid on the 2007 and 1994 mapping, changes between these and the 2012 mapping were calculated, and the results were tabulated. Land-use sustainability was assessed as above.

Appendix 3 – Hill country vegetation, land use, and land-use sustainability data for all monitoring periods, 1994–2022

Note on data presentation: *Data tabulated in this section are rounded to two decimal places. Where a cell in a table contains the sum of other cells, the raw data are first summed and then rounded to avoid the cumulative effect of rounding data in individual cells before calculating sums.*

Data for vegetation cover, land use, land-use sustainability, and changes in these over the entire 1994–2022 monitoring period are tabulated below in Tables A3.1 to A3.27. The results are discussed in Section 4 of the main report.

Operations and Regulatory Committee - SEM Hill/Coastal Sand Country Sustainable Landuse Report by Landcare Rearch Ltd.

Table A3.1. Vegetation cover classes in 1994, 2000, 2007, 2012, 2017 and 2022 for all hill country monitoring sites (hectares)

Site	Pasture						Crops						Plantation Forest						Indigenous Forest						Scrub >3 m					
	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022
1	169.17	157.32	145.37	159.84	151.14	162.91	0.00	0.00	0.00	0.00	8.57	0.00	0.38	0.38	0.00	0.00	0.00	0.00	407.74	407.74	386.26	388.60	388.38	392.42	0.00	0.00	3.01	5.94	5.73	5.90
2	299.51	294.65	285.46	293.00	289.68	278.68	0.00	0.00	0.00	0.31	0.31	0.31	3.02	6.13	10.61	9.93	11.50	12.75	506.94	507.25	496.70	499.07	497.14	494.85	34.71	30.53	15.14	26.88	30.46	29.48
3	313.96	249.86	241.57	284.76	264.29	256.83	0.00	0.00	3.78	7.95	7.95	7.95	6.10	6.53	13.51	10.45	10.06	11.95	300.21	299.92	370.33	361.68	359.38	358.20	142.20	119.60	64.51	68.90	113.51	113.63
4	617.58	613.85	615.73	600.87	609.51	598.27	0.00	0.00	0.00	0.00	0.00	0.06	13.35	24.58	29.27	24.62	8.80	8.98	97.95	92.14	86.27	89.79	89.79	89.45	76.64	69.55	74.57	73.48	75.81	76.45
5	341.73	347.00	360.88	378.90	394.33	375.83	0.00	0.00	0.00	0.00	0.00	0.12	8.04	11.18	8.36	8.53	8.47	6.56	0.00	0.00	0.00	0.00	0.00	0.00	407.31	396.83	454.59	449.47	428.05	419.50
6	397.99	406.67	409.62	425.32	410.32	356.97	0.00	0.00	0.00	0.00	0.00	0.00	12.59	12.59	12.07	8.08	2.26	2.43	321.43	321.43	315.99	314.01	313.29	311.60	40.25	40.25	26.48	28.53	61.28	60.96
7	646.73	612.15	610.10	606.52	606.05	649.63	0.00	0.00	0.00	0.00	0.00	0.00	10.96	46.64	56.74	58.35	56.62	9.94	164.07	154.71	126.73	122.64	123.29	118.81	29.66	33.15	37.78	45.31	45.54	47.97
8	218.53	137.43	115.34	130.11	126.90	166.56	0.00	0.00	0.00	0.00	0.00	0.00	1.67	78.68	66.45	80.91	86.91	33.06	499.55	497.56	494.51	491.26	491.26	491.17	60.18	35.02	75.38	68.50	64.73	61.90
9	635.04	588.61	584.29	581.47	640.54	647.00	0.00	0.00	0.00	0.00	0.00	0.00	51.82	108.51	118.67	120.37	73.69	70.07	51.82	22.92	22.92	21.82	21.82	21.82	50.73	49.14	51.52	54.04	53.23	53.33
10	289.03	267.50	221.72	167.02	184.67	175.81	0.00	0.00	0.00	0.00	0.00	0.00	8.14	20.99	34.40	122.30	134.47	135.16	275.68	275.60	279.32	233.43	232.71	232.52	52.56	50.85	46.23	104.51	163.14	161.50
11	262.72	262.23	217.18	216.78	223.03	257.49	0.00	0.00	0.00	0.00	0.00	0.00	282.31	312.28	308.64	294.76	334.75	265.86	15.64	15.64	14.09	14.09	14.09	14.09	126.20	125.84	106.00	106.00	100.65	101.83
12	847.56	850.78	824.39	834.98	837.27	827.58	0.00	0.00	8.60	8.99	0.00	0.00	3.91	3.91	1.83	1.83	2.41	1.00	2.18	2.18	0.00	0.00	0.00	0.00	1.79	1.79	4.60	4.33	6.10	3.97
13	694.42	664.93	669.73	683.49	656.14	663.60	0.00	0.00	0.00	0.00	0.15	0.00	3.46	32.37	24.34	23.55	21.79	21.94	5.32	5.32	1.02	0.00	0.00	0.00	56.08	56.08	42.80	42.96	42.56	42.52
14	689.42	697.31	716.03	722.01	672.30	655.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	21.67	39.82	0.00	0.00	0.00	0.00	0.00	0.00	5.12	5.12	6.44	5.61	5.61	5.13
15	55.05	58.63	58.86	57.84	54.88	53.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.95	135.17	126.45	126.45	126.45	126.45	178.91	175.56	324.90	325.29	322.16	322.21
16	862.06	862.06	869.69	854.57	850.32	845.21	0.00	0.00	0.00	2.00	0.00	0.00	1.61	1.61	1.42	2.21	4.97	4.94	0.52	0.52	0.33	0.00	0.00	0.00	4.64	4.64	16.03	18.61	17.02	17.34
17	137.77	149.17	130.37	123.74	107.81	94.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	58.21	58.21	48.02	48.02	48.02	48.02	61.59	61.42	81.48	82.99	83.19	82.89
18	241.66	241.66	232.75	230.54	224.98	232.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	322.64	322.64	299.71	298.43	298.43	298.43	233.83	233.83	261.33	258.75	259.16	261.30
19	754.18	716.85	682.11	702.61	698.00	662.90	0.00	0.00	0.00	0.00	0.00	0.00	0.77	38.99	44.54	43.55	43.73	44.51	0.00	0.00	0.00	0.00	0.00	0.00	34.04	34.71	15.67	41.47	34.34	33.72
20	609.12	591.04	539.11	520.71	497.26	515.22	0.00	0.00	13.17	12.64	35.99	10.82	12.63	33.37	74.01	91.35	101.06	110.66	0.00	0.00	0.00	0.00	0.00	0.00	28.60	19.60	23.15	21.13	22.84	22.94
21	266.55	282.21	262.92	241.71	276.33	161.13	0.00	0.00	0.00	3.37	0.00	0.00	48.42	55.36	101.34	127.18	100.80	204.39	0.00	0.00	0.00	0.00	0.00	0.00	423.00	420.49	417.17	425.56	420.51	420.00
22	336.42	338.64	373.00	357.28	404.97	384.38	0.00	0.00	0.00	0.00	0.00	0.00	16.33	19.25	39.80	39.77	44.78	43.07	0.00	0.00	0.00	0.00	0.00	0.00	131.41	131.10	139.86	136.33	135.36	135.57
23	458.75	505.27	500.95	261.01	241.62	236.38	0.00	0.00	0.00	0.00	0.00	0.00	9.07	21.37	26.59	262.64	261.23	248.57	154.78	154.35	140.36	140.59	141.23	139.77	5.86	7.28	18.95	20.22	17.72	19.23
24	499.67	455.97	442.08	471.07	471.36	461.76	0.00	0.00	0.00	10.15	22.31	9.98	31.68	50.83	57.98	48.59	37.39	40.68	0.00	0.57	0.00	0.00	0.00	0.00	65.65	65.86	32.97	36.65	38.51	39.77
25	127.27	101.43	70.23	84.57	106.80	135.82	0.00	0.00	0.00	0.00	0.00	0.00	2.07	2.38	4.22	4.22	16.42	22.45	87.97	87.29	86.59	86.41	86.60	86.60	40.83	36.60	49.40	45.91	45.12	45.00
Total	10,771.88	10,453.25	10,179.50	9,990.73	10,000.52	9,855.74	0.00	0.00	25.55	45.41	75.28	29.24	528.33	887.92	1,034.78	1,383.47	1,383.79	1,339.43	3,379.68	3,361.14	3,294.50	3,236.31	3,231.89	3,224.20	2,291.78	2,204.83	2,389.98	2,497.39	2,592.32	2,584.04
%	49.01	47.56	46.31	45.45	45.50	44.84	0.00	0.00	0.12	0.21	0.34	0.13	2.40	4.04	4.71	6.29	6.30	6.09	15.38	15.29	14.99	14.72	14.70	14.67	10.43	10.03	10.87	11.36	11.79	11.76

Table A3.1 (continued). Vegetation cover classes in 1994, 2000, 2007, 2012, 2017 and 2022 for all hill country monitoring sites (hectares)

Site	Scrub < 3 m						Weeds						Pole plantings (2017 onwards)						Water						Total					
	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022
1	76.52	88.37	118.49	97.84	98.19	91.40	0.00	0.00	0.00	0.92	1.15	0.34	n/a	n/a	n/a	n/a	0.00	0.00	232.81	232.81	233.50	233.47	233.47	233.66	886.62	886.62	886.62	886.62	886.62	886.62
2	32.61	38.23	67.18	45.78	44.80	52.69	0.00	0.00	0.00	0.00	0.00	2.20	n/a	n/a	n/a	n/a	0.00	2.73	12.84	12.84	14.53	14.66	15.73	15.94	889.63	889.63	889.63	889.63	889.63	889.63
3	106.17	187.48	95.22	94.24	90.06	103.66	2.23	7.47	81.99	42.60	25.34	17.84	n/a	n/a	n/a	n/a	0.00	0.00	0.71	0.71	0.66	0.97	0.97	1.50	871.56	871.56	871.56	871.56	871.56	871.56
4	63.68	65.81	59.52	58.82	63.45	69.23	0.00	3.27	3.84	21.28	21.50	23.73	n/a	n/a	n/a	n/a	0.00	2.45	0.00	0.00	0.00	0.33	0.33	0.59	869.20	869.20	869.20	869.20	869.20	869.20
5	142.78	144.86	88.35	68.29	79.69	102.73	12.33	12.33	0.00	6.91	1.52	6.27	n/a	n/a	n/a	n/a	0.00	1.06	0.00	0.00	0.00	0.08	0.12	0.12	912.19	912.19	912.19	912.19	912.19	912.19
6	97.87	89.18	105.96	88.97	78.66	125.21	0.00	0.00	0.00	5.22	0.09	5.69	n/a	n/a	n/a	n/a	4.22	7.26	0.00	0.00	0.00	0.00	0.00	0.00	870.13	870.13	870.13	870.13	870.13	870.13
7	41.98	35.27	57.86	58.53	60.64	61.90	0.00	11.48	4.18	1.80	0.89	3.60	n/a	n/a	n/a	n/a	0.00	1.00	0.00	0.00	0.00	0.25	0.37	0.55	893.40	893.40	893.40	893.40	893.40	893.40
8	90.78	122.78	112.52	104.95	106.08	119.18	6.37	5.60	12.56	1.00	0.72	4.73	n/a	n/a	n/a	n/a	0.00	0.00	0.34	0.34	0.65	0.70	0.82	0.82	877.41	877.41	877.41	877.41	877.41	877.41
9	118.02	101.45	102.18	95.95	80.27	60.27	0.00	7.91	0.00	4.59	0.41	7.37	n/a	n/a	n/a	n/a	8.08	18.05	1.37	1.37	1.42	1.67	1.87	1.99	879.90	879.90	879.90	879.90	879.90	879.90
10	272.95	281.32	312.96	255.85	181.90	172.13	0.00	2.08	3.22	14.76	0.97	19.44	n/a	n/a	n/a	n/a	0.00	1.29	4.57	4.57	5.06	5.06	5.06	5.06	902.91	902.91	902.91	902.91	902.91	902.91
11	164.07	134.95	206.55	220.25	179.89	213.02	1.79	1.79	0.00	0.53	0.00	0.12	n/a	n/a	n/a	n/a	0.00	0.00	0.15	0.15	0.42	0.48	0.48	0.48	852.88	852.88	852.88	852.88	852.88	852.88
12	10.76	7.55	30.21	18.73	21.16	23.64	0.00	0.00	0.00	0.62	0.00	0.10	n/a	n/a	n/a	n/a	1.94	12.34	9.69	9.69	6.27	6.44	7.02	7.28	875.90	875.90	875.90	875.90	875.90	875.90
13	60.84	61.41	83.09	64.44	81.53	65.88	0.00	0.00	0.00	5.66	2.53	6.52	n/a	n/a	n/a	n/a	15.14	19.39	9.52	9.52	8.65	9.53	9.79	9.79	829.63	829.63	829.63	829.63	829.63	829.63
14	160.76	146.34	132.82	121.54	141.45	141.12	0.00	6.53	0.00	5.84	8.80	4.29	n/a	n/a	n/a	n/a	5.47	9.85	0.00	0.00	0.00	0.00	0.00	0.00	855.30	855.30	855.30	855.30	855.30	855.30
15	357.13	357.67	216.81	217.37	223.46	224.37	0.00	0.00	0.00	0.00	0.00	0.00	n/a	n/a	n/a	n/a	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	727.03	727.03	727.03	727.03	727.03	727.03
16	31.17	31.17	12.15	22.07	22.32	26.08	0.00	0.00	0.37	0.44	0.00	0.16	n/a	n/a	n/a	n/a	5.16	6.01	0.00	0.00	0.00	0.09	0.20	0.25	899.99	899.99	899.99	899.99	899.99	899.99
17	491.70	481.43	485.96	486.53	503.44	514.49	0.00	0.56	0.00	2.35	1.19	2.87	n/a	n/a	n/a	n/a	0.00	0.00	94.54	93.03	97.97	100.17	100.17	100.17	843.81	843.81	843.81	843.81	843.81	843.81
18	105.52	105.52	110.17	114.56	120.14	109.79	0.00	0.00	0.00	1.68	1.25	0.95	n/a	n/a	n/a	n/a	0.00	1.44	1.18	1.18	0.87	0.87	0.87	0.87	904.83	904.83	904.83	904.83	904.83	904.83
19	114.20	112.64	160.39	113.37	94.92	102.39	0.00	0.00	0.00	1.93	3.04	5.97	n/a	n/a	n/a	n/a	28.89	53.44	1.74	1.74	2.22	2.01	2.01	2.00	904.93	904.93	904.93	904.93	904.93	904.93
20	265.28	264.61	258.16	248.88	248.96	244.04	0.00	6.99	7.87	19.13	7.70	9.77	n/a	n/a	n/a	n/a	0.00	0.06	3.37	3.37	3.53	5.15	5.17	5.49	918.99	918.99	918.99	918.99	918.99	918.99
21	291.86	255.20	242.02	219.26	222.46	217.61	0.00	16.56	6.38	12.59	9.33	26.01	n/a	n/a	n/a	n/a	0.39	0.69	0.00	0.00	0.00	0.15	0.00	0.00	1029.82	1029.82	1029.82	1029.82	1029.82	1029.82
22	353.42	352.90	295.77	293.51	254.72	264.13	14.33	10.03	3.49	25.03	4.88	18.13	n/a	n/a	n/a	n/a	7.22	6.64	0.00	0.00	0.00	0.00	0.00	0.00	851.92	851.92	851.92	851.92	851.92	851.92
23	221.98	155.27	164.49	145.13	176.41	183.48	0.00	6.90	0.00	20.75	5.47	15.50	n/a	n/a	n/a	n/a	6.66	7.40	13.64	13.64	12.74	13.74	13.74	13.74	864.08	864.08	864.08	864.08	864.08	864.08
24	344.90	259.16	325.14	295.32	367.17	368.33	0.00	109.51	83.58	79.95	4.75	20.41	n/a	n/a	n/a	n/a	0.00	0.66	0.00	0.00	0.14	0.18	0.41	0.31	941.90	941.90	941.90	941.90	941.90	941.90
25	568.57	568.96	568.66	542.21	555.64	521.91	0.00	25.77	47.60	63.38	12.67	8.65	n/a	n/a	n/a	n/a	3.43	6.25	0.00	4.27	0.00	0.00	0.01	0.01	826.70	826.70	826.70	826.70	826.70	826.70
Total	4,585.53	4,449.54	4,412.65	4,092.38	4,097.40	4,178.67	37.04	234.79	255.09	338.92	114.19	210.65	n/a	n/a	n/a	n/a	86.60	158.03	386.44	389.20	388.64	396.08	398.68	400.67	21,980.67	21,980.67	21,980.67	21,980.67	21,980.67	21,980.67
%	20.86	20.24	20.08	18.62	18.64	19.01	0.17	1.07	1.16	1.54	0.52	0.96	n/a	n/a	n/a	n/a	0.39	0.72	1.76	1.77	1.77	1.80	1.81	1.82	100.00	100.00	100.00	100.00	100.00	100.00

Table A3.2. Vegetation change summary, 1994–2000 (hectares)

Vegetation cover changes 1994–2000		Pasture	Cropping	Plantation forest	Indigenous forest	Tall scrub (>3 m)	Short scrub (<3 m)	Weeds	Water	Total ha	Total %
		1994	1994	1994	1994	1994	1994	1994	1994	(2000)	(2000)
Pasture	2000	10,123.59	0.00	3.34	1.91	14.65	303.11	6.64	0.00	10,453.25	47.56
Cropping	2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plantation forest	2000	284.02	0.00	518.31	0.31	0.32	84.20	0.76	0.00	887.92	4.04
Indigenous forest	2000	0.81	0.00	0.00	3,358.63	0.53	1.17	0.00	0.00	3,361.14	15.29
Tall scrub (>3 m)	2000	5.81	0.00	0.00	7.66	2,182.04	9.32	0.00	0.00	2,204.83	10.03
Short scrub (<3 m)	2000	215.19	0.00	1.81	11.16	94.24	4,124.30	1.32	1.53	4,449.54	20.24
Weeds	2000	142.45	0.00	4.88	0.00	0.00	58.78	28.32	0.36	234.79	1.07
Water	2000	0.00	0.00	0.00	0.00	0.00	4.65	0.00	384.55	389.20	1.77
	Total ha (1994)	10,771.88	0.00	528.33	3,379.68	2,291.78	4,585.53	37.04	386.44	21,980.67	100.00
	Total % (1994)	49.01	0.00	2.40	15.38	10.43	20.86	0.17	1.76	100.00	

Reading rules for this Table (also used for Tables A3.3–A3.7 and A3.9–A3.14):

- **Bold numbers** represent the area of the vegetation class common to both monitoring years (1994 and 2000). Other numbers, either in the row or column where the bold number appears, represent the hectare value of the vegetation class change
- Following are examples to work out what went to what and by how much.
 1. Reading down the column headed Pasture on the LHS of the table, the bold number of 10,123.59 is the area (ha) of pasture common to both monitoring years (1994 and 2000). Reading further down this column, the number 284.02 indicates that 284.02 ha of the pasture mapped in 1994 has gone to plantation forest by 2000, 215.19 ha to short scrub <3 m, and so on. The bottom two cells of the column give area totals (ha, %) mapped as pasture in 1994.
 2. Reading across the table along the row headed Plantation forest, the bold number of 518.31 is the area (ha) of plantation forest common to both monitoring years (1994 and 2000). The first number (284.02) of this row indicates that 284.02 ha of the plantation forest mapped in 2000 was under pasture in 1994, and reading further along the row, 84.20 ha of short scrub <3 m in 1994 became plantation forest by 2000, and so on. The final two cells of the row give area totals (ha, %) mapped in 2000.
 3. Using the totals: for example, the third entry down the totals (ha) column shows that 887.92 ha (4.04% of the total monitoring area) were under plantation forest in 2000, and the third entry along the totals (ha) row shows that in 1994 the area of plantation forest covered 528.33 ha (2.4%).

Table A3.3. Vegetation change summary, 2000–2007 (hectares)

Vegetation cover changes 2000–2007		Pasture	Cropping	Plantation forest	Indigenous forest	Tall scrub (>3 m)	Short scrub (<3 m)	Weeds	Water	Total ha	Total %
		2000	2000	2000	2000	2000	2000	2000	2000	(2007)	(2007)
Pasture	2007	9,201.89	0.00	70.23	68.76	138.58	593.98	72.77	33.29	10,179.50	46.31
Cropping	2007	24.60	0.00	0.00	0.00	0.09	0.87	0.00	0.00	25.55	0.12
Plantation forest	2007	189.96	0.00	674.64	7.01	38.01	109.56	15.43	0.17	1,034.78	4.71
Indigenous forest	2007	53.11	0.00	12.44	3,034.32	114.86	75.41	1.10	3.26	3,294.50	14.99
Tall scrub (>3 m)	2007	122.02	0.00	19.61	122.77	1,572.19	547.87	0.73	4.78	2,389.98	10.87
Short scrub (<3 m)	2007	769.90	0.00	108.10	124.02	328.41	2,980.46	88.16	13.59	4,412.65	20.08
Weeds	2007	59.12	0.00	2.70	2.43	9.76	126.15	54.79	0.14	255.09	1.16
Water	2007	32.66	0.00	0.19	1.84	2.94	15.24	1.80	333.98	388.64	1.77
Total ha (2000)		10,453.25	0.00	887.92	3,361.14	2,204.83	4,449.54	234.79	389.20	21,980.67	100.00
Total % (2000)		47.56	0.00	4.04	15.29	10.03	20.24	1.07	1.77	100.00	

To read this table easily, refer to the notes under Table A3.2.

Table A3.4. Vegetation change summary, 2007–2012 (hectares)

Vegetation cover changes 2007–2012		Pasture	Cropping	Plantation forest	Indigenous forest	Tall scrub (>3 m)	Short scrub (<3 m)	Weeds	Water	Total ha (2012)	Total % (2012)
		2007	2007	2007	2007	2007	2007	2007	2007	(2012)	(2012)
Pasture	2012	9,520.87	15.56	25.39	4.47	24.07	309.84	89.44	1.09	9,990.73	45.45
Cropping	2012	27.14	9.99	8.27	0.00	0.00	0.01	0.00	0.00	45.41	0.21
Plantation forest	2012	332.19	0.00	938.41	20.84	7.24	83.80	1.00	0.00	1,383.47	6.29
Indigenous forest	2012	0.48	0.00	0.37	3,212.32	16.84	6.13	0.17	0.00	3,236.31	14.72
Tall scrub (>3 m)	2012	36.99	0.00	0.56	50.21	2,326.83	82.44	0.35	0.01	2,497.39	11.36
Short scrub (<3 m)	2012	159.88	0.00	43.69	6.56	12.53	3,857.60	11.96	0.17	4,092.39	18.62
Weeds	2012	95.11	0.00	18.06	0.09	2.10	71.55	151.99	0.00	338.90	1.54
Water	2012	6.85	0.00	0.04	0.00	0.36	1.31	0.18	387.34	396.08	1.80
Total ha (2007)		10,179.51	25.55	1,034.79	3,294.50	2,389.97	4,412.67	255.09	388.61	21,980.67	100.00
Total % (2007)		46.31	0.12	4.71	14.99	10.87	20.08	1.16	1.77	100.00	

To read this table easily, refer to the notes under Table A3.2.

