HAWKE'S BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Meeting of the Hawke's Bay Regional Council Māori Committee

Date: Wednesday 6 March 2024

Time: 10.00am

Venue: Council Chamber
Hawke's Bay Regional Council
159 Dalton Street
NAPIER

Attachments Excluded From Agenda

Manaaki Whenua
Landcare Research

Sediment and cultural values in Wairoa: overview report

Prepared for: Wairoa Tripartite (Tātau Tātau o te Wairoa, Hawke's Bay Regional Council, Wairoa District Council)

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Sediment and cultural values in Wairoa: overview report

Contract Report: LC4422

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Summary

Te Wairoa Hōpūpū Hōnengenenge Mātangi Rau (also known as the Wairoa River) and its tributaries are significant to the iwi and hapū of Te Rohe o Te Wairoa. They are valued ecologically, and for recreation and mahinga kai, but the river is heavily affected by sediment.

The Whitiwhiti Ora project team and the Wairoa Tripartite (comprising Tātau Tātau o te Wairoa , Hawke's Bay Regional Council, and Wairoa District Council) formed a partnership to gain a better understanding of the relationship between sediment and cultural values in and around Te Wairoa Hōpūpū Hōnengenenge Mātangi Rau and its tributaries. Specifically, we sought to understand:

- the cultural values and the current health of cultural values
- how sediment affects these values
- the sources of sediment and the likely impacts of climate change
- what mitigations are possible to reduce sediment loads.

To understand the cultural values, a kaupapa Māori-based conceptual framework for cultural monitoring was adapted for use in this project. The framework is based on te ao Māori (Māori world view) concepts of holistic interconnectedness (whakapapa), the reciprocal interactions of atua (ancestors), whenua (land), and tāngata (people), and the shared mauri (lifeforce) that determines the health of each.

To understand the current health of cultural values, the framework was used to conduct 92 assessments in the Te Wairoa Hōpūpū Hōnengenenge Mātangi Rau and Waiau tributary. The results showed that the current health of cultural values is variable, with many of the physical indicators, especially those relating to sediment, assessed as being in poor health. However, indicators of connectedness to the river, and use of cultural practices and the ability to practise cultural ethics such as manaakitanga, kaitiakitanga, and whānaungatanga, were assessed as being in better health. These assessments also showed variability in different reaches of the river and over time, and after storm events.

While sediment loss and erosion are a natural feature of the Wairoa catchment, the rate of sediment loss has increased because of changes in land use from native forest to pasture, and forestry and farming land-use practices. Current sediment losses are estimated to be approximately 240% higher than before human arrival. This significant increase in sediment is of particular concern, as sediments affect cultural values in multiple ways: directly, via impacts on mahinga kai, and indirectly, by affecting cultural practices.

A key insight from these data is that although sediment affects cultural values in many ways, and its reduction should be an area of focus, sediment reduction isn't the only way to improve cultural values in the Wairoa catchment.

To understand the sources of sediment and the likely impacts of climate change, the SednetNZ model was run for the Wairoa catchment. Baseline modelling indicates that the predominant source of sediment losses is from shallow landslides, in particular from land under pasture. Using a series of regional climate projections, 'best case' and 'worst case'

scenarios were run, which showed estimated increases in sediment in the waterways of 10–37% by mid-century and 7–69% by late century.

To understand what mitigations are possible to reduce sediment loads, the Tripartite devised a 'best effort' land-use scenario comprising some reversion to native scrub on the steepest slopes, space planting of trees on moderately sloping grasslands, and riparian fencing on some waterways. This resulted in considerable reductions of between 43 and 58% for the worst- and best-case scenarios by the end of the century when compared with current land use under climate change scenarios. The best-effort scenario also yielded significant improvements compared with the current baseline.

A high-level economic evaluation of this best-effort scenario indicated that it could have significant impacts if implemented fully, and suggested three measures to reduce the economic impacts:

- assist with the cost of implementing mitigation measures
- stimulate greater intensification and land-use change on the remaining area
- undertake smaller-scale mitigation measures.

A project evaluation based on the Tripartite Working Agreement was conducted by members of the project team. From this evaluation several key factors were identified for project success:

- the time spent at the beginning of the project to build relationships and to find a common area of interest
- the commitment to outcomes for Wairoa and investment in local people and local knowledge
- the strong Tripartite leadership
- the resources for supporting mātauranga locally
- the intent to work across knowledge systems, and the preparedness to listen, learn and change, especially when science framing was too dominant
- the willingness to adapt to challenges, such as Covid and Cyclone Gabrielle, and to opportunities, such as pivoting some work in response to the cyclone
- the disposition and commitment of the team members.

1 Introduction

Te Wairoa Hōpūpū Hōnengenenge Mātangi Rau (also known as the Wairoa River) and its tributaries are significant to the iwi and hapū of Te Rohe o Te Wairoa and are valued ecologically and for recreation and mahinga kai.

In December 2019 members of the Whitiwhiti Ora[1] project team met with Hawke's Bay Regional Council to discuss the possibility of conducting a case study in the Wairoa District. Over the ensuing 16 months, until April 2021, the Wairoa Tripartite (Tātau Tātau o te Wairoa, Hawke's Bay Regional Council (HBRC), Wairoa District Council, and the Whitiwhiti Ora project team met multiple times, during which they developed an understanding of the aspirations of the Tripartite partners, the Wairoa context, and the principal challenges facing the area.

Out of this period of relationship building a common area of interest emerged: the relationship between sediment and cultural values and mahinga kai. Based on this common interest, a project outline was agreed, focusing on gaining a better understanding of this relationship in and around Te Wairoa Hōpūpū Hōnengenenge Mātangi Rau and its tributaries. Specifically, the aims were to understand:

- the cultural values and current health of cultural values
- how sediment affects these values
- the sources of sediment and the likely impacts of climate change
- what mitigations are possible to reduce sediment loads.

A project team was formed[2] and a project relationship document[3] was agreed. Figure 1 shows the project timeline.

[1] A research programme in the Our Land and Water Toitū te whenua Toiora te Wai National Science Challenge https://ourlandandwater.nz/project/land-use-opportunities/ .

[2] Appendix 1.

[3] Appendix 2.