Table A3.5. Vegetation change summary, 2012–2017 (hectares)

Vegetation cover changes 2012–2017	Pasture	Cropping	Plantation forest	Indigenous forest	Tall scrub (>3 m)	Short scrub (<3 m)	Weeds	Water	Pole plantings (2017 onwards)	Total ha	Total %	
	2012	2012	2012	2012	2012	2012	2012	2012	2012	(2017)	(2017)	
Pasture	2017	9,479.36	29.43	126.82	3.52	41.29	251.62	68.31	0.17	0.00	10,000.52	45.50
Cropping	2017	59.08	15.92	0.02	0.00	0.00	0.13	0.13	0.00	0.00	75.28	0.34
Plantation forest	2017	71.72	0.00	1,211.34	2.47	9.40	78.35	10.51	0.00	0.00	1,383.79	6.30
Indigenous forest	2017	0.63	0.00	0.12	3,229.82	0.00	1.32	0.00	0.00	0.00	3,231.89	14.70
Tall scrub (>3 m)	2017	10.00	0.00	3.64	0.00	2,423.71	154.66	0.30	0.00	0.00	2,592.32	11.79
Short scrub (<3 m)	2017	249.60	0.00	32.33	0.39	13.47	3,598.05	203.56	0.00	0.00	4,097.40	18.64
Weeds	2017	43.62	0.05	9.07	0.00	0.90	4.55	55.97	0.02	0.00	114.19	0.52
Water	2017	2.24	0.00	0.09	0.11	0.12	0.23	0.00	395.89	0.00	398.68	1.81
Pole plantings (2017 onwards)	2017	74.48	0.00	0.04	0.00	5.40	6.54	0.14	0.00	0.00	86.60	0.39
Total ha (2012)		9,990.73	45.41	1,383.47	3,236.31	2,494.30	4,095.47	338.92	396.08	0.00	21,980.67	100.00
Total % (2012)		45.45	0.21	6.29	14.72	11.35	18.63	1.54	1.80	0.00	100.00	

To read this table easily, refer to the notes under Table A3.2.

Table A3.6. Vegetation change summary, 2017–2022 (hectares)

Vegetation cover changes 2017–2022		Pasture	Cropping	Plantation forest	Indigenous forest	Tall scrub (>3 m)	Short scrub (<3 m)	Weeds	Water	Pole plantings (2017 onwards)	Total ha	Total %
		2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	(2022)
Pasture	2022	9410.99	54.99	156.99	4.66	18.61	177.68	25.66	0.89	5.28	9855.74	44.84
Cropping	2022	8.95	20.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.24	0.13
Plantation forest	2022	128.91	0.00	1167.01	1.49	4.68	35.78	1.42	0.00	0.14	1339.43	6.09
Indigenous forest	2022	0.61	0.00	0.15	3218.74	0.00	4.57	0.06	0.07	0.00	3224.20	14.67
Tall scrub (>3 m)	2022	10.50	0.00	2.14	4.14	2558.02	9.07	0.17	0.00	0.00	2584.04	11.76
Short scrub (<3 m)	2022	239.88	0.00	43.06	2.83	8.79	3850.71	32.78	0.08	0.55	4178.67	19.01
Weeds	2022	130.24	0.00	12.32	0.03	0.97	13.29	53.20	0.10	0.49	210.65	0.96
Water	2022	2.20	0.00	0.32	0.00	0.00	0.37	0.25	397.53	0.00	400.67	1.82
Pole plantings (2017 onwards)	2022	68.24	0.00	1.81	0.00	1.24	5.94	0.65	0.00	80.14	158.03	0.72
Total ha (2017)		10000.52	75.28	1383.79	3231.89	2592.32	4097.40	114.19	398.68	86.60	21980.67	100.00
Total % (2017)		45.50	0.34	6.30	14.70	11.79	18.64	0.52	1.81	0.39	100.00	

To read this table easily, refer to the notes under Table A3.2.

Table A3.7. Vegetation change summary, 1994–2022 (hectares)

Vegetation cover changes 1994–2022		Pasture	Cropping	Plantation forest	Indigenous forest	Tall scrub (>3 m)	Short scrub (<3 m)	Weeds	Water	Pole plantings (2017 onwards)	Total ha	Total %
		1994	1994	1994	1994	1994	1994	1994	1994	1994	(2022)	(2022)
Pasture	2022	8595.72	0.00	142.25	85.64	160.06	817.55	27.54	26.97	0.00	9855.74	44.84
Cropping	2022	27.57	0.00	1.53	0.00	0.01	0.14	0.00	0.00	0.00	29.24	0.13
Plantation forest	2022	660.27	0.00	272.88	10.15	44.98	348.58	1.37	1.20	0.00	1339.43	6.09
Indigenous forest	2022	55.04	0.00	2.17	2979.43	119.16	66.10	0.00	2.30	0.00	3224.20	14.67
Tall scrub (>3 m)	2022	169.73	0.00	11.36	183.92	1634.22	577.63	1.59	5.59	0.00	2584.04	11.76
Short scrub (<3 m)	2022	972.10	0.00	72.73	115.42	314.56	2687.75	5.59	10.53	0.00	4178.67	19.01
Weeds	2022	108.57	0.00	22.10	2.40	14.36	61.24	0.78	1.21	0.00	210.65	0.96
Water	2022	41.74	0.00	0.28	1.90	3.58	16.09	0.17	336.92	0.00	400.67	1.82
Pole plantings (2017 onwards)	2022	141.15	0.00	3.04	0.83	0.85	10.45	0.00	1.72	0.00	158.03	0.72
Total ha (1994)		10771.88	0.00	528.33	3379.68	2291.78	4585.53	37.04	386.44	0.00	21,980.67	100.00
Total % (1994)		49.01	0.00	2.40	15.38	10.43	20.86	0.17	1.76	0.00	100.00	

To read this table easily, refer to the notes under Table A3.2.

Table A3.8. Land-use classes in 1994, 2000, 2007, 2012, 2017 and 2022 for all hill country monitoring sites (hectares)

Site	Horticulture/cash cropping						Dairying						Meat & wool farming						Revegetated meat and wool farming						Plantation Forestry					
	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022
1	0.00	0.00	0.00	0.00	8.57	0.00	0.00	0.00	0.00	0.00	0.00	169.16	156.94	150.00	160.59	152.72	164.11	76.53	88.75	118.38	101.64	103.49	96.44	0.38	0.38	0.00	0.00	0.00	0.00	
2	0.00	0.00	0.00	0.31	0.31	0.31	0.00	0.00	0.00	91.95	100.51	96.72	319.03	315.92	286.86	201.06	189.82	187.50	48.56	48.56	81.29	72.66	74.60	78.83	3.02	6.13	10.61	9.93	11.50	12.75
3	0.00	0.00	8.43	7.95	7.95	7.95	0.00	0.00	91.47	121.31	132.92	94.89	407.60	299.75	189.10	169.93	161.72	175.53	160.88	268.51	207.92	199.27	198.55	221.42	6.19	6.62	5.72	10.45	8.67	11.95
4	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.91	678.20	665.24	623.27	605.23	634.60	604.54	81.08	86.21	130.37	149.22	135.85	162.22	12.38	23.75	28.43	24.62	8.62	8.98	
5	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	389.90	393.35	366.22	382.00	399.35	383.90	514.25	511.45	536.92	521.57	504.25	520.43	4.48	3.83	5.08	8.53	8.47	6.56	
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	502.08	502.08	418.36	433.29	412.97	362.51	34.03	34.03	123.70	147.26	137.38	186.32	9.08	9.08	12.07	7.15	2.26	2.43	
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	120.29	100.37	0.00	693.78	656.70	621.36	486.88	512.12	654.63	44.40	45.24	99.44	104.31	100.64	108.46	9.53	45.77	58.33	59.03	56.62	9.94	
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	305.07	171.04	134.02	130.61	127.91	166.56	70.79	119.45	181.79	173.87	170.52	185.81	1.67	89.03	80.14	80.97	86.91	33.06	
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.01	36.59	37.06	735.90	682.84	591.85	554.50	610.79	614.84	66.13	66.13	146.14	143.34	127.06	115.50	52.18	105.24	118.67	120.56	73.69	70.07	
10	0.00	5.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	320.96	286.38	243.82	205.65	202.96	175.81	293.58	309.58	340.64	336.48	327.82	353.07	8.14	20.99	34.40	122.30	134.47	135.16	
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	273.82	272.97	227.12	217.11	223.53	221.46	245.22	245.22	307.71	326.44	280.03	350.99	318.06	318.91	303.54	294.76	334.75	265.86	
12	0.00	0.00	8.60	8.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	860.68	860.68	835.79	837.74	840.88	827.58	1.62	1.62	23.40	20.87	23.65	27.71	3.91	3.91	1.83	1.83	2.41	1.00	
13	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	774.54	745.63	688.83	694.27	669.87	671.56	42.12	42.12	107.81	102.28	112.71	106.95	3.46	32.37	24.34	23.55	21.79	21.94	
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	855.30	721.66	734.85	695.61	687.44	0.00	0.00	133.64	120.15	132.55	118.20	0.00	0.00	0.00	0.30	21.67	39.82	
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.05	58.63	58.86	57.84	54.88	53.69	536.04	533.23	541.72	542.66	545.62	546.89	0.00	0.00	0.00	0.00	0.00	0.00	
16	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	879.69	879.69	870.06	857.21	851.30	845.37	18.17	18.17	28.18	38.49	38.36	43.42	1.61	1.61	1.42	2.21	4.97	4.94	
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	275.12	206.15	133.45	126.35	109.21	94.72	415.95	484.93	564.36	569.27	586.41	600.26	0.00	0.00	0.00	0.00	0.00	0.64	
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	243.50	243.50	232.75	232.22	227.70	233.07	337.51	337.51	371.50	373.31	377.83	371.02	0.00	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	857.06	818.74	676.29	711.27	701.75	664.27	45.36	45.47	182.61	148.11	128.55	140.71	0.77	38.98	44.54	43.55	43.73	44.51	
20	0.00	0.00	13.17	12.64	35.99	10.82	435.43	432.43	405.16	358.48	446.13	121.98	223.32	210.78	138.53	166.55	59.58	395.11	244.26	244.72	284.60	284.81	271.05	274.88	12.61	27.69	74.01	91.35	101.06	110.66
21	0.00	0.00	0.00	3.37	0.00	0.00	42.55	42.21	0.00	0.00	0.00	265.77	262.53	262.93	245.50	286.25	161.24	673.08	669.72	665.55	653.63	642.38	663.50	48.42	55.36	101.34	127.18	100.80	204.39	
22	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	363.82	351.57	376.97	531.42	413.44	466.38	471.78	479.43	438.54	280.72	386.30	335.84	16.32	19.24	36.42	39.77	44.78	43.07	
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	618.50	582.15	538.93	273.18	247.39	251.95	68.08	92.14	145.46	173.92	193.83	202.65	4.94	17.24	26.59	262.64	261.23	248.57	
24	0.00	0.00	0.00	10.15	22.31	6.93	61.75	61.75	68.27	68.54	86.76	85.15	505.19	483.08	415.41	412.53	388.43	380.91	343.28	346.24	396.84	401.92	406.60	427.36	31.68	50.83	61.24	48.59	37.39	40.68
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	276.31	261.55	114.67	93.10	164.30	135.82	460.36	475.11	621.23	631.12	555.93	575.56	2.07	2.07	4.22	16.07	16.42	22.45	
Total	0.00	7.50	30.20	45.41	75.28	26.19	539.73	536.40	564.89	798.57	903.28	436.71	11,849.36	11,223.19	9,917.10	9,520.87	9,339.09	9,580.49	5,293.05	5,593.53	6,779.74	6,617.33	6,561.97	6,814.43	550.88	879.00	1,032.94	1,395.33	1,382.22	1,339.43
%	0.00	0.03	0.14	0.21	0.34	0.12	2.46	2.44	2.57	3.63	4.11	1.99	53.91	51.06	45.12	43.31	42.49	43.59	24.08	25.45	30.84	30.11	29.85	31.00	2.51	4.00	4.70	6.35	6.29	6.09

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Table A3.8 (continued). Land-use classes in 1994, 2000, 2007, 2012, 2017 and 2022 for all hill country monitoring sites (hectares)

Site	Meat & wool farming with trees						Indigenous Forest						Water						Total					
	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022
1	0.00	0.00	0.00	0.00	0.00	0.00	407.74	407.74	384.78	390.92	388.38	392.42	232.82	232.82	233.47	233.47	233.47	233.66	886.62	886.62	886.62	886.62	886.62	886.62
2	0.00	0.00	0.00	0.00	0.00	2.73	506.18	506.18	496.34	499.07	497.14	494.85	12.84	12.84	14.53	14.66	15.73	15.94	889.63	889.63	889.63	889.63	889.63	889.63
3	0.00	0.00	0.00	0.00	0.00	0.13	296.08	295.86	368.27	361.68	360.77	358.20	0.83	0.83	0.66	0.97	0.97	1.50	871.56	871.56	871.56	871.56	871.56	871.56
4	0.98	0.98	0.84	0.00	0.00	2.45	96.57	93.02	86.28	89.79	89.79	89.45	0.00	0.00	0.00	0.33	0.33	0.59	869.20	869.20	869.20	869.20	869.20	869.20
5	3.56	3.56	3.97	0.00	0.00	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.12	0.12	912.19	912.19	912.19	912.19	912.19	912.19
6	3.51	3.51	0.00	0.00	4.22	7.26	321.43	321.43	316.00	282.43	313.29	311.60	0.00	0.00	0.00	0.00	0.00	0.00	870.13	870.13	870.13	870.13	870.13	870.13
7	1.43	1.43	0.00	0.00	0.00	1.00	144.26	144.26	114.27	122.64	123.29	118.81	0.00	0.00	0.00	0.25	0.37	0.55	893.40	893.40	893.40	893.40	893.40	893.40
8	0.00	0.00	0.00	0.00	0.00	0.00	499.54	497.56	480.83	491.26	491.26	491.17	0.34	0.34	0.65	0.70	0.82	0.82	877.41	877.41	877.41	877.41	877.41	877.41
9	3.84	3.84	0.00	0.00	8.08	18.61	20.48	20.48	21.82	21.82	21.82	21.82	1.37	1.37	1.42	1.67	1.87	1.99	879.90	879.90	879.90	879.90	879.90	879.90
10	0.00	0.00	0.00	0.00	0.00	1.29	275.68	275.60	279.00	233.43	232.60	232.52	4.56	4.56	5.06	5.06	5.06	5.06	902.91	902.91	902.91	902.91	902.91	902.91
11	0.00	0.00	0.00	0.00	0.00	0.00	15.64	15.64	14.09	14.09	14.09	14.09	0.15	0.15	0.42	0.48	0.48	0.48	852.88	852.88	852.88	852.88	852.88	852.88
12	0.00	0.00	0.00	0.00	1.94	12.34	0.00	0.00	0.00	0.00	0.00	0.36	9.68	9.68	6.27	6.48	7.02	6.92	875.90	875.90	875.90	875.90	875.90	875.90
13	0.00	0.00	0.00	0.00	15.32	18.49	0.00	0.00	0.00	0.00	0.00	0.13	9.51	9.51	8.65	9.53	9.79	10.56	829.63	829.63	829.63	829.63	829.63	829.63
14	0.00	0.00	0.00	0.00	5.47	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	855.30	855.30	855.30	855.30	855.30
15	0.00	0.00	0.00	0.00	0.00	0.00	135.95	135.17	126.45	126.45	126.45	126.45	0.00	0.00	0.00	0.07	0.07	0.00	727.03	727.03	727.03	727.03	727.03	727.03
16	0.00	0.00	0.00	0.00	5.16	6.01	0.52	0.52	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.20	0.25	899.99	899.99	899.99	899.99	899.99	899.99
17	0.00	0.00	0.00	0.00	0.00	0.00	58.21	58.21	48.02	48.02	48.02	48.02	94.53	94.53	97.97	100.17	100.17	100.17	843.81	843.81	843.81	843.81	843.81	843.81
18	0.00	0.00	0.00	0.00	0.00	1.44	322.64	322.64	299.71	298.43	298.43	298.43	1.18	1.18	0.87	0.87	0.87	0.87	904.83	904.83	904.83	904.83	904.83	904.83
19	0.00	0.00	0.00	0.00	28.89	53.44	0.00	0.00	0.00	0.00	0.00	0.00	1.74	1.74	1.49	2.01	2.01	2.00	904.93	904.93	904.93	904.93	904.93	904.93
20	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	3.37	3.37	3.53	5.15	5.17	5.49	918.99	918.99	918.99	918.99	918.99	918.99
21	0.00	0.00	0.00	0.00	0.39	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	1029.82	1029.82	1029.82	1029.82	1029.82	1029.82
22	0.00	0.00	0.00	0.00	7.40	6.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	851.92	851.92	851.92	851.92	851.92	851.92
23	4.13	4.13	0.00	0.00	6.66	7.40	154.78	154.78	140.36	140.59	141.23	139.77	13.64	13.64	12.74	13.74	13.74	13.74	864.08	864.08	864.08	864.08	864.08	864.08
24	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.18	0.41	0.31	941.90	941.90	941.90	941.90	941.90	941.90
25	0.00	0.00	0.00	0.00	3.43	6.25	87.97	87.97	86.59	86.41	86.60	86.60	0.00	0.00	0.00	0.00	0.01	0.01	826.70	826.70	826.70	826.70	826.70	826.70
Total	17.45	17.45	4.80	0.00	86.97	157.72	3,343.66	3,337.05	3,263.12	3,207.04	3,233.18	3,224.69	386.55	386.55	387.88	396.12	398.68	401.01	21,980.67	21,980.67	21,980.67	21,980.67	21,980.67	21,980.67
%	0.08	0.08	0.02	0.00	0.40	0.72	15.21	15.18	14.85	14.59	14.71	14.67	1.76	1.76	1.76	1.80	1.81	1.82	100.00	100.00	100.00	100.00	100.00	100.00

Table A3.9. Land-use change summary, 1994–2000 (hectares)

Land-use changes 1994–2000	Horticulture/ cash cropping	Dairying	Meat & wool farming	Revegetated meat & wool farming	Plantation forestry	Meat & wool farming with trees	Indigenous forest	Water	Total ha	Total %
	1994	1994	1994	1994	1994	1994	1994	1994	(2000)	(2000)
Hort/cash cropping	2000	0.00	0.00	7.50	0.00	0.00	0.00	0.00	7.50	0.03
Dairying	2000	0.00	536.01	0.27	0.11	0.00	0.00	0.00	536.40	2.44
Meat & wool	2000	0.00	0.00	11,200.18	19.10	2.93	0.00	0.98	11,223.19	51.06
Rev. meat and wool	2000	0.00	0.00	333.90	5,247.49	6.69	0.00	5.45	5,593.53	25.45
Plantation forestry	2000	0.00	3.71	307.36	26.34	541.27	0.00	0.31	879.00	4.00
M & W with trees	2000	0.00	0.00	0.00	0.00	0.00	17.45	0.00	17.45	0.08
Indigenous forest	2000	0.00	0.00	0.14	0.00	0.00	0.00	3,336.91	3,337.05	15.18
Water	2000	0.00	0.00	0.00	0.00	0.00	0.00	386.55	386.55	1.76
Total ha (1994)	0.00	539.73	11,849.36	5,293.05	550.88	17.45	3,343.66	386.55	21,980.67	100.00
Total % (1994)	0.00	2.46	53.91	24.08	2.51	0.08	15.21	1.76	100.00	

To read this table easily, refer to the notes under Table A3.2. Rev. meat and wool – Revegetated meat & wool farming. M & W with trees – Meat & wool farming with trees.

Table A3.10. Land-use change summary, 2000–2007 (hectares)

Land-use changes 2000–2007	Horticulture/ cash cropping	Dairying	Meat & wool farming	Revegetated meat & wool farming	Plantation forestry	Meat & wool farming with trees	Indigenous forest	Water	Total ha	Total %
	2000	2000	2000	2000	2000	2000	2000	2000	(2007)	(2007)
Hort/cash cropping 2007	0.00	13.01	15.68	0.05	1.45	0.00	0.00	0.00	30.20	0.14
Dairying 2007	0.00	421.99	129.71	5.98	7.21	0.00	0.00	0.00	564.89	2.57
Meat & wool 2007	6.33	66.17	9,242.31	438.55	65.83	3.51	62.81	31.59	9,917.10	45.12
Rev. meat and wool 2007	1.16	15.83	1540.77	4,852.86	107.35	0.21	245.19	16.37	6,779.74	30.84
Plantation forestry 2007	0.00	19.40	183.74	119.75	693.03	9.83	7.03	0.14	1,032.93	4.70
M & W with trees 2007	0.00	0.00	0.90	0.00	0.00	3.90	0.00	0.00	4.80	0.02
Indigenous forest 2007	0.00	0.00	71.79	163.66	3.93	0.00	3,020.46	3.28	3,263.12	14.85
Water 2007	0.00	0.00	38.28	12.67	0.19	0.00	1.56	335.17	387.88	1.76
Total ha (2000)	7.50	536.40	11,223.19	5,593.53	879.00	17.45	3,337.05	386.55	21,980.67	100.00
Total % (2000)	0.03	2.44	51.06	25.45	4.00	0.08	15.18	1.76	100.00	

To read this table easily, refer to the notes under Table A3.2. Rev. meat and wool – Revegetated meat & wool farming. M & W with trees – Meat & wool farming with trees.

Table A3.11. Land-use change summary, 2007–2012 (hectares)

Land-use changes 2007–2012	Horticulture/ cash cropping	Dairying	Meat & wool farming	Revegetated meat & wool farming	Plantation forestry	Meat & wool farming with trees	Indigenous forest	Water	Total ha	Total %
	2007	2007	2007	2007	2007	2007	2007	2007	(2012)	(2012)
Hort/cash cropping	2012 17.94	5.96	21.18	0.01	0.31	0.00	0.00	0.00	45.41	0.21
Dairying	2012 0.00	485.19	304.08	8.27	0.86	0.00	0.16	0.00	798.57	3.63
Meat & wool	2012 12.25	71.68	8,894.60	513.74	24.12	0.59	3.53	0.35	9,520.87	43.31
Rev. meat and wool	2012 0.00	1.60	332.49	6,170.46	27.32	0.93	84.35	0.18	6,617.33	30.11
Plantation forestry	2012 0.00	0.46	357.32	47.52	979.91	3.28	6.83	0.00	1,395.33	6.35
M & W with trees	2012 0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indigenous forest	2012 0.00	0.00	0.65	37.78	0.37	0.00	3,168.25	0.00	3,207.04	14.59
Water	2012 0.00	0.00	6.77	1.97	0.04	0.00	0.00	387.34	396.12	1.80
Total ha (2007)	30.20	564.89	9,917.10	6,779.75	1,032.94	4.80	3,263.11	387.88	21,980.67	100.00
Total % (2007)	0.14	2.57	45.12	30.84	4.70	0.02	14.85	1.76	100.00	

To read this table easily, refer to the notes under Table A3.2. Rev. meat and wool – Revegetated meat & wool farming. M & W with trees – Meat & wool farming with trees.

Table A3.12. Land-use change summary, 2012–2017 (hectares)

Land-use changes 2012–2017	Horticulture/ cash cropping	Dairying	Meat & wool farming	Revegetated meat & wool farming	Plantation forestry	Meat & wool farming with trees	Indigenous forest	Water	Total ha	Total %
	2012	2012	2012	2012	2012	2012	2012	2012	(2017)	(2017)
Hort/cash cropping 2017	15.92	21.45	37.77	0.13	0.02	0.00	0.00	0.00	75.28	0.34
Dairying 2017	4.33	744.43	146.67	5.27	2.06	0.00	0.52	0.00	903.28	4.11
Meat & wool 2017	25.16	24.22	8,782.49	369.07	134.83	0.00	3.10	0.23	9,339.09	42.49
Rev. meat and wool 2017	0.00	8.14	399.32	6,112.00	39.79	0.00	2.71	0.00	6,561.97	29.85
Plantation forestry 2017	0.00	0.33	72.22	90.21	1,218.38	0.00	1.08	0.00	1,382.22	6.29
M & W with trees 2017	0.00	0.00	79.41	7.52	0.04	0.00	0.00	0.00	86.97	0.40
Indigenous forest 2017	0.00	0.00	0.62	32.91	0.12	0.00	3,199.53	0.00	3,233.18	14.71
Water 2017	0.00	0.00	2.36	0.23	0.09	0.00	0.11	395.89	398.68	1.81
Total ha (2012)	45.41	798.57	9,520.87	6,617.33	1,395.33	0.00	3,207.04	396.12	21,980.67	100.00
Total % (2012)	0.21	3.63	43.31	30.11	6.35	0.00	14.59	1.80	100.00	

To read this table easily, refer to the notes under Table A3.2. Rev. meat and wool – Revegetated meat & wool farming. M & W with trees – Meat & wool farming with trees.

Table A3.13. Land-use change summary, 2017–2022 (hectares)

Land-use changes 2017–2022		Horticulture/ cash cropping	Dairying	Meat & wool farming	Revegetated meat & wool farming	Plantation forestry	Meat & wool farming with trees	Indigenous forest	Water	Total ha	Total %
		2017	2017	2017	2017	2017	2017	2017	2017	2017	(2022)
Hort/cash cropping	2022	20.29	5.72	0.17	0.00	0.00	0.00	0.00	0.00	26.19	0.12
Dairying	2022	10.08	424.08	1.62	0.36	0.00	0.00	0.57	0.00	436.71	1.99
Meat & wool	2022	44.90	454.37	8695.65	250.68	124.48	5.28	4.24	0.89	9580.49	43.59
Rev. meat and wool	2022	0.00	11.16	446.00	6259.22	89.72	1.22	6.85	0.25	6814.43	31.00
Plantation forestry	2022	0.00	7.05	123.36	40.38	1165.62	0.14	2.89	0.00	1339.43	6.09
M & W with trees	2022	0.00	0.06	68.99	6.41	1.94	80.32	0.00	0.00	157.72	0.72
Indigenous forest	2022	0.00	0.07	0.70	4.57	0.15	0.00	3218.63	0.56	3224.69	14.67
Water	2022	0.00	0.77	2.60	0.35	0.32	0.00	0.00	396.98	401.01	1.82
Total ha (2017)		75.28	903.28	9339.09	6561.97	1382.22	86.97	3233.18	398.68	21,980.67	100.00
Total % (2017)		0.34	4.11	42.49	29.85	6.29	0.40	14.71	1.81	100.00	

To read this table easily, refer to the notes under Table A3.2. Rev. meat and wool – Revegetated meat & wool farming. M & W with trees – Meat & wool farming with trees.

Table A3.14. Land-use change summary, 1994–2022 (hectares)

Land-use changes 1994–2022		Horticulture/ cash cropping	Dairying	Meat & wool farming	Revegetated meat & wool farming	Plantation forestry	Meat & wool farming with trees	Indigenous forest	Water	Total ha	Total %
		1994	1994	1994	1994	1994	1994	1994	1994	1994	(2022)
Hort/cash cropping	2022	0.00	10.58	13.84	0.10	1.67	0.00	0.00	0.00	26.19	0.12
Dairying	2022	0.00	155.71	258.17	12.74	4.73	0.00	3.24	2.13	436.71	1.99
Meat & wool	2022	0.00	330.74	8553.67	489.85	105.38	9.27	66.61	24.98	9580.49	43.59
Rev. meat and wool	2022	0.00	18.63	1896.15	4452.05	138.15	3.34	288.93	17.18	6814.43	31.00
Plantation Forestry	2022	0.00	23.95	835.76	168.46	295.64	4.66	9.77	1.20	1339.43	6.09
M & W with trees	2022	0.00	0.06	146.25	6.03	2.88	0.17	0.63	1.72	157.72	0.72
Indigenous Forest	2022	0.00	0.00	94.18	153.06	2.17	0.00	2972.87	2.40	3224.69	14.67
Water	2022	0.00	0.07	51.35	10.77	0.28	0.00	1.62	336.94	401.01	1.82
Total ha (1994)		0.00	539.73	11849.36	5293.05	550.88	17.45	3343.66	386.55	21,980.67	100.00
Total % (1994)		0.00	2.46	53.91	24.08	2.51	0.08	15.21	1.76	100.00	

To read this table easily, refer to the notes under Table A3.2. Rev. meat and wool – Revegetated meat & wool farming. M & W with trees – Meat & wool farming with trees.

Operations and Regulatory Committee - SEM Hill/Coastal Sand Country Sustainable Landuse Report by Landcare Rearch Ltd.

Table A3.15. Physical sustainability of land-use at all hill country monitoring sites, 1994 (hectares)

Site	Horticulture/cash cropping			Dairying			Meat & wool farming			Revegetated meat & wool farming			Plantation forestry			Meat & wool farming with trees			Indigenous forest			Water			Total		
	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.
1	0.00	0.00	0.00	0.00	0.00	0.00	169.16	136.52	32.64	76.53	76.53	0.00	0.38	0.38	0.00	0.00	0.00	0.00	407.74	407.74	0.00	232.82	232.82	0.00	886.62	853.98	32.64
2	0.00	0.00	0.00	0.00	0.00	0.00	319.03	302.16	16.87	48.56	48.56	0.00	3.02	3.02	0.00	0.00	0.00	0.00	506.18	506.18	0.00	12.84	12.84	0.00	889.63	872.76	16.87
3	0.00	0.00	0.00	0.00	0.00	0.00	407.60	355.45	52.15	160.88	160.88	0.00	6.19	6.19	0.00	0.00	0.00	0.00	296.08	296.08	0.00	0.83	0.83	0.00	871.56	819.41	52.15
4	0.00	0.00	0.00	0.00	0.00	0.00	678.20	610.85	67.34	81.08	81.08	0.00	12.38	12.38	0.00	0.98	0.04	0.94	96.57	96.57	0.00	0.00	0.00	0.00	869.20	800.92	68.28
5	0.00	0.00	0.00	0.00	0.00	0.00	389.90	329.55	60.35	514.25	514.25	0.00	4.48	4.45	0.03	3.56	0.86	2.70	0.00	0.00	0.00	0.00	0.00	0.00	912.19	849.11	63.07
6	0.00	0.00	0.00	0.00	0.00	0.00	502.08	261.38	240.71	34.03	34.03	0.00	9.08	9.08	0.00	3.51	1.08	2.42	321.43	321.43	0.00	0.00	0.00	0.00	870.13	627.00	243.13
7	0.00	0.00	0.00	0.00	0.00	0.00	693.78	665.95	27.83	44.40	44.40	0.00	9.53	9.53	0.00	1.43	1.43	0.00	144.26	144.26	0.00	0.00	0.00	0.00	893.40	865.57	27.83
8	0.00	0.00	0.00	0.00	0.00	0.00	305.07	272.12	32.95	70.79	70.79	0.00	1.67	1.67	0.00	0.00	0.00	0.00	499.54	499.54	0.00	0.34	0.34	0.00	877.41	844.46	32.95
9	0.00	0.00	0.00	0.00	0.00	0.00	735.90	633.33	102.57	66.13	66.13	0.00	52.18	52.18	0.00	3.84	3.84	0.00	20.48	20.48	0.00	1.37	1.37	0.00	879.90	777.33	102.57
10	0.00	0.00	0.00	0.00	0.00	0.00	320.96	201.00	119.96	293.58	293.58	0.00	8.14	8.14	0.00	0.00	0.00	0.00	275.68	275.68	0.00	4.56	4.56	0.00	902.91	782.95	119.96
11	0.00	0.00	0.00	0.00	0.00	0.00	273.82	258.75	15.08	245.22	245.22	0.00	318.06	316.53	1.53	0.00	0.00	0.00	15.64	15.64	0.00	0.15	0.15	0.00	852.88	836.28	16.61
12	0.00	0.00	0.00	0.00	0.00	0.00	860.68	793.50	67.18	1.62	1.62	0.00	3.91	3.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.68	9.68	0.00	875.90	808.72	67.18
13	0.00	0.00	0.00	0.00	0.00	0.00	774.54	612.37	162.17	42.12	42.12	0.00	3.46	3.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.51	9.51	0.00	829.63	667.46	162.17
14	0.00	0.00	0.00	0.00	0.00	0.00	855.30	501.04	354.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	501.04	354.26
15	0.00	0.00	0.00	0.00	0.00	0.00	55.05	54.70	0.35	536.04	536.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.95	135.95	0.00	0.00	0.00	0.00	727.03	726.68	0.35
16	0.00	0.00	0.00	0.00	0.00	0.00	879.69	603.28	276.41	18.17	18.17	0.00	1.61	1.61	0.00	0.00	0.00	0.00	0.52	0.52	0.00	0.00	0.00	0.00	899.99	623.59	276.41
17	0.00	0.00	0.00	0.00	0.00	0.00	275.12	126.83	148.29	415.95	415.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.21	58.21	0.00	94.53	94.53	0.00	843.81	695.51	148.29
18	0.00	0.00	0.00	0.00	0.00	0.00	243.50	32.19	211.31	337.51	337.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	322.64	322.64	0.00	1.18	1.18	0.00	904.83	693.52	211.31
19	0.00	0.00	0.00	0.00	0.00	0.00	857.06	430.63	426.44	45.36	45.36	0.00	0.77	0.04	0.73	0.00	0.00	0.00	0.00	0.00	0.00	1.74	1.74	0.00	904.93	477.77	427.17
20	0.00	0.00	0.00	435.43	402.86	32.57	223.32	171.30	52.03	244.26	244.26	0.00	12.61	12.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.37	3.37	0.00	918.99	834.39	84.60
21	0.00	0.00	0.00	42.55	37.92	4.63	265.77	135.90	129.87	673.08	673.08	0.00	48.42	42.26	6.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1029.82	889.16	140.66
22	0.00	0.00	0.00	0.00	0.00	0.00	363.82	175.44	188.38	471.78	471.78	0.00	16.32	16.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	851.92	663.54	188.38
23	0.00	0.00	0.00	0.00	0.00	0.00	618.50	238.17	380.34	68.08	68.08	0.00	4.94	4.94	0.00	4.13	0.23	3.90	154.78	154.78	0.00	13.64	13.64	0.00	864.08	479.84	384.24
24	0.00	0.00	0.00	61.75	61.18	0.58	505.19	365.23	139.96	343.28	343.28	0.00	31.68	29.91	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	941.90	799.59	142.31
25	0.00	0.00	0.00	0.00	0.00	0.00	276.31	110.17	166.13	460.36	460.36	0.00	2.07	2.07	0.00	0.00	0.00	0.00	87.97	87.97	0.00	0.00	0.00	0.00	826.70	660.57	166.13
Total	0.00	0.00	0.00	539.73	501.95	37.78	11,849.35	8,377.80	3,471.55	5,293.05	5,293.05	0.00	550.88	540.67	10.22	17.45	7.50	9.95	3,343.66	3,343.66	0.00	386.55	386.55	0.00	21,980.67	18,451.17	3,529.49
%	0.00	0.00	0.00	2.46	2.28	0.17	53.91	38.11	15.79	24.08	24.08	0.00	2.51	2.46	0.05	0.08	0.03	0.05	15.21	15.21	0.00	1.76	1.76	0.00	100.00	83.94	16.06

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Table A3.16. Physical sustainability of land-use at all hill country monitoring sites, 2000 (hectares)

Site	Horticulture/cash cropping			Dairying			Meat & wool farming			Revegetated meat & wool farming			Plantation forestry			Meat & wool farming with trees			Indigenous forest			Water			Total		
	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.
1	0.00	0.00	0.00	0.00	0.00	0.00	156.94	128.93	28.01	88.75	88.75	0.00	0.38	0.38	0.00	0.00	0.00	0.00	407.74	407.74	0.00	232.82	232.82	0.00	886.62	858.61	28.01
2	0.00	0.00	0.00	0.00	0.00	0.00	315.92	299.05	16.87	48.56	48.56	0.00	6.13	6.13	0.00	0.00	0.00	0.00	506.18	506.18	0.00	12.84	12.84	0.00	889.63	872.76	16.87
3	0.00	0.00	0.00	0.00	0.00	0.00	299.75	294.27	5.48	268.51	268.51	0.00	6.62	6.62	0.00	0.00	0.00	0.00	295.86	295.86	0.00	0.83	0.83	0.00	871.56	866.08	5.48
4	0.00	0.00	0.00	0.00	0.00	0.00	665.24	599.81	65.43	86.21	86.21	0.00	23.75	23.75	0.00	0.98	0.04	0.94	93.02	93.02	0.00	0.00	0.00	0.00	869.20	802.84	66.36
5	0.00	0.00	0.00	0.00	0.00	0.00	393.35	330.74	62.61	511.45	511.45	0.00	3.83	3.75	0.08	3.56	0.86	2.70	0.00	0.00	0.00	0.00	0.00	0.00	912.19	846.80	65.38
6	0.00	0.00	0.00	0.00	0.00	0.00	502.08	261.38	240.71	34.03	34.03	0.00	9.08	9.08	0.00	3.51	1.08	2.42	321.43	321.43	0.00	0.00	0.00	0.00	870.13	627.00	243.13
7	0.00	0.00	0.00	0.00	0.00	0.00	656.70	631.88	24.82	45.24	45.24	0.00	45.77	45.77	0.00	1.43	1.43	0.00	144.26	144.26	0.00	0.00	0.00	0.00	893.40	868.58	24.82
8	0.00	0.00	0.00	0.00	0.00	0.00	171.04	160.59	10.45	119.45	119.45	0.00	89.03	89.03	0.00	0.00	0.00	0.00	497.56	497.56	0.00	0.34	0.34	0.00	877.41	866.96	10.45
9	0.00	0.00	0.00	0.00	0.00	0.00	682.84	589.57	93.27	66.13	66.13	0.00	105.24	105.24	0.00	3.84	3.84	0.00	20.48	20.48	0.00	1.37	1.37	0.00	879.90	786.64	93.27
10	5.81	0.00	5.81	0.00	0.00	0.00	286.38	182.27	104.12	309.58	309.58	0.00	20.99	20.99	0.00	0.00	0.00	0.00	275.60	275.60	0.00	4.56	4.56	0.00	902.91	792.99	109.92
11	0.00	0.00	0.00	0.00	0.00	0.00	272.97	257.90	15.08	245.22	245.22	0.00	318.91	317.38	1.53	0.00	0.00	0.00	15.64	15.64	0.00	0.15	0.15	0.00	852.88	836.28	16.61
12	0.00	0.00	0.00	0.00	0.00	0.00	860.68	793.50	67.18	1.62	1.62	0.00	3.91	3.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.68	9.68	0.00	875.90	808.72	67.18
13	0.00	0.00	0.00	0.00	0.00	0.00	745.63	592.08	153.55	42.12	42.12	0.00	32.37	31.83	0.54	0.00	0.00	0.00	0.00	0.00	0.00	9.51	9.51	0.00	829.63	675.54	154.09
14	0.00	0.00	0.00	0.00	0.00	0.00	855.30	501.04	354.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	501.04	354.26
15	0.00	0.00	0.00	0.00	0.00	0.00	58.63	58.28	0.35	533.23	533.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.17	135.17	0.00	0.00	0.00	0.00	727.03	726.68	0.35
16	0.00	0.00	0.00	0.00	0.00	0.00	879.69	603.28	276.41	18.17	18.17	0.00	1.61	1.61	0.00	0.00	0.00	0.00	0.52	0.52	0.00	0.00	0.00	0.00	899.99	623.59	276.41
17	0.00	0.00	0.00	0.00	0.00	0.00	206.15	111.50	94.65	484.93	484.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.21	58.21	0.00	94.53	94.53	0.00	843.81	749.16	94.65
18	0.00	0.00	0.00	0.00	0.00	0.00	243.50	32.19	211.31	337.51	337.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	322.64	322.64	0.00	1.18	1.18	0.00	904.83	693.52	211.31
19	0.00	0.00	0.00	0.00	0.00	0.00	818.74	409.73	409.01	45.47	45.47	0.00	38.98	37.00	1.98	0.00	0.00	0.00	0.00	0.00	0.00	1.74	1.74	0.00	904.93	493.95	410.99
20	0.00	0.00	0.00	432.43	401.36	31.07	210.78	162.19	48.59	244.72	244.72	0.00	27.69	27.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.37	3.37	0.00	918.99	839.33	79.66
21	0.00	0.00	0.00	42.21	37.75	4.47	262.53	132.92	129.61	669.72	669.72	0.00	55.36	49.63	5.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1029.82	890.01	139.81
22	1.69	0.00	1.69	0.00	0.00	0.00	351.57	172.71	178.85	479.43	479.43	0.00	19.24	19.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	851.92	671.38	180.55
23	0.00	0.00	0.00	0.00	0.00	0.00	582.15	227.86	354.29	92.14	92.14	0.00	17.24	17.24	0.00	4.13	0.23	3.90	154.78	154.78	0.00	13.64	13.64	0.00	864.08	505.89	358.19
24	0.00	0.00	0.00	61.75	61.18	0.58	483.08	358.62	124.46	346.24	346.24	0.00	50.83	46.08	4.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	941.90	812.11	129.79
25	0.00	0.00	0.00	0.00	0.00	0.00	261.55	107.65	153.90	475.11	475.11	0.00	2.07	2.07	0.00	0.00	0.00	0.00	87.97	87.97	0.00	0.00	0.00	0.00	826.70	672.81	153.90
Total	7.50	0.00	7.50	536.40	500.29	36.11	11,223.19	7,999.94	3,223.25	5,593.53	5,593.53	0.00	879.00	864.39	14.61	17.45	7.50	9.95	3,337.05	3,337.05	0.00	386.55	386.55	0.00	21,980.67	18,689.25	3,291.41
%	0.03	0.00	0.03	2.44	2.28	0.16	51.06	36.40	14.66	25.45	25.45	0.00	4.00	3.93	0.07	0.08	0.03	0.05	15.18	15.18	0.00	1.76	1.76	0.00	100.00	85.03	14.97

Table A3.17. Physical sustainability of land-use at all hill country monitoring sites, 2007 (hectares)

Site	Horticulture/cash cropping			Dairying			Meat & wool farming			Revegetated meat & wool farming			Plantation forestry			Meat & wool farming with trees			Indigenous forest			Water			Total		
	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.
1	0.00	0.00	0.00	0.00	0.00	0.00	150.00	123.15	26.85	118.38	118.38	0.00	0.00	0.00	0.00	0.00	0.00	384.78	384.78	0.00	233.47	233.47	0.00	886.62	859.77	26.85	
2	0.00	0.00	0.00	0.00	0.00	0.00	286.86	279.82	7.04	81.29	81.29	0.00	10.61	10.51	0.10	0.00	0.00	0.00	496.34	496.34	0.00	14.53	14.53	0.00	889.63	882.48	7.14
3	8.43	7.58	0.85	91.47	66.36	25.11	189.10	175.48	13.61	207.92	207.92	0.00	5.72	5.72	0.00	0.00	0.00	0.00	368.27	368.27	0.00	0.66	0.66	0.00	871.56	831.99	39.57
4	0.00	0.00	0.00	0.00	0.00	0.00	623.27	567.12	56.16	130.37	130.37	0.00	28.43	28.43	0.00	0.84	0.13	0.70	86.28	86.28	0.00	0.00	0.00	0.00	869.20	812.34	56.86
5	0.00	0.00	0.00	0.00	0.00	0.00	366.22	319.55	46.67	536.92	536.92	0.00	5.08	5.08	0.00	3.97	1.21	2.75	0.00	0.00	0.00	0.00	0.00	0.00	912.19	862.76	49.42
6	0.00	0.00	0.00	0.00	0.00	0.00	418.36	245.09	173.27	123.70	123.70	0.00	12.07	11.69	0.39	0.00	0.00	0.00	316.00	316.00	0.00	0.00	0.00	0.00	870.13	696.47	173.66
7	0.00	0.00	0.00	0.00	0.00	0.00	621.36	602.44	18.92	99.44	99.44	0.00	58.33	58.33	0.00	0.00	0.00	0.00	114.27	114.27	0.00	0.00	0.00	0.00	893.40	874.48	18.92
8	0.00	0.00	0.00	0.00	0.00	0.00	134.02	127.85	6.16	181.79	181.79	0.00	80.14	80.14	0.00	0.00	0.00	0.00	480.83	480.83	0.00	0.65	0.65	0.00	877.41	871.25	6.16
9	0.00	0.00	0.00	0.00	0.00	0.00	591.85	524.10	67.75	146.14	146.14	0.00	118.67	118.67	0.00	0.00	0.00	0.00	21.82	21.82	0.00	1.42	1.42	0.00	879.90	812.15	67.75
10	0.00	0.00	0.00	0.00	0.00	0.00	243.82	160.09	83.73	340.64	340.64	0.00	34.40	34.40	0.00	0.00	0.00	0.00	279.00	279.00	0.00	5.06	5.06	0.00	902.91	819.18	83.73
11	0.00	0.00	0.00	0.00	0.00	0.00	227.12	223.38	3.74	307.71	307.71	0.00	303.54	300.63	2.91	0.00	0.00	0.00	14.09	14.09	0.00	0.42	0.42	0.00	852.88	846.24	6.65
12	8.60	0.00	8.60	0.00	0.00	0.00	835.79	773.93	61.87	23.40	23.40	0.00	1.83	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.27	6.27	0.00	875.90	805.43	70.47
13	0.00	0.00	0.00	0.00	0.00	0.00	688.83	543.47	145.35	107.81	107.81	0.00	24.34	24.30	0.03	0.00	0.00	0.00	0.00	0.00	0.00	8.65	8.65	0.00	829.63	684.24	145.39
14	0.00	0.00	0.00	0.00	0.00	0.00	721.66	459.07	262.58	133.64	133.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	592.71	262.58	
15	0.00	0.00	0.00	0.00	0.00	0.00	58.86	57.60	1.26	541.72	541.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126.45	126.45	0.00	0.00	0.00	0.00	727.03	725.77	1.26
16	0.00	0.00	0.00	0.00	0.00	0.00	870.06	602.56	267.50	28.18	28.18	0.00	1.42	1.42	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	899.99	632.49	267.50
17	0.00	0.00	0.00	0.00	0.00	0.00	133.45	77.54	55.91	564.36	564.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.02	48.02	0.00	97.97	97.97	0.00	843.81	787.90	55.91
18	0.00	0.00	0.00	0.00	0.00	0.00	232.75	30.21	202.54	371.50	371.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	299.71	299.71	0.00	0.87	0.87	0.00	904.83	702.29	202.54
19	0.00	0.00	0.00	0.00	0.00	0.00	676.29	355.37	320.93	182.61	182.61	0.00	44.54	44.23	0.31	0.00	0.00	0.00	0.00	0.00	0.00	1.49	1.49	0.00	904.93	583.70	321.23
20	13.17	12.93	0.24	405.16	360.06	45.10	138.53	117.38	21.14	284.60	284.60	0.00	74.01	72.55	1.46	0.00	0.00	0.00	0.00	0.00	0.00	3.53	3.53	0.00	918.99	851.04	67.95
21	0.00	0.00	0.00	0.00	0.00	0.00	262.93	141.11	121.82	665.55	665.55	0.00	101.34	94.93	6.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1029.82	901.59	128.24
22	0.00	0.00	0.00	0.00	0.00	0.00	376.97	172.25	204.73	438.54	438.54	0.00	36.42	35.37	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	851.92	646.15	205.77
23	0.00	0.00	0.00	0.00	0.00	0.00	538.93	214.00	324.93	145.46	145.46	0.00	26.59	26.14	0.45	0.00	0.00	0.00	140.36	140.36	0.00	12.74	12.74	0.00	864.08	538.70	325.38
24	0.00	0.00	0.00	68.27	64.26	4.01	415.41	311.25	104.16	396.84	396.84	0.00	61.24	54.43	6.82	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.00	941.90	826.91	114.99
25	0.00	0.00	0.00	0.00	0.00	0.00	114.67	57.44	57.23	621.23	621.23	0.00	4.22	4.22	0.00	0.00	0.00	0.00	86.59	86.59	0.00	0.00	0.00	0.00	826.70	769.48	57.23
Total	30.20	20.51	9.69	564.89	490.67	74.22	9,917.10	7,261.24	2,655.86	6,779.74	6,779.74	0.00	1,032.94	1,013.02	19.93	4.80	1.35	3.46	3,263.12	3,263.12	0.00	387.87	387.87	0.00	21,980.67	19,217.52	2,763.15
%	0.14	0.09	0.04	2.57	2.23	0.34	45.12	33.03	12.08	30.84	30.84	0.00	4.70	4.61	0.09	0.02	0.01	0.02	14.85	14.85	0.00	1.76	1.76	0.00	100.00	87.43	12.57