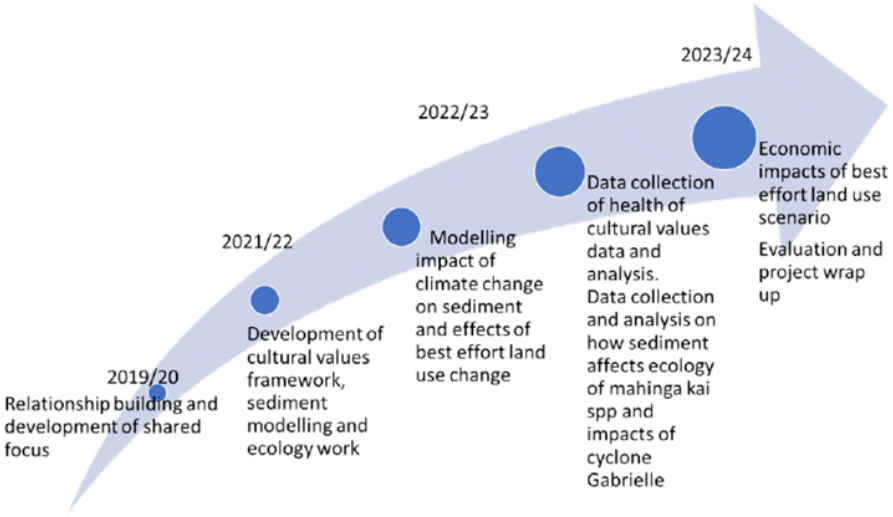

Figure 1. Project timeline.

Figure 2 shows the information flows between different parts of the project and the core team, and

Table 1 shows the full reports from each part of the project.

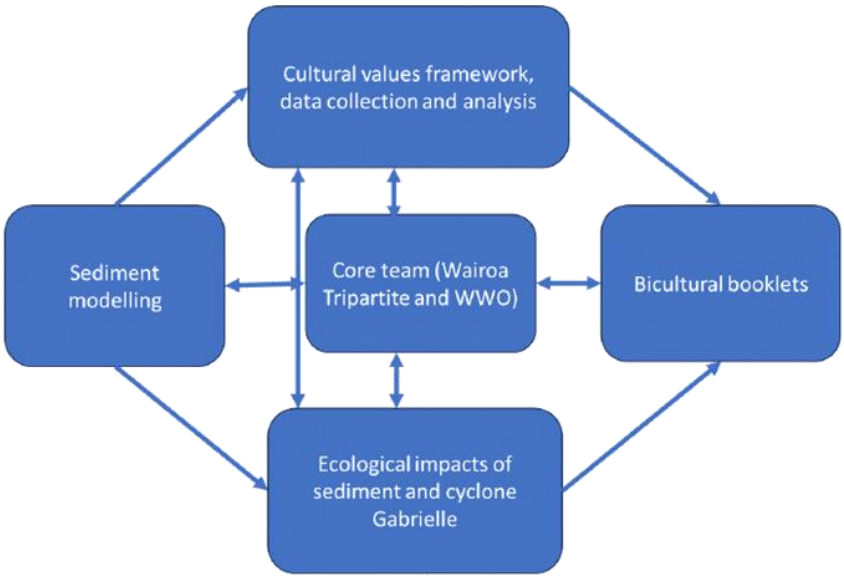

Figure 2. Information flows between different parts of the project and the core team.
Note: WWO = Whitiwhiti Ora.

Table 1. List of project reports

Part of project	Author(s) and report name	Links
Cultural values framework and analysis	Galvan and Kawana 2021: Awa case study: Te Wairoa-Hōpūpū-Hōnengenenge-Mātangi Rau Galvan et al.: The health of cultural values and mahinga kai in the Te Wairoa-hōpūpū-hōnengenenge-matangi-rau, Wairoa river catchment and the impacts of sediment. (Paper submitted and in review) Robson-Wiliams et al.:2024. Sediment and cultural values in Wairoa: Overview report	https://ourlandandwater.nz/project/land-use-opportunities/
Sediment modelling	Smith et al. 2021: Climate change impacts on suspended sediment loads in the Wairoa catchment, Hawke's Bay Vale et al. 2023: Effects of climate change and erosion mitigation on suspended sediment loads and visual clarity in the Wairoa catchment, Hawke's Bay	https://ourlandandwater.nz/outputs/effects-of-climate-change-and-erosion-mitigation-on-suspended-sediment-loads-and-visual-clarity-in-the-wairoa-catchment-hawkes-bay/
Ecological impacts – report	Elliott et al. 2023. Implications of sediment for fish in the lower Wairoa River, Hawke's Bay	https://ourlandandwater.nz/project/land-use-opportunities/
Ecological impacts – sediment factsheets	Hickford et al. 2023: Impacts of sediment on freshwater and estuarine fish species. 11 factsheets on Aua yellow eyed mullet, Kanae grey mullet, Īnanga, Kōaro, banded Kōkopu, Giant kōkopu, shortjaw kōkopu, Kahawai, Pātiki mohoao, Longfin tuna, and Shortfin tuna.	Impacts of sediment on freshwater and estuarine and freshwater fish species | NIWA
Bicultural booklets	Wairoa Tripartite (forthcoming). Bicultural booklets on key mahinga kai species in Te Wairoa-hōpūpū-hōnengenenge-mātangi-rau: Aua yellow eyed mullet, Kanae grey mullet, Īnanga, Kōaro, banded Kōkopu, Giant kōkopu, shortjaw kōkopu, Kahawai, Pātiki mohoao, Longfin tuna, and Shortfin tuna.	To be completed in early 2024 Link forthcoming
Core team	Robson-Wiliams et al.:2024. Sediment and cultural values in Wairoa: overview report	https://ourlandandwater.nz/project/land-use-opportunities/

2 Understanding cultural values and the current health of cultural values

Understanding cultural values

The framework used for data collection was based on the 'Whakaoho ake te mauri' framework developed by Galvan and submitted as an MSc thesis (Galvan 2023). The framework was adapted by Galvan and Kawana (2021) for use in this research to focus on the river and the impacts of sediment on cultural values (Appendix 3). Permission to apply this framework to the project was received from the iwi authority in the study area (Tātau Tātau o te Wairoa), and the use of the framework was endorsed on 3 December 2021 by Kaumātua Kaunihera (a council of elders who provide advice and guidance on appropriate ways of working).

The framework is inspired by the whakataukī (proverb) 'Toitū te marae a Tangaroa, Toitū te marae a Tāne-Mahuta, Toitū te Tāngata (If the water is thriving, if the land is thriving, the people will thrive).

The framework signifies the holistic concept of human health and well-being from a Māori perspective, which acknowledges the interaction between the environment and the various dimensions of physical and cultural well-being. The framework comprises three domains; mana atua, mana whenua and mana tangata (Figure 3). Figure 3 also shows the interconnecting core concepts of mauri (life force), wairua (spirit), and mana, which are relevant throughout each domain.