Table A3.18. Physical sustainability of land-use at all hill country monitoring sites, 2012 (hectares)

Site	Horticulture/cash cropping			Dairying			Meat & wool farming			Revegetated meat & wool farming			Plantation forestry			Meat & wool farming with trees			Indigenous forest			Water			Total		
	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.
1	0.00	0.00	0.00	0.00	0.00	0.00	160.59	128.30	32.29	101.64	101.64	0.00	0.00	0.00	0.00	0.00	0.00	390.92	390.92	0.00	233.47	233.47	0.00	886.62	854.33	32.29	
2	0.31	0.00	0.31	91.95	70.96	20.98	201.06	197.15	3.90	72.66	72.66	0.00	9.93	9.82	0.10	0.00	0.00	0.00	499.07	499.07	0.00	14.66	14.66	0.00	889.63	864.32	25.31
3	7.95	7.30	0.65	121.31	75.94	45.37	169.93	157.67	12.26	199.27	199.27	0.00	10.45	10.45	0.00	0.00	0.00	0.00	361.68	361.68	0.00	0.97	0.97	0.00	871.56	813.28	58.29
4	0.00	0.00	0.00	0.00	0.00	0.00	605.23	554.02	51.21	149.22	149.22	0.00	24.62	24.62	0.00	0.00	0.00	0.00	89.79	89.79	0.00	0.33	0.33	0.00	869.20	817.99	51.21
5	0.00	0.00	0.00	0.00	0.00	0.00	382.00	331.89	50.11	521.57	521.57	0.00	8.53	8.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	912.19	862.08	50.11
6	0.00	0.00	0.00	0.00	0.00	0.00	433.29	254.40	178.89	147.26	147.26	0.00	7.15	6.33	0.82	0.00	0.00	0.00	282.43	282.43	0.00	0.00	0.00	0.00	870.13	690.42	179.71
7	0.00	0.00	0.00	120.29	55.75	64.55	486.88	469.17	17.70	104.31	104.31	0.00	59.03	59.03	0.00	0.00	0.00	0.00	122.64	122.64	0.00	0.25	0.25	0.00	893.40	811.15	82.25
8	0.00	0.00	0.00	0.00	0.00	0.00	130.61	123.78	6.83	173.87	173.87	0.00	80.97	80.97	0.00	0.00	0.00	0.00	491.26	491.26	0.00	0.70	0.70	0.00	877.41	870.58	6.83
9	0.00	0.00	0.00	38.01	4.72	33.29	554.50	485.01	69.48	143.34	143.34	0.00	120.56	120.56	0.00	0.00	0.00	0.00	21.82	21.82	0.00	1.67	1.67	0.00	879.90	777.12	102.78
10	0.00	0.00	0.00	0.00	0.00	0.00	205.65	145.44	60.21	336.48	336.48	0.00	122.30	119.16	3.14	0.00	0.00	0.00	233.43	233.43	0.00	5.06	5.06	0.00	902.91	839.56	63.35
11	0.00	0.00	0.00	0.00	0.00	0.00	217.11	212.51	4.61	326.44	326.44	0.00	294.76	291.59	3.16	0.00	0.00	0.00	14.09	14.09	0.00	0.48	0.48	0.00	852.88	845.11	7.77
12	8.99	0.00	8.99	0.00	0.00	0.00	837.74	772.22	65.53	20.87	20.87	0.00	1.83	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.48	6.48	0.00	875.90	801.38	74.51
13	0.00	0.00	0.00	0.00	0.00	0.00	694.27	548.31	145.96	102.28	102.28	0.00	23.55	23.51	0.03	0.00	0.00	0.00	0.00	0.00	0.00	9.53	9.53	0.00	829.63	683.64	145.99
14	0.00	0.00	0.00	0.00	0.00	0.00	734.85	470.95	263.90	120.15	120.15	0.00	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	591.40	263.90
15	0.00	0.00	0.00	0.00	0.00	0.00	57.84	56.72	1.13	542.66	542.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126.45	126.45	0.00	0.07	0.07	0.00	727.03	725.91	1.13
16	2.00	0.00	2.00	0.00	0.00	0.00	857.21	595.04	262.17	38.49	38.49	0.00	2.21	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.00	899.99	635.83	264.17
17	0.00	0.00	0.00	0.00	0.00	0.00	126.35	77.23	49.11	569.27	569.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.02	48.02	0.00	100.17	100.17	0.00	843.81	794.69	49.11
18	0.00	0.00	0.00	0.00	0.00	0.00	232.22	29.79	202.43	373.31	373.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	298.43	298.43	0.00	0.87	0.87	0.00	904.83	702.40	202.43
19	0.00	0.00	0.00	0.00	0.00	0.00	711.27	374.18	337.09	148.11	148.11	0.00	43.55	42.81	0.74	0.00	0.00	0.00	0.00	0.00	0.00	2.01	2.01	0.00	904.93	567.10	337.83
20	12.64	8.02	4.63	358.48	303.58	54.90	166.55	154.43	12.13	284.81	284.81	0.00	91.35	89.89	1.46	0.00	0.00	0.00	0.00	0.00	0.00	5.15	5.15	0.00	918.99	845.88	73.11
21	3.37	3.37	0.00	0.00	0.00	0.00	245.50	119.27	126.23	653.63	653.63	0.00	127.18	121.18	5.99	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.00	1,029.82	897.60	132.22
22	0.00	0.00	0.00	0.00	0.00	0.00	531.42	211.66	319.76	280.72	280.72	0.00	39.77	38.72	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	851.92	531.10	320.82
23	0.00	0.00	0.00	0.00	0.00	0.00	273.18	141.58	131.60	173.92	173.92	0.00	262.64	242.98	19.66	0.00	0.00	0.00	140.59	140.59	0.00	13.74	13.74	0.00	864.08	712.82	151.26
24	10.15	9.77	0.38	68.54	64.18	4.35	412.53	301.62	110.91	401.92	401.92	0.00	48.59	41.88	6.71	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.00	941.90	819.55	122.35
25	0.00	0.00	0.00	0.00	0.00	0.00	93.10	60.13	32.97	631.12	631.12	0.00	16.07	16.07	0.00	0.00	0.00	0.00	86.41	86.41	0.00	0.00	0.00	0.00	826.70	793.73	32.97
Total	45.41	28.45	16.95	798.57	575.13	223.45	9,520.87	6,972.45	2,548.42	6,617.33	6,617.33	0.00	1,395.33	1,352.45	42.87	0.00	0.00	0.00	3,207.04	3,207.04	0.00	396.12	396.12	0.00	21,980.67	19,148.98	2,831.69
%	0.21	0.13	0.08	3.63	2.62	1.02	43.31	31.72	11.59	30.11	30.11	0.00	6.35	6.15	0.20	0.00	0.00	0.00	14.59	14.59	0.00	1.80	1.80	0.00	100.00	87.12	12.88

Table A3.19. Physical sustainability of land-use at all hill country monitoring sites, 2017 (hectares)

Site	Horticulture/cash cropping			Dairying			Meat & wool farming			Revegetated meat & wool farming			Plantation forestry			Meat & wool farming with trees			Indigenous forest			Water			Total		
	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.
1	8.57	0.00	8.57	0.00	0.00	0.00	152.72	121.03	31.68	103.49	103.49	0.00	0.00	0.00	0.00	0.00	0.00	388.38	388.38	0.00	233.47	233.47	0.00	886.62	846.37	40.25	
2	0.31	0.00	0.31	100.51	78.19	22.32	189.82	186.94	2.88	74.60	74.60	0.00	11.50	11.40	0.10	0.00	0.00	0.00	497.14	497.14	0.00	15.73	15.73	0.00	889.63	864.01	25.62
3	7.95	7.30	0.65	132.92	72.98	59.93	161.72	147.56	14.16	198.55	198.55	0.00	8.67	8.67	0.00	0.00	0.00	0.00	360.77	360.77	0.00	0.97	0.97	0.00	871.56	796.81	74.75
4	0.00	0.00	0.00	0.00	0.00	0.00	634.60	576.12	58.48	135.85	135.85	0.00	8.62	8.62	0.00	0.00	0.00	0.00	89.79	89.79	0.00	0.33	0.33	0.00	869.20	810.72	58.48
5	0.00	0.00	0.00	0.00	0.00	0.00	399.35	343.46	55.89	504.25	504.25	0.00	8.47	8.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.00	912.19	856.30	55.89
6	0.00	0.00	0.00	0.00	0.00	0.00	412.97	244.41	168.56	137.38	137.38	0.00	2.26	2.02	0.24	4.22	2.30	1.92	313.29	313.29	0.00	0.00	0.00	0.00	870.13	699.40	170.73
7	0.00	0.00	0.00	100.37	38.65	61.72	512.12	494.82	17.30	100.64	100.64	0.00	56.62	56.62	0.00	0.00	0.00	0.00	123.29	123.29	0.00	0.37	0.37	0.00	893.40	814.39	79.01
8	0.00	0.00	0.00	0.00	0.00	0.00	127.91	121.45	6.46	170.52	170.52	0.00	86.91	86.91	0.00	0.00	0.00	0.00	491.26	491.26	0.00	0.82	0.82	0.00	877.41	870.95	6.46
9	0.00	0.00	0.00	36.59	4.72	31.87	610.79	533.32	77.47	127.06	127.06	0.00	73.69	73.69	0.00	8.08	7.48	0.60	21.82	21.82	0.00	1.87	1.87	0.00	879.90	769.96	109.94
10	0.00	0.00	0.00	0.00	0.00	0.00	202.96	143.72	59.24	327.82	327.82	0.00	134.47	131.50	2.97	0.00	0.00	0.00	232.60	232.60	0.00	5.06	5.06	0.00	902.91	840.70	62.21
11	0.00	0.00	0.00	0.00	0.00	0.00	223.53	219.31	4.23	280.03	280.03	0.00	334.75	330.87	3.88	0.00	0.00	0.00	14.09	14.09	0.00	0.48	0.48	0.00	852.88	844.78	8.10
12	0.00	0.00	0.00	0.00	0.00	0.00	840.88	776.01	64.87	23.65	23.65	0.00	2.41	2.41	0.00	1.94	1.94	0.00	0.00	0.00	0.00	7.02	7.02	0.00	875.90	811.03	64.87
13	0.15	0.00	0.15	0.00	0.00	0.00	669.87	530.03	139.84	112.71	112.71	0.00	21.79	21.76	0.03	15.32	14.91	0.42	0.00	0.00	0.00	9.79	9.79	0.00	829.63	689.19	140.44
14	0.00	0.00	0.00	0.00	0.00	0.00	695.61	448.91	246.70	132.55	132.55	0.00	21.67	18.80	2.86	5.47	5.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	855.30	605.73	249.56
15	0.00	0.00	0.00	0.00	0.00	0.00	54.88	53.78	1.10	545.62	545.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126.45	126.45	0.00	0.07	0.07	0.00	727.03	725.93	1.10
16	0.00	0.00	0.00	0.00	0.00	0.00	851.30	590.99	260.31	38.36	38.36	0.00	4.97	4.97	0.00	5.16	4.31	0.85	0.00	0.00	0.00	0.20	0.20	0.00	899.99	638.84	261.16
17	0.00	0.00	0.00	0.00	0.00	0.00	109.21	73.70	35.50	586.41	586.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.02	48.02	0.00	100.17	100.17	0.00	843.81	808.30	35.50
18	0.00	0.00	0.00	0.00	0.00	0.00	227.70	29.99	197.70	377.83	377.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	298.43	298.43	0.00	0.87	0.87	0.00	904.83	707.13	197.70
19	0.00	0.00	0.00	0.00	0.00	0.00	701.75	360.80	340.95	128.55	128.55	0.00	43.73	43.11	0.62	28.89	15.02	13.88	0.00	0.00	0.00	2.01	2.01	0.00	904.93	549.49	355.44
20	35.99	35.53	0.46	446.13	341.85	104.28	59.58	52.74	6.84	271.05	271.05	0.00	101.06	99.60	1.46	0.00	0.00	0.00	0.00	0.00	0.00	5.17	5.17	0.00	918.99	805.95	113.03
21	0.00	0.00	0.00	0.00	0.00	0.00	286.25	131.43	154.82	642.38	642.38	0.00	100.80	100.12	0.68	0.39	0.35	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1,029.82	874.28	155.54
22	0.00	0.00	0.00	0.00	0.00	0.00	413.44	175.12	238.32	386.30	386.30	0.00	44.78	43.61	1.17	7.40	5.30	2.10	0.00	0.00	0.00	0.00	0.00	0.00	851.92	610.33	241.60
23	0.00	0.00	0.00	0.00	0.00	0.00	247.39	137.04	110.35	193.83	193.83	0.00	261.23	242.11	19.12	6.66	1.38	5.28	141.23	141.23	0.00	13.74	13.74	0.00	864.08	729.33	134.75
24	22.31	19.98	2.33	86.76	79.95	6.81	388.43	277.12	111.31	406.60	406.60	0.00	37.39	33.43	3.97	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.41	0.00	941.90	817.48	124.42
25	0.00	0.00	0.00	0.00	0.00	0.00	164.30	60.03	104.27	555.93	555.93	0.00	16.42	16.42	0.00	3.43	3.25	0.18	86.60	86.60	0.00	0.01	0.01	0.00	826.70	722.25	104.45
Total	75.28	62.81	12.47	903.28	616.35	286.93	9,339.09	6,829.85	2,509.24	6,561.97	6,561.97	0.00	1,382.22	1,345.11	37.11	86.97	61.70	25.27	3,233.18	3,233.18	0.00	398.68	398.68	0.00	21,980.67	19,109.65	2,871.02
%	0.34	0.29	0.06	4.11	2.80	1.31	42.49	31.07	11.42	29.85	29.85	0.00	6.29	6.12	0.17	0.40	0.28	0.11	14.71	14.71	0.00	1.81	1.81	0.00	100.00	86.94	13.06

Operations and Regulatory Committee - SEM Hill/Coastal Sand Country Sustainable Landuse Report by Landcare Rearch Ltd.

Table A3.20. Physical sustainability of land-use at all hill country monitoring sites, 2022 (hectares)

Site	Horticulture/cash cropping			Dairying			Meat & wool farming			Revegetated meat & wool farming			Plantation forestry			Meat & wool farming with trees			Indigenous forest			Water			Total		
	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.	Total	Sust.	Unsust.
1	0.00	0.00	0.00	0.00	0.00	0.00	164.11	129.97	34.14	96.44	96.44	0.00	0.00	0.00	0.00	0.00	0.00	392.42	392.42	0.00	233.66	233.66	0.00	886.62	852.48	34.14	
2	0.31	0.00	0.31	96.72	75.22	21.50	187.50	183.88	3.62	78.83	78.83	0.00	12.75	12.65	0.10	2.73	2.73	0.00	494.85	494.85	0.00	15.94	15.94	0.00	889.63	864.09	25.54
3	7.95	7.30	0.65	94.89	62.17	32.71	175.53	160.62	14.91	221.42	221.42	0.00	11.95	11.95	0.00	0.13	0.13	0.00	358.20	358.20	0.00	1.50	1.50	0.00	871.56	823.28	48.28
4	0.06	0.00	0.06	0.91	0.86	0.06	604.54	554.17	50.37	162.22	162.22	0.00	8.98	8.98	0.00	2.45	2.44	0.02	89.45	89.45	0.00	0.59	0.59	0.00	869.20	818.70	50.50
5	0.12	0.00	0.12	0.00	0.00	0.00	383.90	330.74	53.16	520.43	520.43	0.00	6.56	6.56	0.00	1.06	1.06	0.00	0.00	0.00	0.00	0.12	0.12	0.00	912.19	858.91	53.28
6	0.00	0.00	0.00	0.00	0.00	0.00	362.51	223.73	138.78	186.32	186.32	0.00	2.43	2.04	0.39	7.26	4.03	3.23	311.60	311.60	0.00	0.00	0.00	0.00	870.13	727.73	142.40
7	0.00	0.00	0.00	0.00	0.00	0.00	654.63	628.14	26.49	108.46	108.46	0.00	9.94	9.94	0.00	1.00	1.00	0.00	118.81	118.81	0.00	0.55	0.55	0.00	893.40	866.91	26.49
8	0.00	0.00	0.00	0.00	0.00	0.00	166.56	155.97	10.59	185.81	185.81	0.00	33.06	33.06	0.00	0.00	0.00	0.00	491.17	491.17	0.00	0.82	0.82	0.00	877.41	866.82	10.59
9	0.00	0.00	0.00	37.06	4.74	32.32	614.84	530.97	83.88	115.50	115.50	0.00	70.07	70.07	0.00	18.61	17.52	1.09	21.82	21.82	0.00	1.99	1.99	0.00	879.90	762.61	117.29
10	0.00	0.00	0.00	0.00	0.00	0.00	175.81	129.45	46.36	353.07	353.07	0.00	135.16	132.19	2.97	1.29	1.07	0.22	232.52	232.52	0.00	5.06	5.06	0.00	902.91	853.35	49.56
11	0.00	0.00	0.00	0.00	0.00	0.00	221.46	214.95	6.51	350.99	350.99	0.00	265.86	261.98	3.88	0.00	0.00	0.00	14.09	14.09	0.00	0.48	0.48	0.00	852.88	842.50	10.39
12	0.00	0.00	0.00	0.00	0.00	0.00	827.58	764.39	63.19	27.71	27.71	0.00	1.00	1.00	0.00	12.34	11.68	0.66	0.36	0.36	0.00	6.92	6.92	0.00	875.90	812.05	63.85
13	0.00	0.00	0.00	0.00	0.00	0.00	671.56	528.66	142.89	106.95	106.95	0.00	21.94	21.89	0.05	18.49	17.71	0.77	0.13	0.13	0.00	10.56	10.56	0.00	829.63	685.91	143.72
14	0.00	0.00	0.00	0.00	0.00	0.00	687.44	444.23	243.20	118.20	118.20	0.00	39.82	36.36	3.46	9.85	8.69	1.15	0.00	0.00	0.00	0.00	0.00	0.00	855.30	607.48	247.82
15	0.00	0.00	0.00	0.00	0.00	0.00	53.69	52.59	1.10	546.89	546.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126.45	126.45	0.00	0.00	0.00	0.00	727.03	725.93	1.10
16	0.00	0.00	0.00	0.00	0.00	0.00	845.37	588.69	256.68	43.42	43.42	0.00	4.94	4.94	0.00	6.01	4.18	1.83	0.00	0.00	0.00	0.25	0.25	0.00	899.99	641.48	258.52
17	0.00	0.00	0.00	0.00	0.00	0.00	94.72	71.03	23.69	600.26	600.26	0.00	0.64	0.64	0.00	0.00	0.00	0.00	48.02	48.02	0.00	100.17	100.17	0.00	843.81	820.12	23.69
18	0.00	0.00	0.00	0.00	0.00	0.00	233.07	29.89	203.18	371.02	371.02	0.00	0.00	0.00	0.00	1.44	0.92	0.52	298.43	298.43	0.00	0.87	0.87	0.00	904.83	701.12	203.71
19	0.00	0.00	0.00	0.00	0.00	0.00	664.27	342.15	322.12	140.71	140.71	0.00	44.51	43.55	0.97	53.44	30.14	23.30	0.00	0.00	0.00	2.00	2.00	0.00	904.93	558.55	346.39
20	10.82	10.30	0.52	121.98	99.03	22.95	395.11	381.32	13.79	274.88	274.88	0.00	110.66	109.02	1.64	0.06	0.06	0.00	0.00	0.00	0.00	5.49	5.49	0.00	918.99	880.10	38.89
21	0.00	0.00	0.00	0.00	0.00	0.00	161.24	113.29	47.95	663.50	663.50	0.00	204.39	199.79	4.60	0.69	0.50	0.19	0.00	0.00	0.00	0.00	0.00	0.00	1,029.82	977.08	52.74
22	0.00	0.00	0.00	0.00	0.00	0.00	466.38	178.24	288.13	335.84	335.84	0.00	43.07	41.90	1.17	6.64	5.46	1.19	0.00	0.00	0.00	0.00	0.00	0.00	851.92	561.44	290.49
23	0.00	0.00	0.00	0.00	0.00	0.00	251.95	131.93	120.02	202.65	202.65	0.00	248.57	229.28	19.29	7.40	2.37	5.03	139.77	139.77	0.00	13.74	13.74	0.00	864.08	719.74	144.34
24	6.93	5.79	1.13	85.15	78.46	6.70	380.91	281.30	99.61	427.36	427.36	0.00	40.68	36.91	3.78	0.56	0.56	0.00	0.00	0.00	0.00	0.31	0.31	0.00	941.90	830.69	111.21
25	0.00	0.00	0.00	0.00	0.00	0.00	135.82	52.37	83.46	575.56	575.56	0.00	22.45	22.45	0.00	6.25	4.23	2.02	86.60	86.60	0.00	0.01	0.01	0.00	826.70	741.23	85.48
Total	26.19	23.39	2.79	436.71	320.48	116.24	9580.49	7,202.67	2,377.83	6,814.43	6,814.43	0.00	1,339.43	1297.13	42.30	157.72	116.50	41.23	3,224.69	3,224.69	0.00	401.01	401.01	0.00	21,980.67	19,400.30	2,580.38
%	0.12	0.11	0.01	1.99	1.46	0.53	43.59	32.77	10.82	31.00	31.00	0.00	6.09	5.90	0.19	0.72	0.53	0.19	14.67	14.67	0.00	1.82	1.82	0.00	100.00	88.26	11.74

Table A3.21. Summary of physical sustainability of land-use at all hill country monitoring sites for 1994, 2000, 2007, 2012, 2017 and 2022 (hectares)