The mana atua domain is made up of a number of different atua presiding over different domains in the natural world, Tangaroa, Tāne-mahuta, Haumia-tiketike and Rongo-mā-Tāne Tāwhiri-mātea, and Tūmatauenga. The mana whenua domain is focussed on the ability to express mana whakahaere (governance) through the cultural ethics of whānaungatanga (establishing connection), kaitiakitanga (obligatory environmental guardianship) and manaakitanga (caring for others). The mana tāngata domain is focussed on the connection and level of personal engagement whānau/hapū/iwi have with their environment and cultural practices.

The centre ring details the measurable indicators, which are grouped into three domains. The approach to determine the health of these measurable indicators is based on the way Māori determine environmental conditions, using themselves as the instruments of measurement through sensory and non-cognitive observations to self-monitor, rather than external monitoring tools or devices.

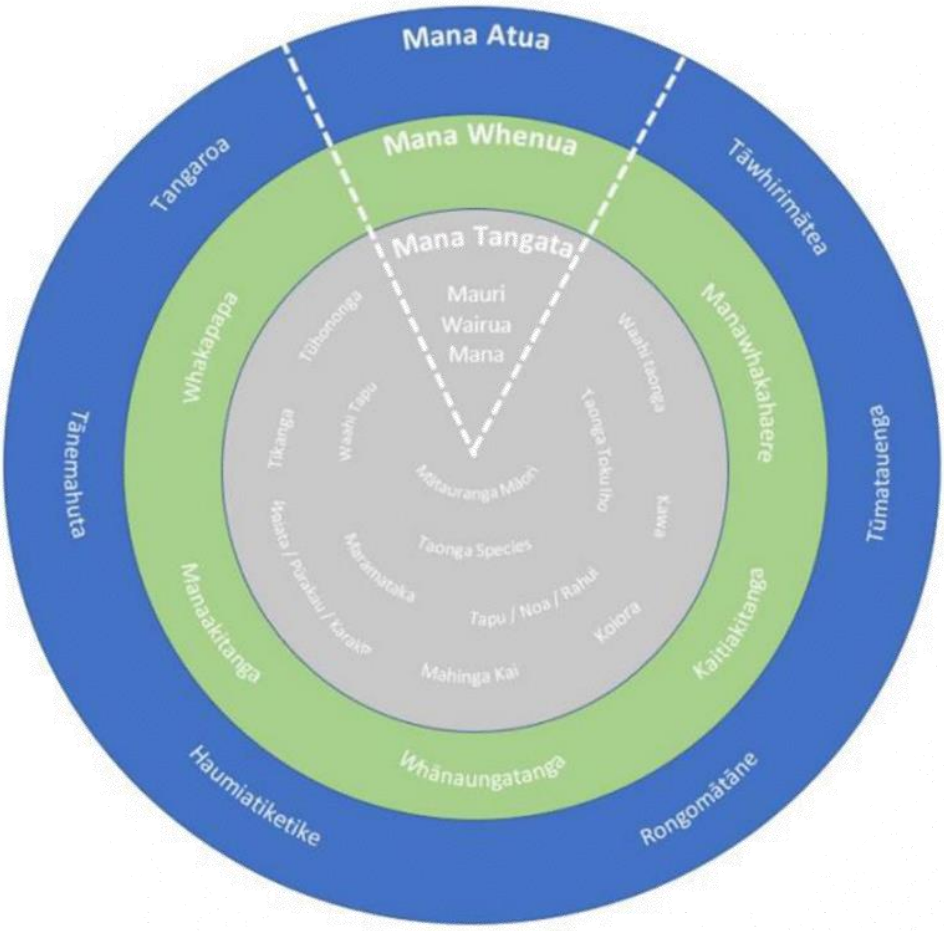

Figure 3. Cultural monitoring framework 'Whakaoho ake te Mauri'.
Source: Galvan (2023).

The current health of cultural values

In total, 92 cultural health assessments were collected. We looked first at all the assessments referring to the current health of cultural values.[4] Out of a maximum score of 4, which indicates the value is flourishing, and a minimum score of 0, indicating the value is languishing, both the mana tangata and mana whenua domain scores averaged 3.2 , while the mana atua domain had an average score of 1.7, with atua sub-domains ranging from 1.3 to 1.8.

[4] Excluding the post-storm/cyclone data assessments.

Figure 4 shows the average indicator scores within each domain. These data suggest that currently the mana tangata and mana whenua domains are on average in good health and are healthier than the mana atua domain.

Does cultural health vary along the river?

The Wairoa River is demarcated into three reaches along traditional mahinga kai areas: Te Wairoa Mātingi Rau, Te Wairoa Hōnengenenge, and Te Wairoa Hōpūpū. We did assessments in each of these areas and also along the Waiau River – a significant tributary of the Wairoa River. Figure 5 shows differences between the four reaches where assessment were made.

The indicators for aquatic mahinga kai (specifically the ability of species to migrate easily, the healthiness of the habitat, and the safety of harvesting and eating the kai) were generally considered less healthy in the lower reaches of the river. This general pattern is expected as land-use intensification in catchments (e.g. urbanisation or pastoral development), such as happened in Wairoa approximately 100 years ago (Elliott et al. 2023), usually results in increased sedimentation and contamination lower in the catchment (Davies-Colley 2013). However, although the aquatic mahinga kai indicators are generally healthier in the upper reaches, the reach that is reported to be least healthy is Te Wairoa Hōnengenenge, the penultimate reach of the river that stretches from Frasertown to the Awatere Stream. The lowest reach, Te Wairoa Mātangi Rau, runs from the Awatere Stream to the sea.

There are several reasons thought to account for this pattern.

- *Tidal flushing:* the tidal flushing that brings clean water into the river and carries out contaminants to the sea has less effect in Te Wairoa Hōnengenenge than in Te Wairoa Mātangi Rau, because it is further upstream, leading to cleaner water at the very bottom of the river.
- *Geomorphological differences:* a provisional geomorphological survey (Elliott et al. 2023) suggested that the upper part of the Te Wairoa Hōnengenenge reach (above Awamate Lagoons) would have naturally had much less sediment and may have been a gravel bed until the land clearance and subsequent erosion that commenced about 100 years ago. The subsequent rapid increase in sediment may therefore represent a greater change, and may have had a significantly greater impact in this reach than further down in Te Wairoa Mātangi Rau, which is considered likely to have always been soft bottomed.
- *Impact of sediment on mahinga kai species:* many of the key mahinga kai species typically caught in the lower river reaches are adapted to, or able to adapt to, turbid waters (e.g. aua/yellow-eye mullet, kanae/grey mullet, pātiki mohoau/black flounder, kahawai, shortfin tuna) (Elliott et al. 2023). However īnanga, which comprise most of the whitebait catch, are highly sensitive to deposited sediment at their spawning sites. There are two key spawning sites in Te Wairoa Hōnengenenge and Te Wairoa Mātangi Rau, which, due to their relative proximity to the main stem, have very different susceptibilities to the impact of sediment in the mainsteam. The īnanga spawning site in Te Wairoa Hōnengenenge is very close to the confluence with the main stem and is therefore more affected by sediments in the main stem of the river being deposited, whereas the spawning site in Te Wairoa Mātangi Rau, although negatively affected by factors such as grazing of the banks, is located approximately 500 m back from the main stem and is less affected by sediments and flooding in the main river (Elliott et al. 2023).

A different pattern emerges for terrestrial indicators located alongside the river, such as the presence of planted riparian margins, the appropriate use of those margins from a te ao Māori perspective, the presence of birds, terrestrial mahinga kai, pest species, rongoā (plants

used in traditional medicine), and site access. For these indicators the lower reaches are often considered to be as good as or better than the upper reaches. There are several reasons thought to account for this pattern.

- *Riverbank erosion:* according to Smith et al. (2021), in the two sub-catchments where all the assessments were conducted (Wairoa corridor and lower Waiau), bankside erosion is modelled to account for between a quarter and a half of the erosion from the sub-catchment, compared with typically less than 5% for all other sub-catchments. Respondents observed that higher up in these sub-catchments, in the Waiau and Te Wairoa Hōpūpū reaches, the river banks are often steep and high as a result of bankside erosion. The dangerous nature of the banks makes access more challenging, and the unstable nature has resulted in less successful riparian planting and observations of losing whole trees into the river as banks are undercut. The lack of stable riparian margins also reduces the presence of manu (birds) through lack of suitable habitat. By comparison, in the lower reaches, where the bank gradients are less steep and there is more fencing, more planting and a greater variety of planting in riparian margins (N. Heath, HBRC, pers. comm., 6 December 2023).
- *Land use and ownership:* the upper reaches have a much higher proportion of privately owned farm land, which is mostly under beef and sheep (Vale et al. 2023), so animals need to be deliberately excluded from riparian margins if damage to the riparian margins is to be prevented. The private land ownership also makes access more difficult. Although some respondents indicated that they could get permission to cross privately owned farm land, it is still challenging compared with the lower reaches, where there is extensive public access and reserve land.[5]

Have values changed over time?

Twenty-nine paired assessments were conducted where respondents answered questions, comparing now with some time in their living memory. Table 2 show the results of the comparison. Each row represents one respondent, and the decade shows the approximate decade the respondent was comparing to current. The values that the respondent noted a decline are shown in red and the values where there was an improvement are shown in green. All respondents reported some change in the health of a value over time, although not in all values: 67% of all reported values stayed the same while 33% were considered to have changed over time. The reported changes were predominantly negative, with 277 counts of a value declining and only 31 of a value increasing, and the extent of degradation was greater than the extent of improvement.

All values except for kai being safe to harvest and eat were reported to have declined by at least one respondent. Eight values were considered to have declined by at least 14 respondents.

[5] https://servicesdev.emtel.co.nz/InfoMapWairoa/?map=f80316af0ccd4dbb8b92041c1c771082&extent=177.358775,-39.063549,177.47602,-39.024752.

Fourteen respondents reported that their ability to practise and sustain manaakitanga from their site had declined, predominantly due to a reduction in kai availability. They said:

> *In the 1960's ... we would carry buckets of fish home.*
>
> *In 60s and 70s could spear flounder with tilly lamp.*
>
> *[N]ow Tuna not as plentiful, kōūra and kākahi not sustainable.*
>
> *Changes seen in one generation are rapidly getting worse* [although some respondents also pointed to quality as well].
>
> *Some tuna [short finned tuna] returned to awa, rather than eating, not good condition.*
>
> *Illness of our kai – it's unsafe to feed guests.*

Fifteen respondents reported that evidence of migrating species had declined at their site, with some reporting lower numbers ('Not as many baby eels this season') and others reporting 'obstacles are up the river or nearby culverts blocking fish passage'.

Fourteen respondents reported that the quality of riparian margins had declined at their sites. They said:

> *Mainly wrong type of trees ... more exotic plant species visible, nuisance trees, silver poplars, wilding willows, pampas.*
>
> *Loss of natives to exotic, poplar, willows, pampas.*
>
> *With less raupō and harakeke, less native – but lucky to have fruit trees scattered here and there.*

Fifteen respondents reported that the strength and diversity of birdsong had declined at their sites.

Fifteen respondents reported that the evidence of erosion had increased at their site, as had evidence of sedimentation on river banks (21 respondents, n = 21), that the condition of the riverbed had declined (n = 27) as well as water clarity (n = 24). They said:

> *River margins (have) changed through erosion.*
>
> *River bank changed over time, human-induced which is why humans are now learning their mistakes.*
>
> *River margins [are] very dangerous, 2–3 stories high.*
>
> *Evidence of urupā falling into the river.*
>
> *More frequent floods, brings more silt.*
>
> *Visibility – can't see within 2 m after hard rain.*

Thirteen respondents reported that one or more values had improved. These improvements are mainly seen in the mana whenua and mana tangata domains; for example, the awareness and use of the traditional harvesting techniques and the māramataka (planting calendar) were reported to have improved by seven respondents. In most cases the respondents who reported improvements in mana whenua and mana tangata also reported values in the mana atua domain as having declined.

Understanding how sediment affects cultural values

While sediment loss and erosion are a natural feature of the Wairoa catchment, the rate of sediment loss has increased because of changes in land use from native forest to pasture, and forestry and farming land-use practices (HBRC 2021). Current sediment losses are estimated to be approximately 240% higher than before human arrival (HBRC 2021).

This significant increase in sediment is of particular concern, as sediments affect cultural values in multiple ways: directly, via impacts on mahinga kai, and indirectly, by affecting cultural practices.

Sediment directly affects cultural indicators such as increased erosion, sediments on riverbanks, riverbed conditions and water clarity, as captured within the Tangaroa domain. The results show that these are among the lowest scoring of all the indicators assessed. This aligns with results from the HBRC water monitoring reports (Table 3), which indicate that of the eight river sites regularly monitored in the Wairoa River and its tributaries, six are below national bottom lines for median visual clarity (Elliott et al. 2023). At this level, ecological communities are significantly altered, and sensitive fish will be lost or be at high risk of being lost (MfE 2020), and HBRC monitoring shows that the sediment is harming animal communities living on the bottom of the riverbeds (HBRC 2021).