Site	1994		2000		2007		2012		2017		2022	
	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable
1	853.98	32.64	858.61	28.01	859.77	26.85	854.33	32.29	846.37	40.25	852.48	34.14
2	872.76	16.87	872.76	16.87	882.48	7.14	864.32	25.31	864.01	25.62	864.09	25.54
3	819.41	52.15	866.08	5.48	831.99	39.57	813.28	58.29	796.81	74.75	823.28	48.28
4	800.92	68.28	802.84	66.36	812.34	56.86	817.99	51.21	810.72	58.48	818.70	50.50
5	849.11	63.07	846.80	65.38	862.76	49.42	862.08	50.11	856.30	55.89	858.91	53.28
6	627.00	243.13	627.00	243.13	696.47	173.66	690.42	179.71	699.40	170.73	727.73	142.40
7	865.57	27.83	868.58	24.82	874.48	18.92	811.15	82.25	814.39	79.01	866.91	26.49
8	844.46	32.95	866.96	10.45	871.25	6.16	870.58	6.83	870.95	6.46	866.82	10.59
9	777.33	102.57	786.64	93.27	812.15	67.75	777.12	102.78	769.96	109.94	762.61	117.29
10	782.95	119.96	792.99	109.92	819.18	83.73	839.56	63.35	840.70	62.21	853.35	49.56
11	836.28	16.61	836.28	16.61	846.24	6.65	845.11	7.77	844.78	8.10	842.50	10.39
12	808.72	67.18	808.72	67.18	805.43	70.47	801.38	74.51	811.03	64.87	812.05	63.85
13	667.46	162.17	675.54	154.09	684.24	145.39	683.64	145.99	689.19	140.44	685.91	143.72
14	501.04	354.26	501.04	354.26	592.71	262.58	591.40	263.90	605.73	249.56	607.48	247.82
15	726.68	0.35	726.68	0.35	725.77	1.26	725.91	1.13	725.93	1.10	725.93	1.10
16	623.59	276.41	623.59	276.41	632.49	267.50	635.83	264.17	638.84	261.16	641.48	258.52
17	695.51	148.29	749.16	94.65	787.90	55.91	794.69	49.11	808.30	35.50	820.12	23.69
18	693.52	211.31	693.52	211.31	702.29	202.54	702.40	202.43	707.13	197.70	701.12	203.71
19	477.77	427.17	493.95	410.99	583.70	321.23	567.10	337.83	549.49	355.44	558.55	346.39
20	834.39	84.60	839.33	79.66	851.04	67.95	845.88	73.11	805.95	113.03	880.10	38.89
21	889.16	140.66	890.01	139.81	901.59	128.24	897.60	132.22	874.28	155.54	977.08	52.74
22	663.54	188.38	671.38	180.55	646.15	205.77	531.10	320.82	610.33	241.60	561.44	290.49
23	479.84	384.24	505.89	358.19	538.70	325.38	712.82	151.26	729.33	134.75	719.74	144.34
24	799.59	142.31	812.11	129.79	826.91	114.99	819.55	122.35	817.48	124.42	830.69	111.21
25	660.57	166.13	672.81	153.90	769.48	57.23	793.73	32.97	722.25	104.45	741.23	85.48
Total	18,451.17	3,529.49	18,689.25	3,291.41	19,217.52	2,763.15	19,148.97	2,831.70	19,109.65	2,871.02	19,400.30	2,580.38
%	83.94	16.06	85.03	14.97	87.43	12.57	87.12	12.88	86.94	13.06	88.26	11.74

Table A3.22. Changes in physical sustainability of land-use at all hill country monitoring sites between 1994, 2000, 2007, 2012, 2017 and 2022 (hectares)

Site	Sustainability change, 1994-2000		Sustainability change, 2000-2007		Sustainability change, 2007-2012		Sustainability change, 2012-2017		Sustainability change, 2017-2022		Sustainability change, 1994-2022	
	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*
1	4.63	?	1.16	?	-5.44	?	-7.96	?	6.11	?	-1.51	?
2	0.00	n.c.	9.73	?	-18.16	x	-0.31	?	0.07	?	-8.67	?
3	46.67	√	-34.09	x	-18.71	x	-16.47	x	26.47	√	3.87	?
4	1.92	?	9.50	?	5.65	?	-7.27	?	7.98	?	17.78	√
5	-2.31	?	15.96	√	-0.68	?	-5.78	?	2.61	?	9.79	?
6	0.00	n.c.	69.47	√	-6.05	?	8.98	?	28.33	√	100.73	√
7	3.01	?	5.90	?	-63.33	x	3.24	?	52.52	√	1.34	?
8	22.50	√	4.29	?	-0.67	?	0.37	?	-4.12	?	22.36	√
9	9.31		25.52	√	-35.03	x	-7.16	?	-7.35	?	-14.72	x
10	10.04	√	26.19	√	20.38	√	1.14	?	12.65	√	70.40	√
11	0.00	n.c.	9.96	?	-1.13	?	-0.33	?	-2.28	?	6.22	?
12	0.00	n.c.	-3.28	?	-4.05	?	9.65	?	1.02	?	3.34	?
13	8.08	?	8.70	?	-0.60	?	5.55	?	-3.28	?	18.45	√
14	0.00	n.c.	91.67	√	-1.31	?	14.33	√	1.74	?	106.44	√
15	0.00	n.c.	-0.91	?	0.14	?	0.02	?	0.01	?	-0.75	?
16	0.00	n.c.	8.91	?	3.34	?	3.01	?	2.64	?	17.89	√
17	53.64	√	38.74	√	6.79	?	13.61	√	11.82	√	124.61	√
18	0.00	n.c.	8.77	?	0.11	?	4.73	?	-6.00	?	7.60	?
19	16.18	√	89.76	√	-16.60	x	-17.61	x	9.05	?	80.78	√
20	4.94	?	11.71	√	-5.16	?	-39.93	x	74.15	√	45.71	√
21	0.85	?	11.57	√	-3.99	?	-23.32	x	102.80	√	87.92	√
22	7.84	?	-25.22	x	-115.05	x	79.23	√	-48.89	x	-102.10	x
23	26.05	√	32.81	√	174.12	√	16.51	√	-9.59	?	239.89	√
24	12.52	√	14.80	√	-7.36	?	-2.07	?	13.21	√	31.10	√
25	12.23	√	96.67	√	24.25	√	-71.48	x	18.97	√	80.65	√
Total	238.08	√	528.26	√	-68.55	?	-39.32	?	290.64	?	949.12	√
%	1.08 ± 0.65		2.40 ± 1.51		-0.31 ± 2.09		-0.18 ± 1.14		1.32 ± 1.33		4.32 ± 2.93	

* Degree of change:

n.c. = no change

? = no significant change (i.e. changes of <10 ha at a site) or, for totals, within 95% sampling error for all sites

√ = significant change towards sustainability

x = significant change away from sustainability

Table A3.23. Summary of physical sustainability of land-use at all hill country monitoring sites for 1994, 2000, 2007, 2012, 2017 and 2022 – considering the 17 hill country monitoring sites reported by O’Leary et al. (1996) (hectares)

Site	1994		2000		2007		2012		2017		2022	
	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable
1	853.98	32.64	858.61	28.01	859.77	26.85	854.33	32.29	846.37	40.25	852.48	34.14
3	819.41	52.15	866.08	5.48	831.99	39.57	813.28	58.29	796.81	74.75	823.28	48.28
4	800.92	68.28	802.84	66.36	812.34	56.86	817.99	51.21	810.72	58.48	818.70	50.50
5	849.11	63.07	846.80	65.38	862.76	49.42	862.08	50.11	856.30	55.89	858.91	53.28
7	865.57	27.83	868.58	24.82	874.48	18.92	811.15	82.25	814.39	79.01	866.91	26.49
8	844.46	32.95	866.96	10.45	871.25	6.16	870.58	6.83	870.95	6.46	866.82	10.59
9	777.33	102.57	786.64	93.27	812.15	67.75	777.12	102.78	769.96	109.94	762.61	117.29
10	782.95	119.96	792.99	109.92	819.18	83.73	839.56	63.35	840.70	62.21	853.35	49.56
11	836.28	16.61	836.28	16.61	846.24	6.65	845.11	7.77	844.78	8.10	842.50	10.39
12	808.72	67.18	808.72	67.18	805.43	70.47	801.38	74.51	811.03	64.87	812.05	63.85
13	667.46	162.17	675.54	154.09	684.24	145.39	683.64	145.99	689.19	140.44	685.91	143.72
15	726.68	0.35	726.68	0.35	725.77	1.26	725.91	1.13	725.93	1.10	725.93	1.10
16	623.59	276.41	623.59	276.41	632.49	267.50	635.83	264.17	638.84	261.16	641.48	258.52
17	695.51	148.29	749.16	94.65	787.90	55.91	794.69	49.11	808.30	35.50	820.12	23.69
18	693.52	211.31	693.52	211.31	702.29	202.54	702.40	202.43	707.13	197.70	701.12	203.71
19	477.77	427.17	493.95	410.99	583.70	321.23	567.10	337.83	549.49	355.44	558.55	346.39
20	834.39	84.60	839.33	79.66	851.04	67.95	845.88	73.11	805.95	113.03	880.10	38.89
Total	12,957.66	1,893.52	13,136.25	1,714.93	13,363.03	1,488.16	13,248.03	1,603.16	13,186.83	1,664.36	13,370.83	1,480.36
%	87.25	12.75	88.45	11.55	89.98	10.02	89.21	10.79	88.79	11.21	90.03	9.97

Table A3.24. Changes in physical sustainability of land-use at all hill country monitoring sites between 1994, 2000, 2007, 2012, 2017 and 2022 – considering the 17 hill country monitoring sites reported by O’Leary et al. (1996) (hectares)

Site	Sustainability change, 1994-2000		Sustainability change, 2000-2007		Sustainability change, 2007-2012		Sustainability change, 2012-2017		Sustainability change, 2017-2022		Sustainability change, 1994-2022	
	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*	Area of change (ha)	Degree of change*
1	4.63	?	1.16	?	-5.44	?	-7.96	?	6.11	?	-1.51	?
3	46.67	√	-34.09	x	-18.71	x	-16.47	x	26.47	√	3.87	?
4	1.92	?	9.50	?	5.65	?	-7.27	?	7.98	?	17.78	√
5	-2.31	?	15.96	√	-0.68	?	-5.78	?	2.61	?	9.79	?
7	3.01	?	5.90	?	-63.33	x	3.24	?	52.52	√	1.34	?
8	22.50	√	4.29	?	-0.67	?	0.37	?	-4.12	?	22.36	√
9	9.31	?	25.52	√	-35.03	x	-7.16	?	-7.35	?	-14.72	x
10	10.04	√	26.19	√	20.38	√	1.14	?	12.65	√	70.40	√
11	0.00	n.c.	9.96	?	-1.13	?	-0.33	?	-2.28	?	6.22	?
12	0.00	n.c.	-3.28	?	-4.05	?	9.65	?	1.02	?	3.34	?
13	8.08	?	8.70	?	-0.60	?	5.55	?	-3.28	?	18.45	√
15	0.00	n.c.	-0.91	?	0.14	?	0.02	?	0.01	?	-0.75	?
16	0.00	n.c.	8.91	?	3.34	?	3.01	?	2.64	?	17.89	√
17	53.64	√	38.74	√	6.79	?	13.61	√	11.82	√	124.61	√
18	0.00	n.c.	8.77	?	0.11	?	4.73	?	-6.00	?	7.60	?
19	16.18	√	89.76	√	-16.60	x	-17.61	x	9.05	?	80.78	√
20	4.94	?	11.71	√	-5.16	?	-39.93	x	74.15	√	45.71	√
Total	178.59	√	226.77	√	-115.00	?	-61.20	?	184.00	?	413.17	?
%	1.20 ± 0.91		1.53 ± 2.06		-0.77 ± 1.55		-0.41 ± 1.03		1.24 ± 1.80		2.78 ± 3.03	

* Degree of change:

n.c. = no change

? = no significant change (i.e., changes of <10 ha at a site) or, for totals, within 95% sampling error for all sites

√ = significant change towards sustainability

x = significant change away from sustainability

Table A3.25. The meat and wool farming land-use class examined according to three key sustainable land-use classes for all sites: 1994, 2000, 2007, 2012, 2017 and 2022 (hectares)

Site	Selected land-use classes where meat and wool farming was mapped — 1994, 2000, 2007, 2012, 2017 and 2022																							
	Other sustainable land-use class (Sustainable)						Pasture with trees (PT) (Sustainable)						Forestry (FO) (Unsustainable)						Protection (PR) (Unsustainable)					
	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022	1994	2000	2007	2012	2017	2022
1	85.21	85.20	82.76	83.47	75.29	83.01	51.32	43.73	40.38	44.83	45.74	46.96	31.30	26.68	25.30	31.35	31.01	33.44	1.34	1.34	1.55	0.95	0.67	0.70
2	243.50	242.98	241.17	163.27	155.23	151.61	58.66	56.07	38.66	33.89	31.72	32.27	13.74	13.74	7.03	3.90	2.88	3.62	3.13	3.13	0.01	0.00	0.00	0.00
3	274.31	253.80	128.09	109.98	95.60	121.11	81.14	40.47	47.39	47.69	51.96	39.51	51.39	4.85	13.26	12.23	14.15	14.76	0.76	0.63	0.35	0.03	0.01	0.15
4	511.51	501.96	490.13	481.92	497.51	481.14	99.34	97.85	76.98	72.10	78.61	73.04	67.34	65.43	56.16	51.21	58.48	50.37	0.00	0.00	0.00	0.00	0.00	0.00
5	186.09	185.88	174.65	176.89	179.01	173.07	143.46	144.86	144.90	155.00	164.45	157.67	52.74	55.06	42.45	45.56	49.89	46.95	7.61	7.55	4.22	4.55	5.99	6.21
6	88.99	88.99	87.92	94.83	93.87	92.03	172.38	172.38	157.17	159.57	150.54	131.70	189.86	189.86	145.60	149.53	139.70	112.40	50.84	50.84	27.67	29.36	28.86	26.38
7	578.01	549.67	523.71	395.71	421.52	544.43	87.94	82.21	78.72	73.46	73.31	83.71	27.83	24.82	18.92	17.70	17.30	26.49	0.00	0.00	0.00	0.00	0.00	0.00
8	143.67	110.61	98.05	95.86	94.84	105.75	128.45	49.98	29.80	27.92	26.61	50.22	32.95	10.45	6.16	6.83	6.46	10.59	0.00	0.00	0.00	0.00	0.00	0.00
9	412.78	401.34	377.69	338.19	352.34	351.63	220.55	188.23	146.41	146.83	180.98	179.34	102.57	93.27	67.75	69.48	77.47	83.88	0.00	0.00	0.00	0.00	0.00	0.00
10	106.24	94.21	80.57	80.40	80.07	71.54	94.76	88.06	79.52	65.03	63.65	57.91	115.50	100.10	77.88	55.20	51.37	41.10	4.46	4.01	5.85	5.02	7.87	5.26
11	197.40	196.55	185.23	177.08	181.27	178.32	61.34	61.34	38.15	35.42	38.04	36.63	15.08	15.08	3.74	4.61	4.23	6.51	0.00	0.00	0.00	0.00	0.00	0.00
12	615.25	615.25	601.67	599.28	604.85	599.11	178.25	178.25	172.26	172.93	171.16	165.28	67.18	67.18	61.87	65.53	64.87	63.19	0.00	0.00	0.00	0.00	0.00	0.00
13	334.12	328.50	299.38	300.37	292.69	287.78	278.25	263.58	244.09	247.94	237.34	240.89	159.88	151.80	144.49	144.97	138.86	141.91	2.29	1.75	0.86	0.98	0.98	0.98
14	188.97	188.97	185.69	186.18	179.08	176.92	312.07	312.07	273.38	284.77	269.83	267.31	311.46	311.46	237.28	237.09	223.66	223.91	42.80	42.80	25.30	26.81	23.04	19.29
15	54.14	57.68	52.66	52.14	49.75	48.77	0.56	0.60	4.94	4.57	4.03	3.82	0.35	0.35	1.26	1.13	1.10	1.10	0.00	0.00	0.00	0.00	0.00	0.00
16	337.54	337.54	338.17	334.11	334.02	333.60	265.74	265.74	264.39	260.92	256.97	255.09	276.41	276.41	267.50	262.17	260.31	256.68	0.00	0.00	0.00	0.00	0.00	0.00
17	68.10	65.41	52.54	51.64	51.47	50.05	58.73	46.08	25.00	25.59	22.23	20.98	138.79	87.37	55.18	48.58	35.22	23.47	9.50	7.27	0.73	0.54	0.28	0.21
18	4.10	4.10	3.32	3.28	3.28	3.28	28.10	28.10	26.90	26.51	26.71	26.61	208.75	208.75	200.86	200.65	195.92	201.48	2.56	2.56	1.68	1.78	1.78	1.70
19	159.21	144.81	129.90	132.54	127.20	120.65	271.42	264.92	225.47	241.64	233.60	221.50	365.62	349.72	286.17	302.12	309.49	295.07	60.81	59.29	34.76	34.97	31.46	27.05
20	130.74	122.92	99.91	136.50	35.54	359.98	40.56	39.27	17.47	17.93	17.21	21.34	51.14	47.70	20.99	12.00	6.72	13.67	0.89	0.89	0.15	0.13	0.12	0.12
21	87.38	86.32	103.35	88.19	102.65	95.10	48.53	46.60	37.76	31.08	28.79	18.19	126.19	125.48	118.58	122.44	145.86	45.80	3.68	4.13	3.24	3.78	8.95	2.15
22	111.23	110.39	107.80	112.05	106.26	101.52	64.21	62.32	64.45	99.61	68.86	76.72	184.71	175.92	201.28	315.86	232.87	279.89	3.68	2.94	3.45	3.91	5.45	8.24
23	158.28	156.06	147.51	108.36	106.37	100.61	79.88	71.80	66.49	33.23	30.67	31.31	347.34	321.29	294.14	121.73	104.57	115.49	33.00	33.00	30.79	9.86	5.78	4.53
24	271.09	267.54	243.79	236.57	212.03	222.41	94.14	91.07	67.45	65.05	65.08	58.89	131.50	118.90	98.07	106.08	105.50	95.21	8.45	5.56	6.09	4.83	5.81	4.40
25	43.77	43.77	24.72	30.75	20.31	20.63	66.41	63.89	32.72	29.38	39.72	31.74	157.72	145.55	51.66	31.11	96.43	76.91	8.41	8.35	5.57	1.86	7.84	6.55
Total	5,391.62	5,240.48	4,860.39	4,569.55	4,452.05	4,874.04	2,986.19	2,759.46	2,400.85	2,402.90	2,377.80	2,328.63	3,227.35	2,987.20	2,503.59	2,419.04	2,374.33	2,263.89	244.20	236.05	152.27	129.37	134.91	113.93
%	45.50	46.69	49.01	48.00	47.67	50.87	25.20	24.59	24.21	25.24	25.46	24.31	27.24	26.62	25.25	25.41	25.42	23.63	2.06	2.10	1.54	1.36	1.44	1.19

Appendix 4 – Coastal sand country monitoring data for all monitoring periods, 1994–2022

Note on data presentation: *Data tabulated in this section are rounded to one decimal place. Where a cell in a table contains the sum of other cells, the raw data are first summed and then rounded to avoid the cumulative effect of rounding data in individual cells before calculating sums. Confidence limits (representing 95% confidence) are rounded to the nearest 0.5%.*

Tables A4.1 to A4.4 detail the results of monitoring for bare sand for each coastal sand country site for 1994 (baseline), 2000 (Jessen et al. 2000), 2007 (Betts & Lynn 2008), 2012 (Betts 2013), 2017 (Betts 2018) and 2022. The results are discussed in Section 4.2 of the main report.

Table A4.1. Site A: Egmont – bare sand baseline (1994) and monitoring (2000, 2007, 2012, 2017 and 2022) results

Site area: 207.5 ha												
Virtual dot grid ground spacing required to achieve minimum of 4,000 sampling points: 22.7 m												
Area represented by virtual dot grid point: 515 m²												
	1994	2000	2007	2012	2017	2022	Change 1994– 2000	Change 2000– 2007	Change 2007– 2012	Change 2012– 2017	Change 2017– 2022	Change 1994– 2022
Bare sand count (points)	61	119	151	267	164	147	+58	+32	+116	-103	-17	+86
Area of bare sand (ha)	3.2	6.2	7.9	14.0	8.6	7.6	+3.0	+1.7	+6.1	-5.4	-1.0	+4.4
Percentage of site (95% confidence)	1.5 ± 0.5	3.0 ± 0.5	3.8 ± 0.5	6.7 ± 1.0	4.1 ± 0.5	3.7 ± 0.5	+1.5 ± 0.5	+0.8 ± 0.5	+2.9 ± 1.0	-2.6 ± 1.0	-0.4 ± 0.5	+2.2 ± 0.5

Table A4.2. Site B: Hāwera – bare sand baseline (1994) and monitoring (2000, 2007, 2012, 2017 and 2022) results

Site area: 579.7 ha												
Virtual dot grid ground spacing required to achieve 4,000 sampling points: 38.0 m												
Area represented by virtual dot grid point: 1,444 m²												
	1994	2000	2007	2012	2017	2022	Change 1994– 2000	Change 2000– 2007	Change 2007– 2012	Change 2012– 2017	Change 2017– 2022	Change 1994– 2022
Bare sand count (points)	138	188	182	163	67	55	+50	-6	-19	-96	-12	-83
Area of bare sand (ha)	20.0	27.3	26.4	23.7	9.7	7.9	+7.3	-0.9	-2.8	-13.9	-1.8	-12.1
Percentage of site (95% confidence)	3.5 ± 0.5	4.7 ± 0.5	4.6 ± 0.5	4.1 ± 0.5	1.7 ± 0.5	1.4 ± 0.5	+1.2 ± 0.5	-0.1 ± 0.5	-0.5 ± 0.5	-2.4 ± 0.5	-0.3 ± 0.5	-2.1 ± 0.5

Table A4.3. Site C: Pātea – bare sand baseline (1994) and monitoring (2000, 2007, 2012, 2017 and 2022) results

Site area: 1,210.4 ha												
Virtual dot grid ground spacing required to achieve 4,000 sampling points: 54.9 m												
Area represented by virtual dot grid point: 3,014 m²												
	1994	2000	2007	2012	2017	2022	Change 1994– 2000	Change 2000– 2007	Change 2007– 2012	Change 2012– 2017	Change 2017– 2022	Change 1994– 2022
Bare sand count (points)	143	156	159	202	143	164	+13	+3	+43	-59	21	21
Area of bare sand (ha)	43.9	47.9	48.8	62.0	43.9	49.4	+4	+0.9	+13.2	-18.1	+5.5	+5.5
Percentage of site (95% confidence)	3.6 ± 0.5	3.9 ± 0.5	4.0 ± 0.5	5.0 ± 0.5	3.6 ± 0.5	4.1 ± 0.5	+0.3 ± 0.5	+0.1 ± 0.5	+1.0 ± 0.5	-1.4 ± 0.5	0.5 ± 0.5	0.5 ± 0.5

Table A4.4. Site D: Wanganui – bare sand baseline (1994) and monitoring (2000, 2007, 2012, 2017 and 2022) results

Site area: 1,292.7 ha												
Virtual dot grid ground spacing required to achieve 4,000 sampling points: 56.7 m												
Area represented by virtual dot grid point: 3,215 m²												
	1994	2000	2007	2012	2017	2022	Change 1994– 2000	Change 2000– 2007	Change 2007– 2012	Change 2012– 2017	Change 2017– 2022	Change 1994– 2022
Bare sand count (points)	517	439	447	338	258	389	-78	+8	-109	-80	+131	-128
Area of bare sand (ha)	170.9	145.1	147.8	111.7	85.3	125.1	-25.8	+2.7	-36.0	-26.5	+39.8	-45.8
Percentage of site (95% confidence)	12.9 ± 1.0	11.0 ± 1.0	11.2 ± 1.0	8.5 ± 1.0	6.5 ± 1.0	9.7 ± 1.0	-1.9 ± 1.5	+0.2 ± 1.5	-2.7 ± 1.5	-2.0 ± 1.5	+3.2 ± 1.5	-3.2 ± 1.5

Sustainable land-use SEM monitoring

Working with people | caring for Taranaki



Summary

1. Statutory requirements for soil conservation
2. National and regional alignment of objectives
3. Landcare study and how it works
4. Results
5. Future technology opportunities

Introduction

- RMA 1991 Sec35(2) (a) RPS 1994.....Regional Soil Plan 2001
- In 1998, NZ government's environment 2010 (E2010) goal for land:

"The maintenance and enhancement of the quality, productivity and life supporting capacity of soils and soils ecosystems"

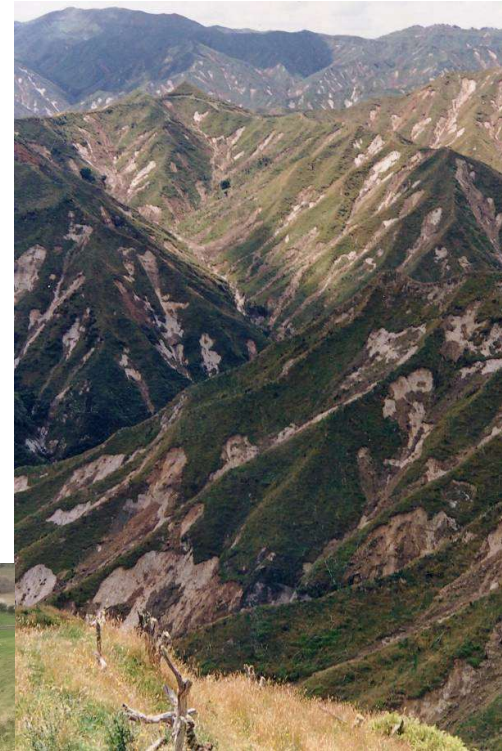
- Essentially – "retaining hill country soils"
- Inappropriate land use and inadequate soil con management often leads to soil loss from accelerated erosion
- Strategy goal 1: appropriate land use (ie. forestry, scrub or indigenous forest on most of the high erosion risk hill country in pasture
- Strategy goal 2: to adopt soil conservation practices on most of the moderate erosion risk hill country in pasture

Monitoring

- Requirement under section 35(2) to monitor state of environment and effectiveness of policies and plans
- Development of monitoring method by LCR in 1994
- Effectively aligned with and already monitoring government's E2010 indicators

Regional Soil Plan 2001

- 1994 RPS Identifies loss of productive capability of soil through accelerated erosion
- 2001 RSP Objective: 'To maintain and enhance the soil resource of the Taranaki region by avoiding, remedying or mitigating accelerated erosion'
- Method: Implementing the SLMP (and rules) by providing advice through property plans.