Table 3. Summary of visual clarity measurements in the Wairoa catchment

Site name	Number of observations	Clarity median (m)	Clarity minimum (m)	River class for suspended sediment	National Objectives Framework band
Hangaroa River at Doneraille Park	133	0.93	0.01	1	D
Mangaaruhe at Mangaaruhe Station22	22	0.99	0.025	2	A
Mangapōike River at Suspension Bridge	107	0.95	0.03	2	A
Ruakituri River at Sports Ground	133	0.83	0.005	1	D
Waiau River at Otoi	115	0.67	0.01	1	D
Wairoa River at Marumaru	22	0.71	0.043	1	D
Wairoa River at Railway Bridge	52	0.53	0.015	1	D
Wairoa River D/S Wastewater Discharge	25	0.35	0.01	1	D

Source: Elliott et. al. 2023

Deposited and suspended sediments also affect the presence and populations of mahinga kai species. NIWA synthesised existing ecological knowledge about important mahinga kai species in Wairoa and categorised the species in terms of their sensitivity to sediment into three bands, high sensitivity, medium sensitivity and low sensitivity They also documented what ecological functions are impacted by sediment in the river for each species (Table 4).

Īnanga, which typically makes up approximately 98% of the whitebait catch in the area (Yungnickel et al. 2020, cited in Elliott et. al. 2023), can be affected by very high suspended sediment because they are visual feeders, but they are primarily (and significantly) affected by the smothering of their spawning habitat with sediments (Hickford & Schiel 2011); and due to their predominantly annual life cycle, they are exposed to sudden and serious declines if a year-class is compromised or fails (Yungnickel et al. 2020).

Other whitebait species are affected by a reduced ability to feed or the suitability of the habitat, leading to avoidance behaviour and therefore lower recruitment, although these species make up a very small part of the catch. Tuna (longfin eels), although themselves relatively insensitive to suspended sediment, prefer stony-bottomed rivers and may be adversely affected in the presence of significant deposited sediment (Elliott et al. 2023).

Table 4. Overall summary of sensitivity for 11 fish species to sediment

Species name	Sensitivity	Why
Banded kōkopu	Top of high band	Avoidance and reduced feeding
Kōaro	Middle of medium band	Avoidance, and reduced habitat suitability and growth
Īnanga	Middle of medium band	Reduced feeding and habitat suitability
Shortjaw kōkopu	Middle of medium band	Reduced habitat suitability, but not visual feeders
Tuna/longfin eel	Top of low band	Reduced habitat suitability
Giant kōkopu	Middle of low band	Avoidance and reduced feeding
Pātaki mohoao / black flounder	Middle of low band	Reduced habitat suitability, feeding, and growth
Kahawai	Middle of low band	Mobile, ocean-living predators
Tuna / shortfin eel	Middle of low band	Few, if any, negative effects on habitat suitability, feeding or growth
Aue / yellow-eye mullet	Middle of low band	Adapted to turbid water
Kanae / grey mullet	Middle of low band	Depend on fine sediment for feeding

Note: Māori name is followed by common name, where relevant.

Source: Elliott et. al. 2023

However, even with species that are tolerant of, or even adapted to, sediment in the water, the decrease in water clarity has led to other changes that affect cultural values, such as increase in catch time, and not being able to use traditional visual harvest methods, such as having to net flounder rather than spear. The reduction in the opportunity to practise these methods risks the eventual loss of that knowledge.

A similar risk is incurred through sediment preventing access to sites. Where erosion has made access points very steep and dangerous, or where sediment deposition has smothered or compromised previous access points or harvest points, the loss not only prevents the expression of connection through everyday practice with that site, but some sites become so altered that they are lost from everyday interaction and ultimately lost from memory.

The impacts on kai species and all the knowledge and practices pertaining to them are inextricably connected. This means that the impacts of sedimentation on mahinga kai, whether direct or indirect, will ultimately affect the ability of whānau, hapū, and iwi to enact core values such as kaitiakitanga, manaakitanga, and whanaungatanga. However, the impacts of sediment go beyond the ability to 'get a feed'. The ability to contribute to whānau hauora isn't just about feeding a family, but is also about the emotional and spiritual sense of belonging, a place to be happy and get into the water and have all senses stimulated and heightened; a place for whānau, whether it be for swimming or for catching kai. So when sediment in or around rivers increases the danger of the site, making it inaccessible or simply not enjoyable to be there, then the ability to practice the cultural ethic of whānaungatanga is compromised.

Impacts of storms on cultural values

During the course of the project the Wairoa District was hit by two very severe storms, in March 2022 and Cyclone Gabrielle in February 2023, as well as numerous smaller events. Of the 92 assessments completed, eight paired assessments were conducted where respondents answered questions before and after a storm event, either the March 2022 storms or Cyclone Gabrielle in 2023 (Table 7). Each row represents one respondent, and the values that the respondent noted a decline are shown in red and the values where there was an improvement are shown in green.

In seven out of the eight comparisons respondents reported some values in decline. The values most reported to have declined were sediments on riverbanks, the condition of the riverbeds and water clarity, the evidence of species migrating, the condition of riparian margins, and the strength and variety of bird song.

However, five of eight respondents reported some improvement in values. These improvements were all in the mana tangata domain, with the most improvement reported to be in the knowledge and practice of cultural harvest methods. It is possible that the loss or degradation that was witnessed after the storms had a galvanising effect, when people observed for themselves that the ngā atua domains are compromised, leading to an increased desire to learn and reconnect 'before it's too late'.

This is a similar pattern to what we see across the data: the quality of the connection and relationship with the river is not solely determined by the quality of the environment, nor is it conditional on strict adherence to practices. This is because the connection between Māori and water is relational and demonstrates that water is a vital, inseparable, and integral component of life for Māori. As humankind was the last of all living forms to come into existence, water itself is an ancestor of humans (How 2017). The water bodies of the Wairoa District compose the life-blood of the landscape and form an integral part of the identity of hapū of the Wairoa District. Waterways are used as cultural identifiers in pepeha (self-introductions), and the status of hapū is enhanced by the many and varied uses of the water bodies of their territory and the resources they contain (How 2017).

This relational connection is considerably different from a transactional connection based on resource extraction. The water is an ancestor, it has sustained people's families for

generations, spiritually, culturally and in terms of nourishment, which means that even when that water is harmed or degraded, it is simply not a being that one can turn one's back on.