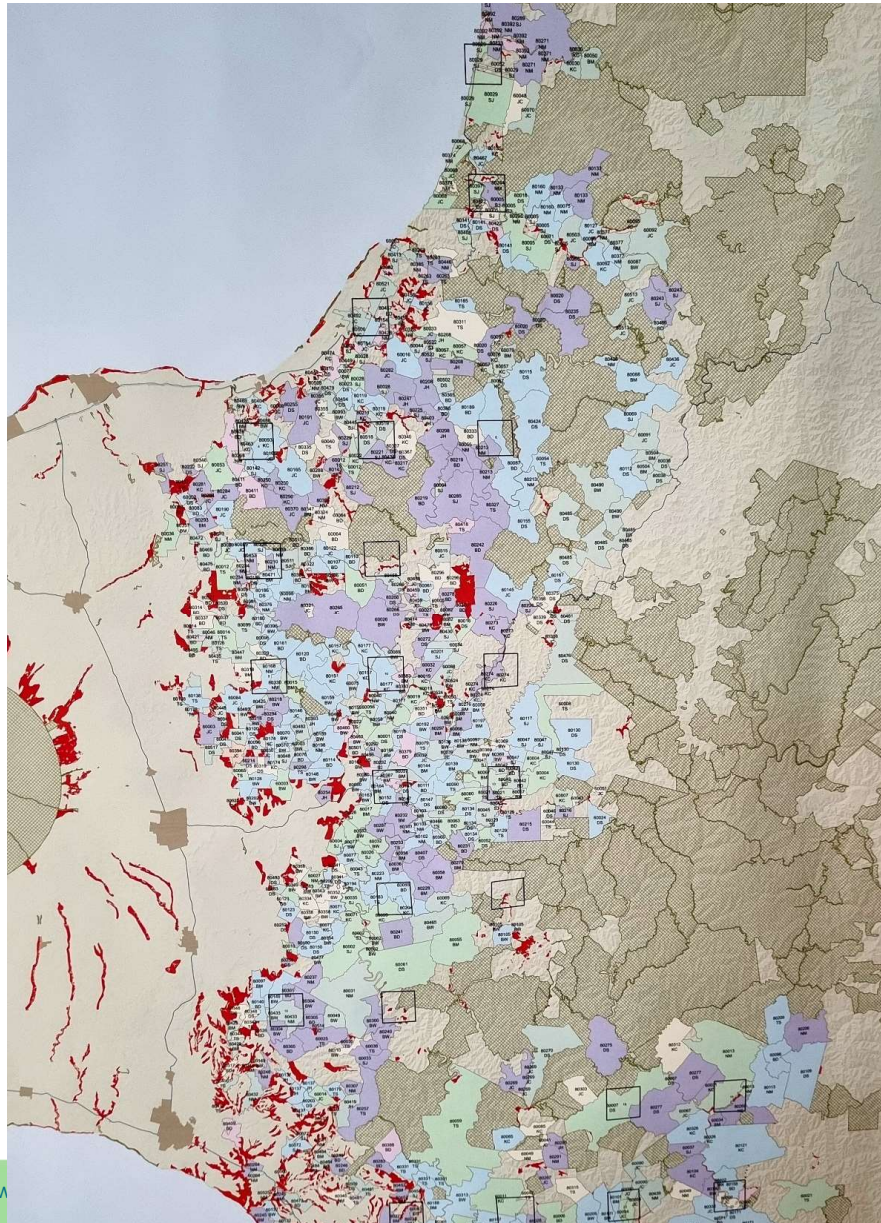
Soil plan targets

- Target: In the hill country: 50% (143 000ha) of private land having a property plan.
- Target: an increase from 83.9% to 89% privately owned land that is sustainably managed.
- Decrease in the area of bare sand in coastal country



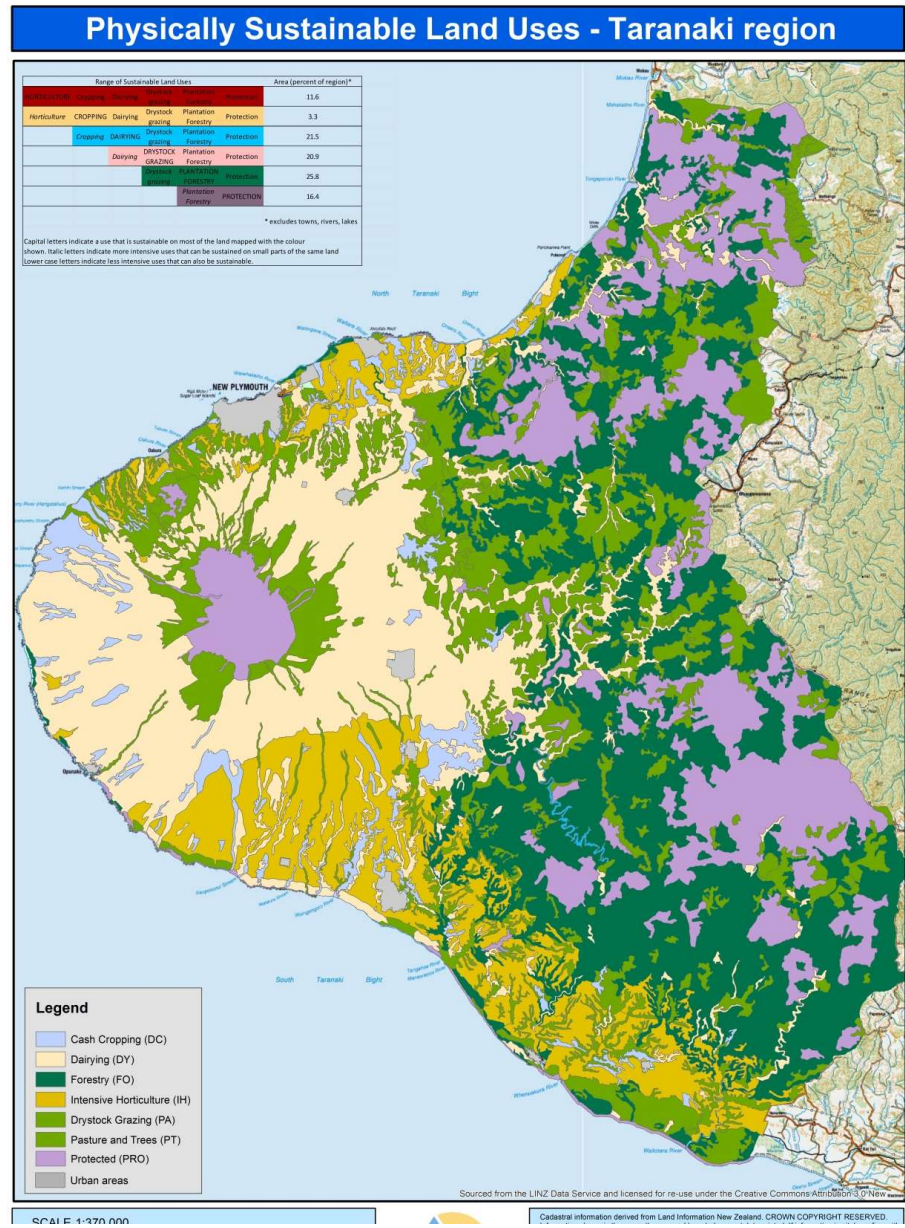
25

sites



SLU Background

- 1992 Sustainable Landuse Classes by DSIR Blaschke et al. so that TRC could develop policies to implement RMA.
- 1996 Review by D. Hicks with changes to principal and minor sustainable landuse classes, combining pasture and trees with drystock grazing.
- Indicate what soil con techniques can sustain the uses (Table 3).
- Using this now and as basis for FWFPs.

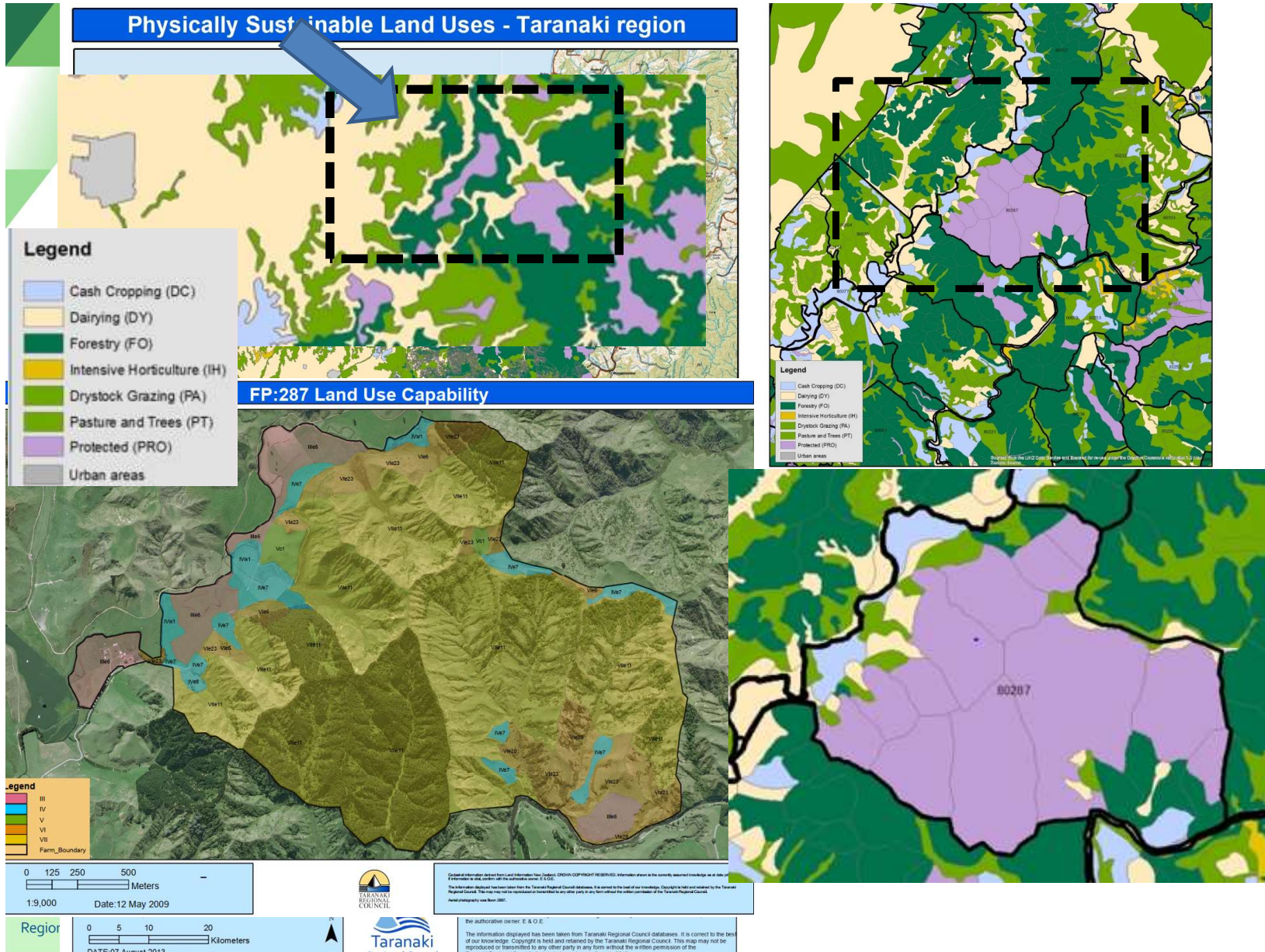


Methods

- Remote sensing, stereoscopy & GIS
- Physically sustainable land use database by DSIR based on LUC and hill country studies (Blaschke *et al* 1992, Hicks 1996)
- Most intensive physically sustainable land use within a range
- Eg. IH, CC, DY, GR, PT, FO, PR.
- Aerial photography ortho-rectified to digital

Methods contd.

- 25 representative sites throughout the hill country
- 22,000 ha or 7.2% sample size
- Detailed results to produce tables with stats on land use changes and vegetation changes
- Studies every 5 years from 1994 stereo pairs, to 2022 digital photography



Recap & Results

- Legally requirement Sec 35 for RMA
- Monitor the outcome of soil policies & plans – SLMP key approach
- 25 hill country sites used for regional picture (SEM). Matching Landuse with land type
- Increase from 83.9 to 88.3% sustainability
- Net decrease in the area of bare sand -3.2%
- Coverage of property plans for hill country 79% (242,000 hectares)

Future opportunities

- The issue with scale (only a regional snapshot)
- Farmscale LUC and LiDAR for SEM monitoring
- Farm scale LUC division for major and minor land uses using LiDAR
- Farm plan erosion risk from LUC mapping
- Connection to waterways
- Monitoring sediment outcomes of works under NPS-FW



Date: 11 June 2024

Subject: Assessment of Fish Mortalities within the Waingongoro and Kaupokonui Rivers

Author: A J Matthews, Director – Environment Quality

Approved by: S J Ruru, Chief Executive

Document: 3275521

Purpose

1. The purpose of this memorandum is to present the findings of a recent investigation into fish mortalities in the Waingongoro and Kaupokonui Rivers, which occurred in January 2024.

Executive summary

2. On 22 and 24 January 2024, the Taranaki Regional Council (the Council) was made aware of fish mortalities in the Waingongoro and Kaupokonui Rivers. These events were brought to the attention of Council officers through public enquiries communicated via Taranaki Fish and Game.
3. An investigation was initiated, with staff surveying the lower reaches of each stream on 25 January. Four species (longfin eel, redfin bully, brown trout and rainbow trout) were identified, with a total of 82 mortalities observed, extending from the mouth of each river to around 1-2km upstream. State of the environment monitoring data were also analysed to determine the environmental conditions at the time of these events.
4. While the cause of these mortalities is not entirely certain, environmental conditions at the time were likely to be a significant stressor. Both rivers experienced low flows and elevated water temperatures, with record maximum temperatures measured in both rivers throughout December and January 2024. Super-saturation levels of dissolved oxygen above 115% are considered toxic to fish; these levels were exceeded over a two week period during January, just prior to these events. Proliferations of periphyton and cyanobacteria were also noted in these catchments in the days leading up to these events.
5. Both catchments would benefit from additional riparian shading to help lower stream temperatures. We are exploring opportunities to build upon Council's successful riparian programme to ensure freshwater habitat is maximised, and developing a strategy to address barriers which may have prevented fish from seeking refuge further upstream. We will be seeking our community's views on these opportunities through a series of engagement events to inform the development of Council's proposed Land and Freshwater Plan throughout June – August 2024.
6. In January 2024, NIWA reported that a marine heatwave was causing hot and humid conditions, with record or near-record temperatures recorded across parts of New Zealand. Future climate projections for Taranaki include an increase in hot, dry summers and lower mean annual low flows in rivers and streams as a result of a warming climate in coming years. Opportunities to adapt to a changing climate,

and mitigate effects arising from water and land use activities, are being actively investigated as part of the Council's science and policy work programmes. New investment to build our knowledge and ability to respond to the effects of climate change has been provided through Council's Long-term Plan 2024-2034.

7. The memorandum sets out a number of recommendations including: improvements to data collection and reporting; development of Council's proposed Land and Freshwater Plan; identifying and prioritising areas for freshwater improvement; and engagement with tangata whenua, Taranaki Fish and Game and central government agencies to develop a response procedure, should events such as these occur in future.

Recommendations

That Taranaki Regional Council:

- a) receives the memorandum Assessment of fish mortalities within the Waingongoro and Kaupokonui Rivers observed in January 2024
- b) notes the findings and recommendations therein.

Background

8. On 22 and 24 January 2024, the Council received notification via Taranaki Fish and Game that members of the public had encountered significant fish mortalities in the lower reaches of the Waingongoro and Kaupokonui Rivers, respectively.
9. Following notification from Taranaki Fish and Game, observational surveys were undertaken by Council Officers on 25 January 2024, extending from the mouths of the Waingongoro and Kaupokonui Rivers to approximately 1-2km upstream. In total, 27 dead fish were recorded in the Waingongoro River and 55 dead fish in the Kaupokonui River. Species included longfin eels, redfin bullies, and both rainbow and brown trout. Both live and dead fish were observed and recorded and, where possible, were collected for species identification.
10. Mass fish deaths are generally associated with water quality changes, pesticide/chemical pollution, or disease/infection. Because they are mobile, fish will tend to avoid adverse environmental conditions and swim to another area to avoid harm. However, if a large proportion of the waterway is affected, there are barriers to movement, or the adverse conditions appear very rapidly, then fish may be unable to relocate. Mass mortalities can occur in both freshwater systems and estuarine systems and are generally more likely to occur during the summer months. In many cases, despite investigation, the exact cause remains unknown.
11. Fish mortality events have been known to occur in Taranaki however, in the past these have been linked to significant pollution events. For example, in February 2020, an unauthorised discharge of ammonia entered the Tawhiti Stream via the Silver Fern Farms Ltd stormwater network. The discharge led to the deaths of numerous fish (including shortfin and longfin eels) along a 13 km reach of the Tawhiti Stream. The company was prosecuted, with a fine of \$337,500 imposed. In February 2011, dead fish were found in the Mangaone Stream (Waiwhakaiho catchment) following the discharge of hydrolysed urea from an AA Contracting Cleanfill site. Prosecution of Ravensdown Fertiliser Co-operative Limited, AA Contracting Ltd and a local contractor resulted in fines totalling \$127,500.
12. Although it cannot be completely ruled out, there were no obvious pollution events or direct discharges identified within either catchment in January 2024. As these fish deaths occurred concurrently in two catchments with similar water quality characteristics, it appears unlikely that they can be attributed to separate and isolated pollution events.

Discussion

13. Council officers were able to draw on river flow, water quality and ecological data to determine the likely drivers of these events, highlighting the importance of Council's state of the environment monitoring programmes. The collection of continuous river water quality and flow data, in particular, were critical to informing this investigation.
14. Around the time of these events, river flows were relatively low. Flows in both rivers reached or fell below mean annual low flow values throughout January 2024.
15. Both the Waingongoro and Kaupokonui Rivers displayed a deviation of up to 5°C of heating beyond median water temperatures for the month of January. Water temperatures exceeded the highest recorded water temperatures in both rivers over multiple consecutive days. The Waingongoro River exceeded the previous highest recorded water temperature of 26.05 °C from 19 - 22 January, reaching 26.77 °C on 20 January. The Kaupokonui River exceeded the previous highest recorded water temperature of 26.88 °C on 12 days including 17 – 22 January 2024, peaking at 28.98°C 20 January. The highest recorded temperatures reached the lower end of the lethal range (27.0 to 39.7°C) for some New Zealand freshwater fish, and exceeded the preferred temperature range (16.1 - 26.9°C) for the majority of species.
16. Dissolved oxygen (DO) reached super saturation levels during the day, then dropped back to within a normal range at night. Super saturation levels of DO above 115% can cause significant death rates and are considered hyperoxic to fish. This level was breached on 15 days during January 2024.
17. Increased algal and periphyton growth can result in elevated photosynthesis during the height of the day, causing dissolved oxygen levels to spike. Periphyton observations were made at both river mouths and along the Kaupokonui River in January 2024. Both periphyton and cyanobacteria were present, following a significant accrual (algal growth) period of nearly two months since the last significant flow event.
18. Riparian planting within the Waingongoro and Kaupokonui catchments is segmented and patchy in places. Additional shading would help to minimise excessive heating, particularly in areas where the flow is very slow moving.
19. The presence of upstream barriers may have prevented fish travelling further up the catchment to seek refuge from the extreme conditions. Barriers preventing fish from reaching improved habitat conditions could be a significant factor in this event, and this will be further investigated as we develop a regional strategy and action plan to improve fish passage.
20. The fish mortality events which occurred in the Waingongoro and Kaupokonui Rivers are likely the result of a number of environmental factors occurring concurrently. These factors included record high water temperatures, coupled with high pH, super-saturated dissolved oxygen concentrations, and low river flows. The proliferation of periphyton/cyanobacteria observed at the time of these events indicated that these conditions had persisted in the days/weeks prior.
21. It is noted that in January 2024, NIWA reported that a marine heatwave was causing hot and humid conditions, with record or near-record temperatures recorded across parts of New Zealand. Although NIWA scientists considered this to be an unusual event given the cooler and windier conditions we might expect during El Niño, climate modelling suggests we can expect to see more frequent and extreme heatwaves in future. Climate projections for Taranaki include an increase in hot, dry summers and lower mean annual low flows in rivers and streams in coming years (NIWA, 2022).
22. Opportunities to adapt to a changing climate, and mitigate effects arising from water and land use activities are being actively investigated as part of the Council's science and policy work programmes. This includes: the ongoing development of our proposed Land and Freshwater Plan to better manage water use; identifying practical ways to reduce land use impacts on water quality; removal/remediation of upstream barriers which may be preventing fish from finding refuge in the upper catchment; and improvements in the quality and extent of riparian cover. Council's Long-term Plan 2024-2034 also

includes dedicated investment to advance our knowledge and ability to respond to the effects of climate change.