One of the most important insights we derive from these data is that although sediment affects cultural values in many ways, and its reduction should be an area of focus, sediment reduction isn't the only way to improve cultural values in the Wairoa catchment. The data demonstrate that the values in the mana tangata and mana whenua domains can be strengthened, even in the face of increased sediment. These values – relating to connection to and relationship with the environment, knowledge of cultural practices, and intergenerational knowledge transfer about these practices, and the ability to practise the cultural ethics of manaakitanga, kaitiakitanga and whānaungatanga – can all be strengthened in themselves, as well as through reducing erosion and sediment loads.

3 Understanding the sources of sediment and the likely impacts of climate change

There are multiple ways that soil can be lost from land. Sediment modelling done by MWLR using the SednetNZ model (Smith et al. 2021) shows that the main way soil is lost in the Wairoa catchment is through landslide erosion (Figure 6). Figure 7 shows an example of shallow landslide erosion.

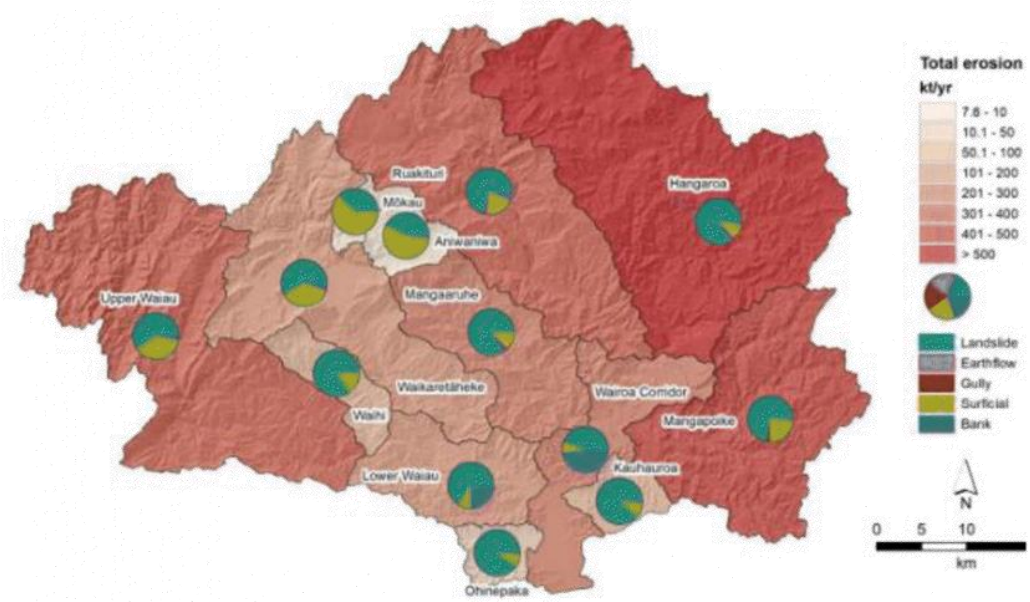

Figure 6. Modelled baseline total erosion (kt/yr) and erosion process contributions for major sub-catchments in the Wairoa catchment.
Source: Smith et al. (2021).
Note: Total erosion represents the sum of sediment loads from all erosion processes and does not account for the losses of sediment to storage in lakes or floodplains.

Figure 7. Shallow landslide erosion.

The modelling is also useful for highlighting where in the catchment the erosion is happening (Figure 8), where the blue colours indicate lower erosion and sediment reaching the water, through to red indicating higher erosion and sediment reaching the water). The pattern is driven by underlying geology, slope, and (importantly) land cover (Figure 9).

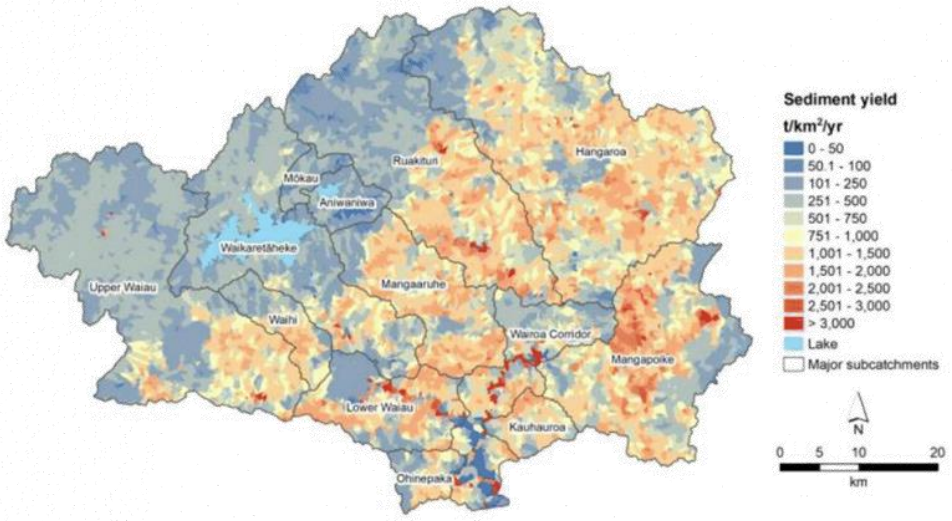

Figure 8. Modelled baseline suspended sediment yield (t/km^2/yr) for each river reach sub-catchment in the Wairoa catchment.
Source: Smith et al. (2021).

A series of localised climate projections were used to estimate the impacts of climate change by the middle of this century and by late this century. 'Best case' (RCP 2.6) and 'worst case' (RCP 8.5) scenarios were run, and they result in an estimated increase in sediment in the waterways of 10–37% by mid-century and 7–69% by late century (Figure 10). The substantial increases modelled in the worst-case scenarios arise predominantly from increased storminess and rainfall intensity leading to an increase in the occurrence of shallow landslides.

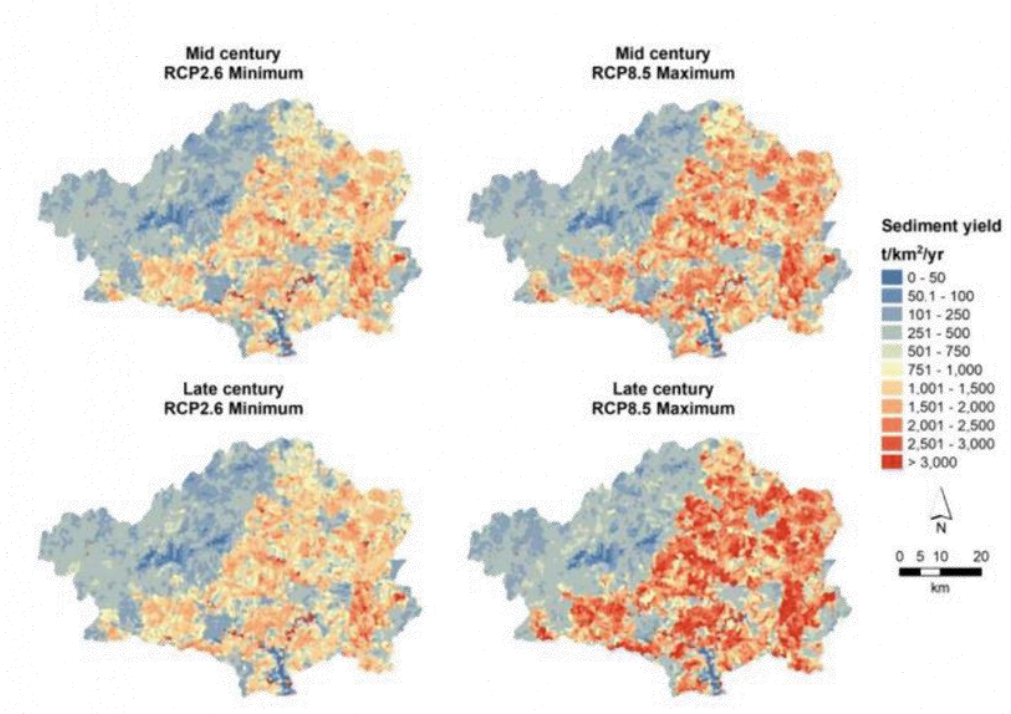

Figure 10. Modelled suspended sediment yield (t/km²/yr) for each river reach sub-catchment for worst- and best-case climate change scenarios across the Wairoa catchment.
Source: Smith et al. (2021).
Note: Scenarios from the Intergovernmental Panel on Climate Change Fifth Assessment Report known as representative concentration pathways (RCPs), are used to drive climate change modelling. The RCP 2.6 represents a mitigation pathway and RCP 8.5 represents very high greenhouse gas concentrations.

4 Understanding what mitigations are possible to reduce sediment loads

The current impact of sediment on cultural values is considerable, and the modelling on the impacts of climate change estimate that the increase in sediment losses could be significant. In order to understand the scale of what would be needed to reduce sediment losses to make material improvements in the rivers, the Tripartite developed a scenario comprising a set of practicable interventions across the catchment. The scenario comprised:

- full reversion to native scrub on steeply sloping land that is susceptible to erosion (LUC[6] 7[7]e[8] and 8[9]e pastoral land) (Figure 11), yielding a 90% reduction in sediment load
- space-planting of trees on moderately sloping land that is susceptible to erosion (LUC 4[10]e, 5[11]e, and 6[12]e pastoral land) (Figure 11), yielding a 90% reduction in sediment load
- fencing and woody re-vegetation of riparian areas on stream orders 3 and above (Figure 12).

This scenario was modelled by MWLR and named 'best effort scenario' (Vale et al. 2023).

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[6] The Land Use Capability system categorises land into eight classes according to its long-term capability to sustain one or more productive uses, based on physical limitations and site-specific management needs. Productive capacity depends on physical qualities of the land, soil and environment. (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

[7] Non-arable. Moderate to very severe limitations to pastoral use. High-risk land requiring active management to achieve sustainable production. Can be suited to grazing with intensive soil conservation measures, but more suited to forestry. (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

[8] Denotes erosion is the limiting factor.

[9] Very severe to extreme limitations to all productive land uses, arable, pastoral or commercial forestry. Suitable for erosion control, water management and conservation. (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

[10] Arable. Significant limitations for arable use or cultivation, very limited crop types, suitable for occasional cropping, pastoralism, tree crops and forestry. Some Class 4 is also suitable for viticulture and berry fruit. (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

[11] Non-arable. Highly productive pastoral land, not suitable for crops but only slight limitations to pastoral, viticulture, tree crops and forestry. (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

[12] Non-arable. Slight to moderate limitations to pastoral use, suitable for pasture, tree crops and forestry and in some cases vineyards. Erosion is generally the dominant limitation (https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/lri_luc_main).

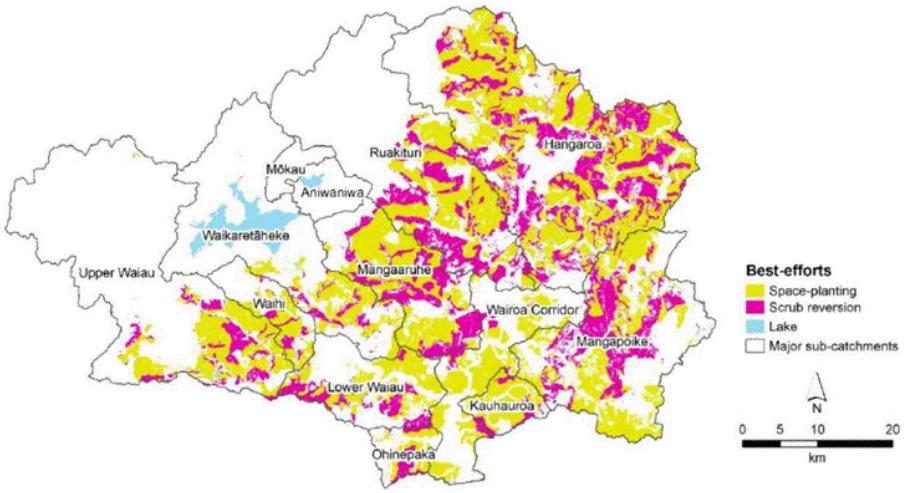

Figure 11. Best-effort scenario showing areas designated for full native scrub reversion and space planting in the Wairoa catchment.
Source: Vale et al. (2023).

Figure 12. Best-effort scenario showing river reaches designated for riparian fencing and native scrub reversion in the Wairoa catchment.
Source: Vale et al. (2023).

The impacts of the best-effort scenario on sediment losses are marked. The best-effort scenario reduced sediment loads under climate change by 51–57% by mid-century and 43–58% by late century, relative to the recent baseline. In Figure 13 the top four maps (also shown in Figure 10) are the losses under the best- and worst-case climate change

projections, and are included for comparison with the lower four maps for the same time frames and projections, but with the best-effort scenario implemented.