23. The memorandum sets out a number of recommendations, including:
 - improvements to data and information collection and provision;
 - the future collection of specimens for autopsy purposes to identify potential cause(s) of mortality;
 - developing and implementing a fit-for-purpose water allocation framework through Council's proposed Land and Freshwater Plan;
 - identifying new or expanded riparian areas for planting and shading; and
 - prioritising upstream barriers for fish passage improvement, through the development of a Fish Passage Action Plan.
24. Finally, developing a response procedure for fish mortality events will also help to ensure appropriate notification and engagement with other parties, should events such as these occur in future. This would include iwi/hapū and key stakeholders such as the Department of Conservation, Taranaki Fish and Game, and the Ministry for Primary Industries. Such a procedure would need to be developed in consultation with those partners and parties.

Financial considerations—LTP/Annual Plan

25. This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Recommendations will be implemented within approved budgets.

Policy considerations

26. 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

27. 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.
28. The memorandum includes recommendations around improving our response to these events should they reoccur, including how we notify and engage with iwi/hapū and key stakeholders at the outset of the response.

Community considerations

29. 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.
30. Council's response to these events was in part due to swift notification the local community, and Taranaki Fish and Game. This highlights the value of open communication channels and the ability of Council Officers to respond quickly to events such as these. Council officers will seek to engage with community groups and central government agencies, alongside tangata whenua, to develop an appropriate response procedure, as per the recommendation set out in this memorandum.

Legal considerations

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

Appendices/Attachments

Document 3243494: [Assessment of fish mortalities within the Waingongoro and Kaupokonui Rivers observed in January 2024](#)



Memorandum

To Thomas McElroy - Science and Technology Manager
From Finnley Binsbergen - Freshwater Scientist
Document 3243494
Date 8 May 2024

Assessment of fish mortalities within the Waingongoro and Kaupokonui Rivers observed in January 2024

Overview

On 22 and 24 January 2024, the Taranaki Regional Council (the Council) was made aware of significant fish mortalities in both the Waingongoro and Kaupokonui Rivers. These events were brought to the attention of the Council through public enquiries communicated via Taranaki Fish and Game.

In response the Council initiated an investigation, performing a river walk along the lower reaches of each stream and undertaking a desktop investigation, analysing continuous river monitoring data to assess any environmental conditions which may have led to these events. During this survey, four species (longfin eel, redfin bully, brown trout and rainbow trout) were identified, with a total of 82 mortalities observed in the Waingongoro and Kaupokonui Rivers, extending from the mouth of each river to around 1-2km upstream.

While the cause of these events is not entirely certain, environmental conditions at the time were likely to be a significant stressor. Both rivers experienced low river flows and elevated water temperatures, with record maximum temperatures measured in both rivers throughout December and January 2024. Super-saturation levels of dissolved oxygen above 115% are considered toxic to fish; these levels were exceeded over a two week period during January, just prior to these events. Proliferations of periphyton and cyanobacteria were also noted in these catchments during January.

The Council has a programme of work underway to inform the development of future freshwater policy, including addressing the impacts of climate change on freshwater. We are also exploring opportunities to build upon Council's successful riparian programme to ensure freshwater habitat is maximised, and developing a strategy to address barriers which may have prevented fish from seeking refuge further upstream. This memorandum sets out a number of recommendations in relation to these opportunities, along with ways in which we can improve data and information collection to better understand these types of events.

Background and discussion

On 22 and 24 January 2024, the Council received notification via Taranaki Fish and Game that members of the public had encountered significant fish mortalities in the lower reaches of the Waingongoro and Kaupokonui Rivers, respectively.

Observational surveys

On 25 January Council officers undertook observational surveys extending from the mouths of the Waingongoro and Kaupokonui Rivers to approximately 1-2km upstream (Figures 1-3). Both live and dead fish were observed and recorded and, where possible, were collected for species identification. Estimates of length or size class were also made for bullies.



Figure 1 Waingongoro River, section of river surveyed for observations of fish mortalities, extending from upstream (near Kawhai Road) to downstream (at the coast) (as indicated by red points)



Figure 2 Waingongoro River below State Highway 45, section of river surveyed for observations of fish mortalities (red points)



Figure 3 Kaūpokonui River, section of river surveyed for observations of fish mortalities, extending from north of Kaūpokonui Heads Road (upstream) to the coast (downstream), as indicated by red points

In total, 27 dead fish were recorded in the Waingongoro River and 55 dead fish were recorded in the Kaūpokonui River. Of those found in the Waingongoro River, four were confirmed to be longfin eels, 11 confirmed to be redfin bully, eight to nine unidentified eels and three to four unidentified trout. In the Kaūpokonui River, six were confirmed to be redfin bully, two confirmed to be rainbow trout, one confirmed to be brown trout, six unidentified bully, five unidentified trout and 43 unidentified eels. Overall there were four different species of dead fish found in each river (longfin eel, redfin bully, brown trout and rainbow trout).

It is noted that the total mortality rate may be higher than that observed by Council officers and members of the public. Some dead fish may not have been discovered for various reasons, including those potentially washed out to sea, or subject to predation. Fish mortalities observed by both the public and council officers are set out in Table 1.

Table 1 Fish mortality observations in the Waingongoro and Kaūpokonui Rivers gained from council and public observations

Catchment	Waingongoro River			Kaūpokonui River			Total for each species
	Fish species/ Collected By or Observed By	TRC	Public	TRC	Public	Size range	
Date	25/01	22/01	Size range	25/01	24/01		
Longfin eel (<i>Anguilla dieffenbachii</i>)	4 2		20cm-50cm				4 2
Redfin bully (<i>Gobiomorphus huttoni</i>)	11 1		S, M, L	6 27		S, M, L	17 28
Rainbow trout (<i>Oncorhynchus mykiss</i>)				1	1	40cm	2
Brown trout (<i>Salmo trutta</i>)				1			1
Torrentfish (<i>Cheimarrichthys fosteri</i>)				1		12cm	1
Unidentified bully*		Observed		6		S, M, L	6
Unidentified trout*	1	3-4			5	≤50cm	8 1
Unidentified eel*	3 1	5-6	10cm-50cm	7 1	28	20cm-80cm	43 2
Number of species	3	3		5	2		
Total abundance	18 5	8-10 (9)		21 29	34		
Overall number of species identified in investigation	2			4			5
Overall abundance	27 5			55 29			82 34

Dead fish observed and/or collected denoted in red

Fish observed alive denoted in blue

Observation of dead rainbow trout in Kaupokonui River at intake weir of Fonterra Kapuni in green

Observed (any fish observed but not counted)

S, M, L (small, medium, large) size classes sourced from Joy et al. 2013.

*Unidentified fish not counted as an additional species

N.B. Double up of counts from TRC and public possible however, unlikely due to counts occurring on different days and differing sections of river.

A number of fish were found alive in both the Waingongoro and Kaūpokonui Rivers. Some of these fish were in poor health and were unlikely to survive. In the Waingongoro River, two longfin eels were recorded and captured alive; both appeared to be extremely docile, were not under cover and one had severe facial damage. An unidentified eel which was still alive was also recorded but appeared to have sustained damage to its eyes. One large unidentified trout was also recorded alive.

In the Kaūpokonui River, 27 redfin bully were recorded and a number were captured alive. One torrentfish was captured alive, which also appeared docile. One unidentified eel was also recorded alive, this specimen also displayed signs of facial damage.

This unidentified eel in the Kaūpokonui River and the longfin eels captured in the Waingongoro River both showed signs of extensive facial growths, although the cause of these is unknown.

Data and information

The Council collects a range of data and information on river flows and levels, water quality and ecosystem health. River flow and level data, along with temperature, dissolved oxygen, conductivity, pH, barometric pressure and turbidity data have been sourced from continuous monitoring sites located at State Highway 45 in the Waingongoro River and Upper Glenn Road in the Kaūpokonui River. Additionally, periphyton and cyanobacteria data were collected during regular surveys.

Physico-chemical data analysis

Around the time of these events, river flows were relatively low. Flows in the Waingongoro River reached or fell below the mean annual low flow (MALF) threshold of 1.429m³/s over four days in January from 25 – 27 and 31 January 2024. The minimum low flow value reached on 25 January was 1.214m³/s. Low flows continued through February with 22 days breaching the MALF, on 1 – 3 and 7 – 29 February 2024. The minimum value reached 1.003m³/s on 29 February 2024 (Figure 10).

In the Kaupokonui River, flow conditions reached or fell below the MALF of 0.672m³/s on three days in January from 25 – 27 January 2024. The minimum low flow value reached on 26 January was 0.644m³/s. Similarly, low flows also continued through February with 17 days breaching the MALF, on 1 – 2 and 14 – 29 February 2024. The minimum value reaching 0.557m³/s on the 29 February/ 1 March 2024 (Figure 11).

These low flow conditions lead to minimal thermal buffering, leaving these water bodies susceptible to rapid responses to air temperature and sunlight.

Low flows can be partially attributed to elevated air temperatures and low soil moisture percentage. Data sourced from the Kaupokonui at Glenn Road continuous environmental monitoring station displayed an increase of 4°C from the median air temperature values in January (Figure 8). While soil moisture percentage displayed a deviation from the median values in January of -7% (Figure 9). High temperatures, coupled with low soil moisture, can result in increased evapotranspiration, meaning moisture is lost to the atmosphere and river levels remain low. These conditions are likely a consequence of the prevailing El Nino weather pattern.

During January 2024, temperatures in the Waingongoro and Kaupokonui Rivers exceeded the highest recorded water temperatures on record over multiple consecutive days. The Waingongoro River had exceeded the previous highest recorded water temperature of 26.05°C over four days from 19 - 22 January, reaching 26.77 °C at 16:30pm on 20 January 2024 (Figure 4). The Kaupokonui River exceeded the previous highest recorded water temperature of 26.88°C over 12 days including 26 and 29 December 2023, and 10 – 13, and 17 – 22 January 2024. The new highest recorded water temperature for the Kaupokonui River measured 28.98°C at 15:30pm on 20 January 2024 (Figure 4).

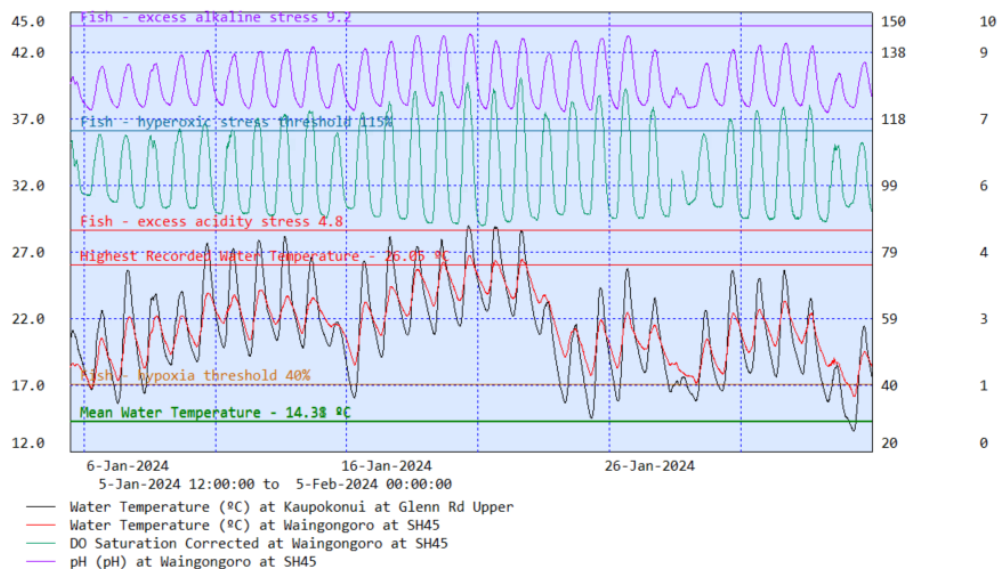


Figure 4 Water temperatures in the Kaupokonui and Waingongoro Rivers, dissolved oxygen (%) and pH in Waingongoro River¹

¹ Dissolved oxygen data adjusted for barometric pressure

Figure 4 also shows pH in the Waingongoro River fluctuating between 7 and 9. Dissolved oxygen (DO) levels reached super saturation levels during the day, then dropped back to within a normal range at night. Super saturation levels of DO above 115% can cause significant death rates and are considered hyperoxic to fish (Davis-Colley et al. 2013). This level was breached on 15 days during January 2024.

The upper lethal temperatures for twelve common freshwater fish range from 27.0 to 39.7°C, while the preferred temperatures span 16.1 - 26.9°C (Richardson et al. 1994). For longfin eel the upper lethal temperatures range from 25.0 - 37.3°C, while for shortfin eel the upper lethal temperatures range from 28.0 - 39.7°C (Richardson et al. 1994). Although redfin bully is not specified within the Richardson et al. (1994) study, crans bully, common bully and upland bully all have an upper lethal temperature of above 30°C, this can be used as an approximate indicator of redfin bully upper lethal temperatures. The preferred temperature range for Bully species (crans, common, upland) is 18.7 - 26.2°C (Richardson et al. 1994).

Figure 5 summarises thermal tolerances of native freshwater fish and macroinvertebrates (Olsen et al, 2012). Shown by this figure is the critical thermal maxima (in red), thermal preference (in blue), upper incipient lethal temperature (in green) and temperatures which may lead to behavioural and developmental effects (in orange). While the temperatures displayed in the Waingongoro and Kaupokonui lower catchments do not exceed the upper lethal temperature for New Zealand freshwater fish by much (if at all), the preferred temperatures for most freshwater fish were exceeded.

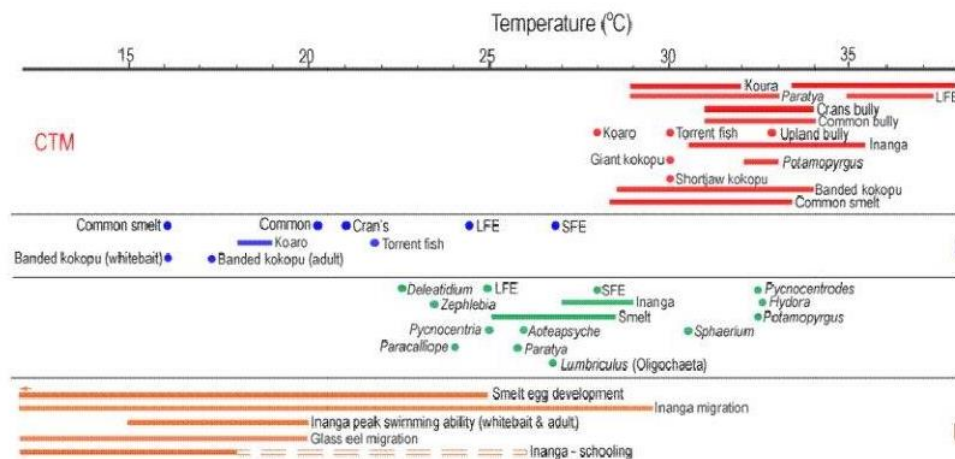


Figure 9
Summary of thermal tolerance of native fish and macroinvertebrates as expressed by critical thermal maxima (CTM - red), thermal preferences (blue), upper incipient lethal temperature (UILT – green) and behavioural and developmental effects (orange). Where CTM or UILT have been determined for multiple acclimation temperatures, the range is shown as a bar. Behavioural and developmental effects are shown as bars representing the range of temperatures when normal behaviour/development is apparent. Inanga schooling is dependent on acclimation temperature (for details see Table 3).

Figure 5 Summary of thermal tolerance of native fish and macroinvertebrates from Olsen et al. (2012)

When compared to historic data, water temperatures in January 2024 clearly deviated from median values (Figures 6 and 7). Both the Waingongoro and Kaupokonui Rivers displayed a deviation of up to 5°C of heating beyond median water temperatures for the month of January. Recorded temperatures in the Waingongoro River extend back to 2004, while in the Kaupokonui River records extend back as far as 1979.

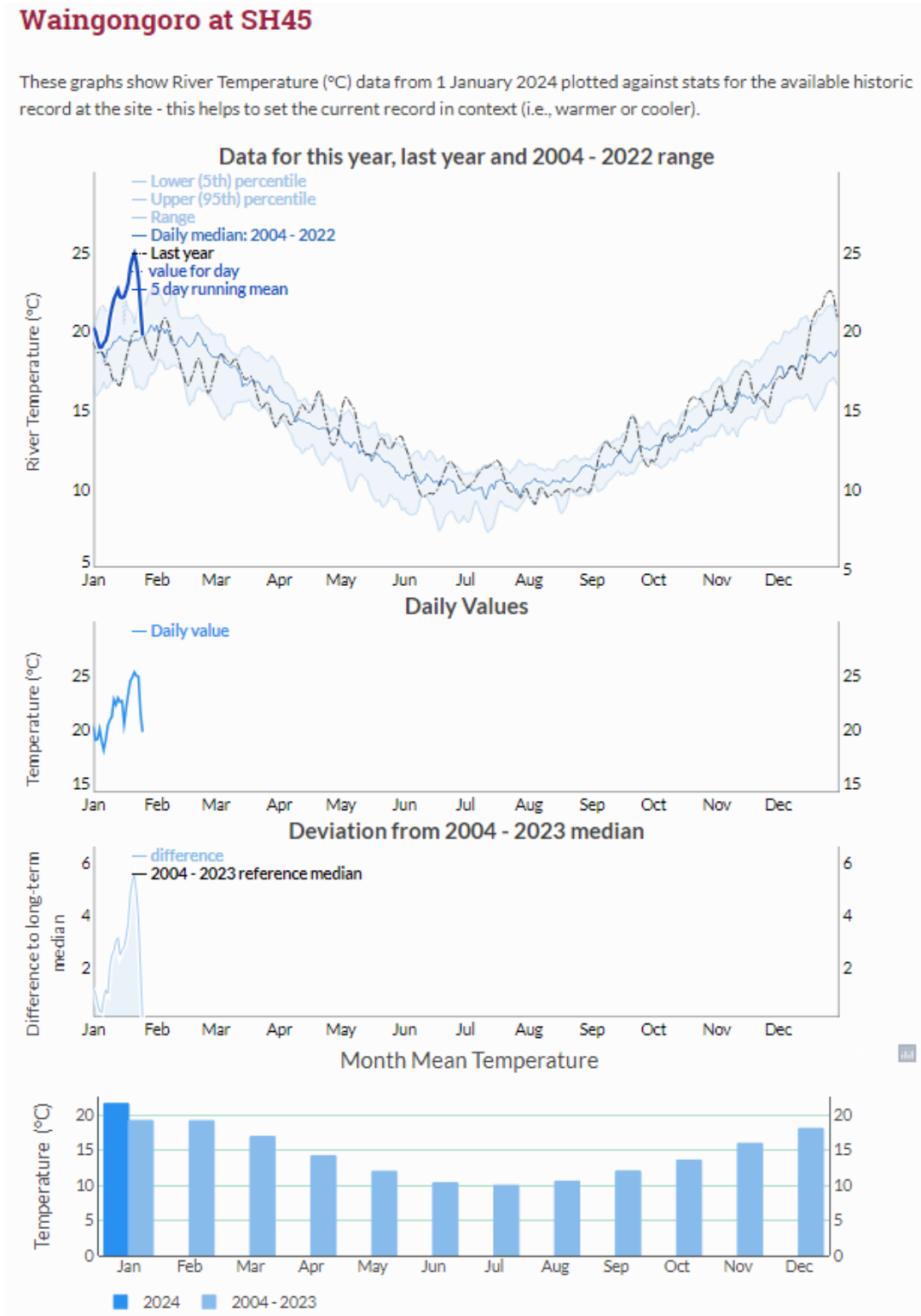


Figure 6 Waingongoro River historic water temperature data compared to January 2024

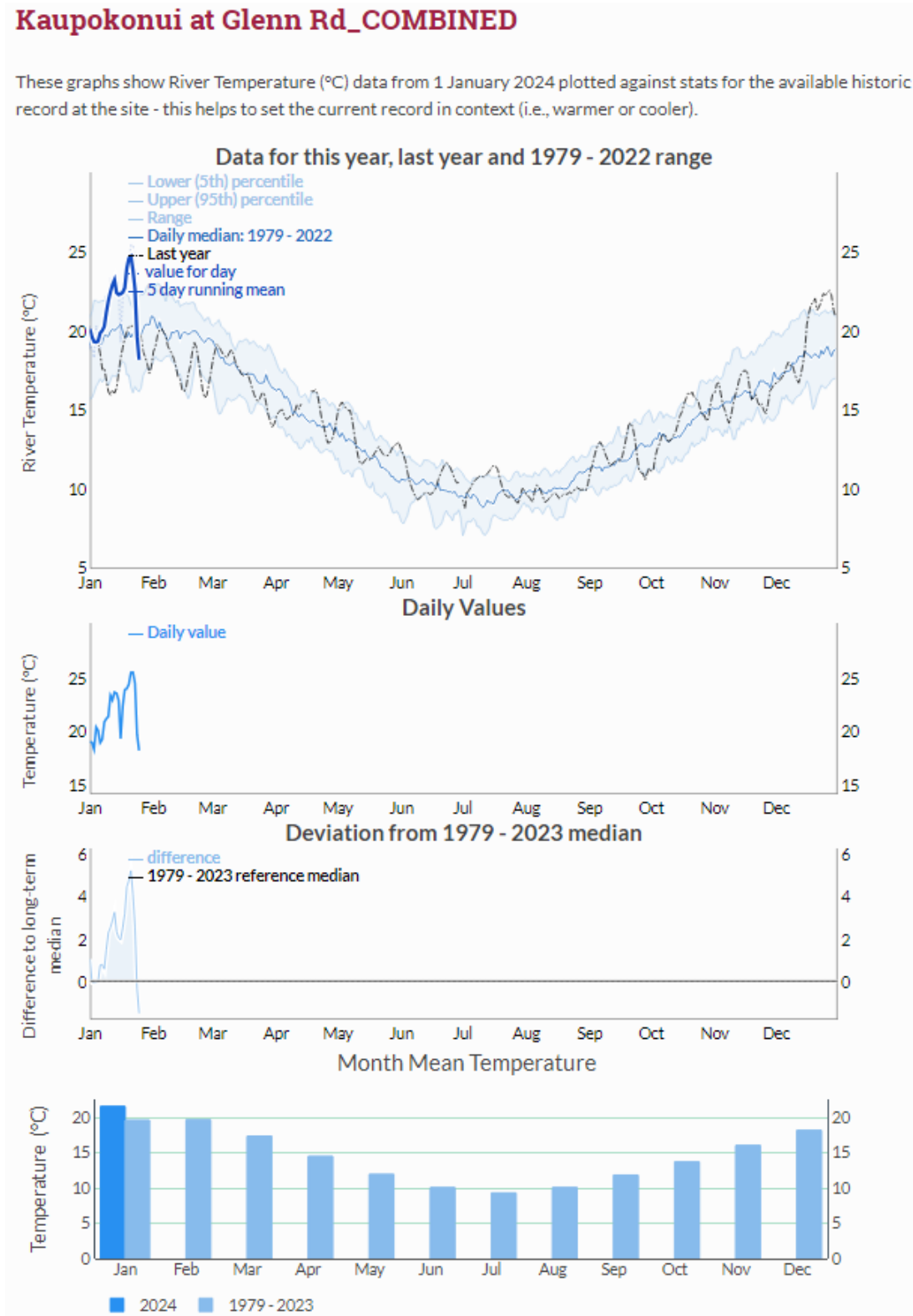


Figure 7 Kaupokonui River historic water temperature data compared to January 2024

Increased algal and periphyton growth can result in elevated photosynthesis during the height of the day, causing dissolved oxygen levels to spike and thus reaching the threshold for super saturation to the point of fish hyperoxia.

Periphyton observations were made at both river mouths during January 2024 as part of the "Can I Swim Here?" (CISH) summer recreational water quality monitoring programme. An initial assessment of these observations suggested that the coverage of thick mats and long filaments (two forms of conspicuous periphyton growth) was higher during the five surveys that had been carried out since November 2023 when compared with survey results from recent summers (Bittner, 2024). A separate assessment of periphyton coverage along the Kaupokonui River on 18 January 2024 showed a decrease in coverage of thin brown periphyton, and an increase in coverage of black cyanobacteria mats from upper catchment sites to lower catchment sites. Water temperature increased by 3.1°C from the upper most site near the national park to the river mouth site. It should also be noted that at the time of the survey it had been 59 days since the last high flow event exceeding three times the median flow, compared to five days at the same time in January 2023 (Bittner, 2024). Overall, this preliminary assessment indicates that periphyton and cyanobacteria were present, following a significant accrual period of nearly two months since the last significant flow event.

Catchment characteristics

Riparian planting within the Waingongoro and Kaupokonui catchments is segmented and patchy with some native and exotic planting present. The lack of riparian plant cover for many sections of these catchments increases the time and intensity of direct sunlight heating the water. The width of the channel in each of these rivers does make it difficult to achieve full shading in the absence of large mature trees however, more extensive partial shading would contribute to protecting the water from excessive heating. This may be exacerbated during low flows in areas where the flow is very slow moving or close to stagnant.

Another factor to consider is the presence of upstream barriers which may prevent fish travelling further into the catchment to find refuge from the extreme environmental conditions. The Greenfern Industries Ltd intake and hydro weir on the Waingongoro River approximately 17.3km from the coast does not provide for fish passage and is a barrier for most fish species. On the Kaupokonui River, the Upper Glenn Road weir footing still remains after the structure was partially removed in 2021. This concrete footing is only 5.2km from the coast and appears to have a perched flow over the remaining structure and is a potential barrier for many fish species. Adverse temperatures and environmental conditions alleviate as distance to the mountain decreases, however, barriers preventing fish from reaching improved habitat conditions could be a significant factor in this event.

Other considerations

Although not investigated, it is possible that there were effects on the macroinvertebrate communities of each river. The loss of fish and macroinvertebrate communities can have wider effects on the overall ecosystem. Macroinvertebrates are an important food source for fish, while fish are an important food source for birds, marine fish and people.

Fish are a useful indicator of water quality. While fish mortalities can occur as a result of poor water quality or pollution events, other effects such can include impacts on behaviour and overall fitness. Behavioural effects can range from emigration and reduced utilisation of affected habitat, to interruptions to spawning patterns, to disease or infection. Migrations during December and January are inclusive of many freshwater fish species. Glass eel migration is at its peak with potentially thousands of individuals travelling upstream during this period (McDowall, 2000). Lamprey are classified as threatened/ nationally vulnerable and migrate upstream as adults to spawn, while juveniles travel downstream to the ocean over the span of three to four years (McDowall, 2000). Compliance fish monitoring performed by the Council in the Kaupokonui

River above the Glenn Road weir in the summer of 2023-2024 detected many juvenile Lamprey. Potential impacts on fish migration and spawning have not been explored as part of this investigation, but cannot be ruled out.

Conclusion and recommendations

The fish mortality events which occurred in the Waingongoro and Kaupokonui Rivers cannot be attributed to a single causal factor, although it is possible that these events are the result of a number of environmental factors occurring concurrently. Record high water temperatures, coupled with high pH, super-saturated dissolved oxygen concentrations, low river flows, proliferation of periphyton/cyanobacteria, are all likely to have played a role in these fish mortality events. While the Council is not aware of any pollution events within either catchment during the affected period, it cannot be completely ruled out. However, as these events occurred concurrently in two catchments with similar water quality characteristics, it appears unlikely that fish mortalities would be attributed to separate and isolated pollution events.

Climate change may lead to events such as these becoming more frequent and of greater magnitude in the future. Opportunities to mitigate these effects, and those arising from water and land use activities, are being actively investigated as part of the Council's freshwater policy programme. These opportunities include reviewing Council's current approach to managing water use; identifying practical ways to reduce land use impacts on water quality; removing/remediating upstream barriers which may be preventing fish from finding refuge in the upper catchment; and improving the quality and extent of riparian cover. These are areas of focus for Council's current and future work programmes.

Recommendations for further work to address these issues, and actions to support any response to events such as this in future, are set out below.

Recommendations

1. Upstream barriers must be prioritised for fish passage improvements or completely removed altogether to provide access for fish to the upper catchment in both rivers respectively. The development of a Fish Passage Action Plan, to be undertaken in consultation with the community as required by the National Policy Statement for Freshwater Management 2020, will assist in this prioritisation.
2. Water allocation within these catchments should continue to be managed so that minimum flows are maintained. A new water allocation framework is currently being developed as part of the Council's proposed Regional Land and Freshwater Plan, which will also account for projected climate change impacts. A recommended framework will be presented to the community for feedback at the next round of consultation in mid-2024.
3. A targeted investigation to identify new or expanded riparian margins for planting, where this is practicable, should be considered. This would include areas of stagnant/slow moving sections of river to help reduce the impacts of high temperatures in sensitive areas; along with areas in which no riparian planting is present. Special consideration should be given to selecting plant and tree species with the greatest shading potential. The Council's Riparian Management Programme has recently transitioned into an auditing phase which will help to identify streambank sections where further improvements can be made.
4. Additional continuous water quality and flow data could potentially be made available on the website in a format that is useful for external parties. For example, the graphs presented in Figures 6 and 7 include useful statistics which help to place current data within the context of longer-term records. Additionally, automated alerts based on pre-defined criteria (e.g. high temperature thresholds) could help Council to undertake proactive measures to monitor future events.

5. Should further events occur in future, collecting specimens for autopsy purposes could provide useful additional evidence regarding potential cause(s) of mortality. Additional investigations/ surveys on macroinvertebrates should also be considered.
6. Developing a response procedure for fish mortality events will also help to ensure appropriate notification and engagement with other parties, should events such as these occur in the future. This would include iwi/hapū and key stakeholders such as the Department of Conservation, Taranaki Fish and Game, and the Ministry for Primary Industries. Such a procedure would need to be developed in consultation with those partners and parties.

References

- Boustead C N. 1982. *Fish Diseases Recorded in New Zealand, with a Discussion on Potential Sources and Certification Procedures*. New Zealand Ministry of Agriculture and Fisheries Wellington.
- Franklin P. 2013. Dissolved oxygen criteria for freshwater fish in New Zealand: a revised approach. *New Zealand Journal of Marine and Freshwater Research*.
- Davies-Colley R, Franklin P, Wilcock B, Clearwater S, and Hickey C. 2013. *National Objectives Framework – Temperature, Dissolved Oxygen & pH Proposed thresholds for discussion*. Client report prepared for Ministry for the Environment.
- Richardson J, Boubee J A T, and West, D W. 1994. Thermal Tolerance and Preference of Some Native New Zealand Freshwater Fish. *New Zealand Journal of Marine and Freshwater Research*. Vol. 28, no. 4.
- Olsen D A, Tremblay L, Clapcott J and Holmes R. 2012. *Water temperature criteria for native aquatic biota*. Auckland Council Technical Report 2012/036.
- McDowall R M. 2000. *The reed field guide to New Zealand freshwater fishes*.
- Smith J. 2014. *Freshwater Fish Spawning and Migration Periods*. NIWA.
- Joy M, David B, and Lake M. 2013. *New Zealand Fish Sampling Protocols Part 1 Wadeable Rivers & Streams*.
- Bittner A. 2024. *Periphyton assessment in relation to fish mortality events in the Waingongoro and Kaipokonui rivers - January 2024*. TRC technical memorandum. Document 3261838.

Appendix I Supplementary graphs and figures

Kaupokonui at Glenn Rd

These graphs show Air Temperature (°C) data from 1 January 2024 plotted against stats for the available historic record at the site - this helps to set the current record in context (i.e., hotter or cooler).

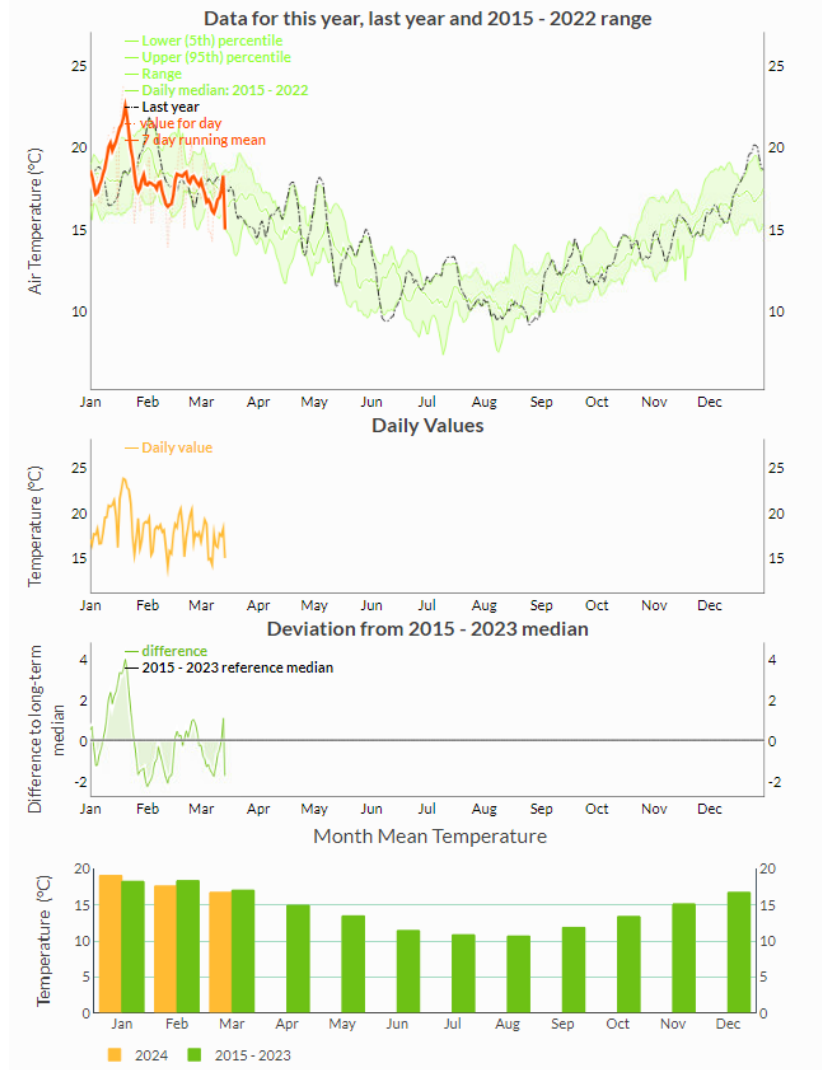


Figure 8 Kaupokonui at Glenn Road historic air temperature data compared to records for January 2024

Kaupokonui at Glenn Rd

These graphs show Soil Moisture % data from 1 January 2024 plotted against stats for the available historic record at the site - this helps to set the current record in context (i.e., wetter or drier).

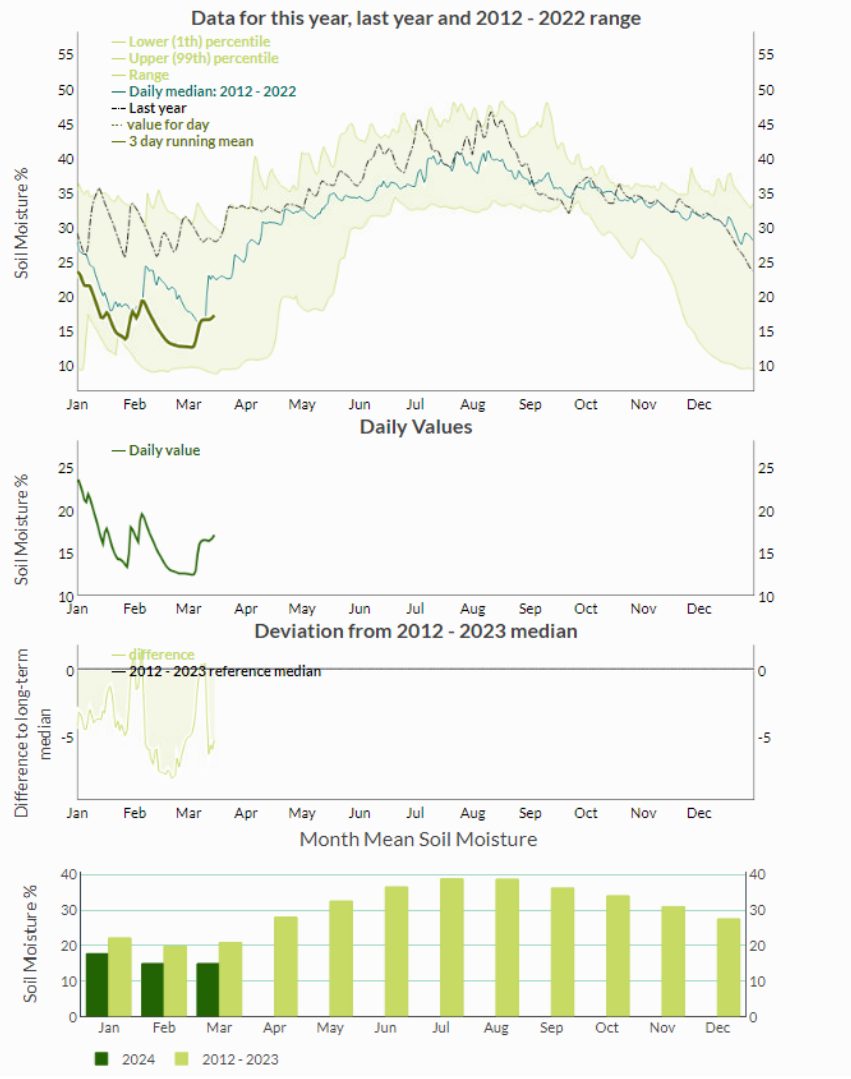


Figure 9 Kaūpokonui at Glenn Road historic soil moisture percentage data compared to records for January 2024

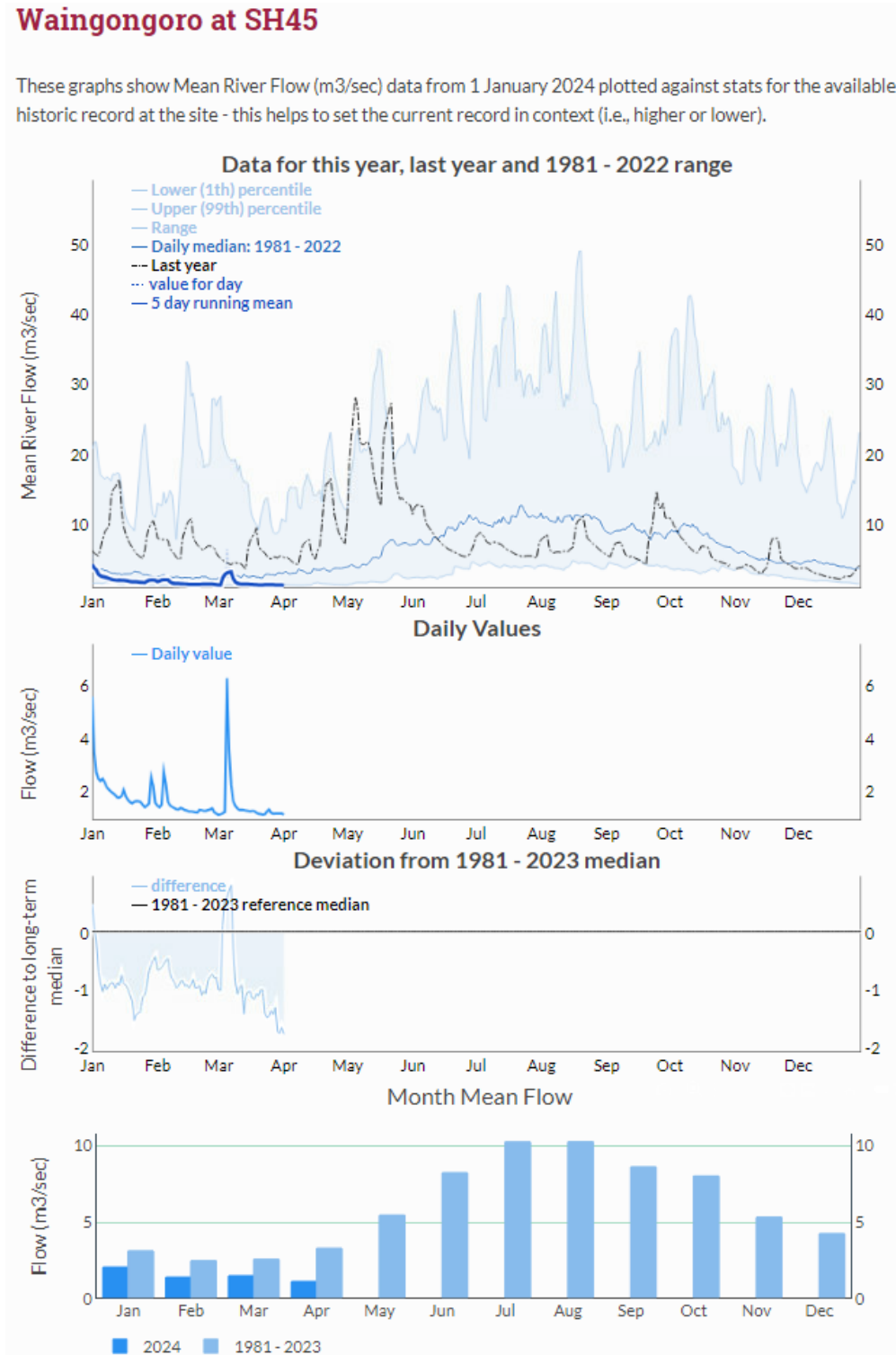


Figure 10 Mean river flow in the Waingongoro River compared with all available historic records

Kaupokonui at Glenn Rd_COMBINED

These graphs show Mean River Flow (m³/sec) data from 1 January 2024 plotted against stats for the available historic record at the site - this helps to set the current record in context (i.e., higher or lower).

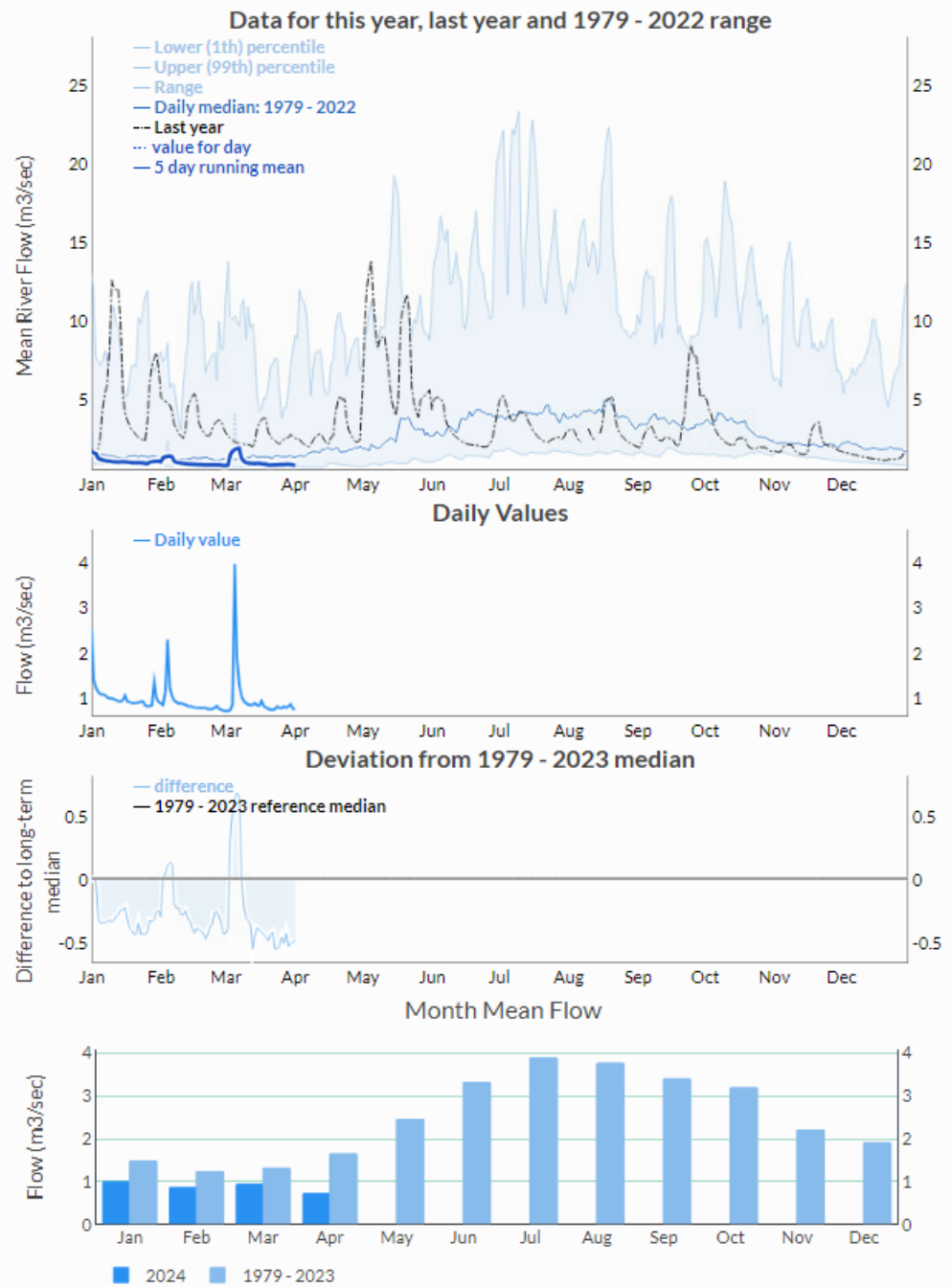


Figure 11 Mean flow in the Kaupokonui River compared with all available historic records

Operations and Regulatory Committee Public Excluded Minutes 30 April 2024

In accordance with section 48(1) of the Local Government Official Information and Meetings Act 1987, resolves that the public is excluded from the following part of the proceedings of the Operations and Regulatory Committee Meeting on Tuesday 11 June 2024.

The matters to be considered while the public is excluded, the reason for passing this resolution in relation to the matter, and the specific grounds under section 48(1) of the *Local Government Official Information and Meetings Act 1987* are as follows:

Item 11: Confirmation of public excluded Operations and Regulatory minutes – 30 April 2024

That the public conduct of the whole or the relevant part of the proceedings of the meeting would be likely to result in the disclosure of information for which good reason for withholding would exist under section 6 (a) and [section 7](#) (2) (a) and (2) (g) of the *Local Government Official Information and Meetings Act 1987*.

AGENDA AUTHORISATION

Agenda for the Operations and Regulatory Committee meeting held on Tuesday 11 June 2024.

Confirmed:



31 May, 2024 3:42:03 PM GMT+12

A J Matthews
Director-Environment Quality

Approved:



30 May, 2024 7:23:59 PM GMT+12

S J Ruru
Chief Executive