The best-effort scenario even reduces the sediment loads below current baseline, from 2.5 Mt/yr modelled mean annual suspended sediment load delivered to the coast under contemporary climatic conditions, to 1.0 Mt/yr being a 60% reduction. Table 6 shows the impact of the best-effort scenario on visual clarity, and shows that of seven HBRC monitoring sites modelled, six show an improvement in predicted visual clarity under the best-effort scenario. The two sites that show less significant change are the Waiau River at Otai and the Wairoa River at Railway Bridge. The best-effort scenario makes a smaller difference to the Waiau River, because a large proportion of the catchment above the monitoring station is already under permanent forest. For the Wairoa River at Railway Bridge, Vale et al. (2023) note that the visual clarity is affected not only by sediment but also by the salinity of the sea water introduced by incoming tides.

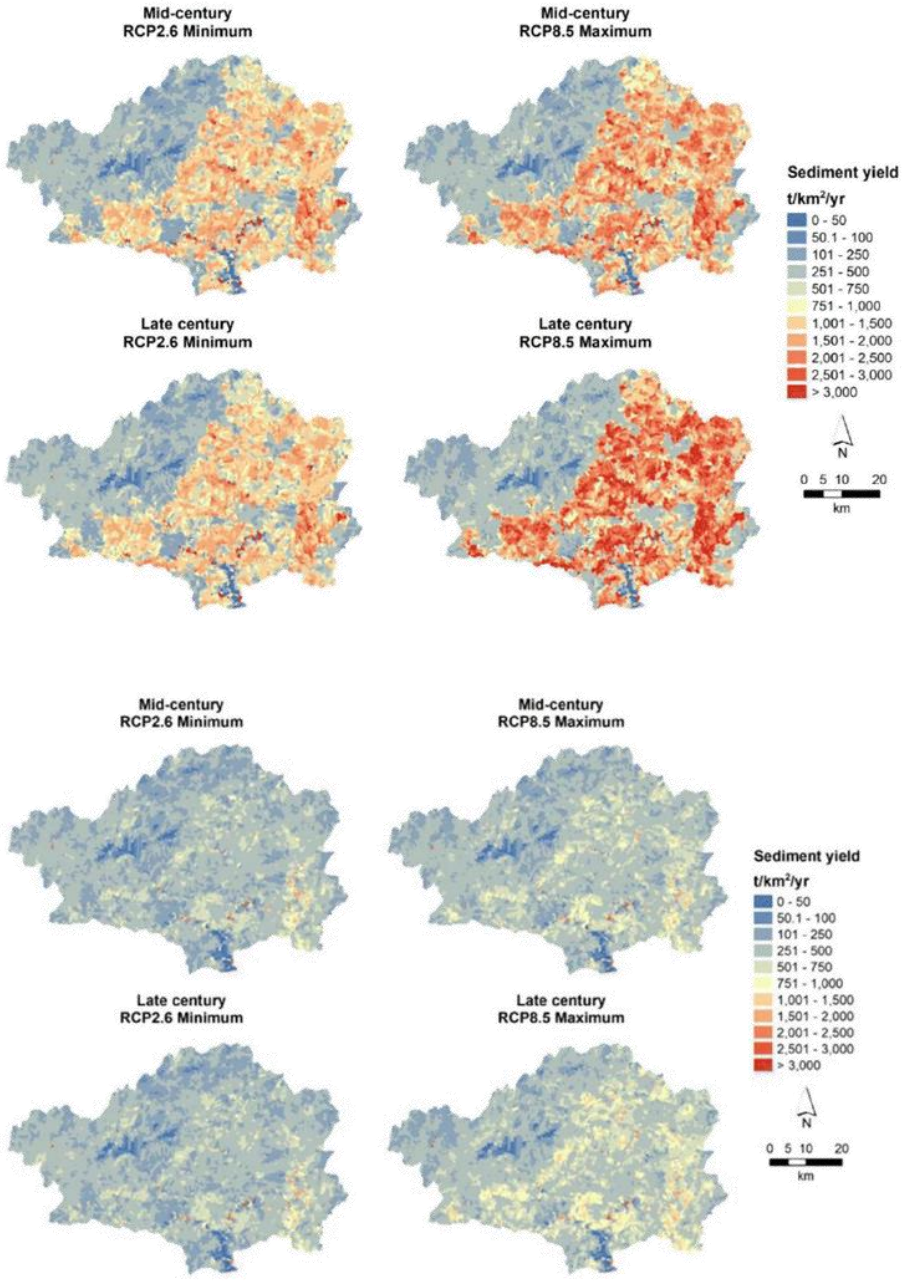

Figure 13. Modelled suspended sediment yield (t/km²/yr) for each river reach sub-catchment for worst- and best-case climate change scenarios across the Wairoa catchment at current land use (top four maps) and with best-effort scenario (bottom four maps).
Source: Vale et al. (2023).

5 Economic impacts

To gain some understanding of the economic implications of the best-effort scenario, a high-level economic evaluation was conducted by Land Water People (Harris 2023) and also funded by Our Land and Water National Science Challenge. For the assessment we used the full implementation of the best effort scenario, we used a non-tailored space planting approach, we used conservative mosdelling assumtions and we didn't account for potential implications of *status quo*.

This economic study indicated that there would likely be significant impacts for the farms and communities from the full implementation of the best-effort scenario, with approximately 30 to 60% of the output from farming potentially lost, particularly on farms with significant areas of erosion-prone land. Furthermore, the mitigations themselves would have significant costs, and if these costs fell on farmers, their profitability before capital and tax would likely be negative while the costs were repaid. However, there would be some offsetting flow on effects in the community from expenditure on the mitigation activities while they were being implemented.

There are a number of areas where the analysis may overestimate the economic impact (overestimates of stock-carrying capacity, impact of space planting on productivity, costing of mitigations, and by not accounted for targeting of space planting). However, the scale of change indicated in this study means that even if the impacts are overestimated, there will still be significant impacts for the district and for Māori. Furthermore, it is possible that the extent of the changes and reduction of overall stock numbers could affect the viability of the meat-processing works.

Several suggestions were made to reduce the economic impacts of the best-effort scenario.

- **Assist with the cost of implementing mitigation measures**. Given the large impact on the farming community in terms of reduction in productivity, it may be that cost sharing would be appropriate, and this would ameliorate at least some of the direct impact for farming operations.
- **Stimulate greater intensification and land-use change on the remaining area**. Intensification of sheep and beef farming on remaining available land would offset some of the losses in terms of stock throughput at the meat works, while land-use change to intensive horticulture may offset the direct employment impacts in the sheep and beef sector. Horticultural operations, with their associated need for post-harvest processing and packing, may also offset the loss of jobs from meat works.
- **Undertake smaller scale or more targeted mitigation measures**. Reducing the scope of the mitigations would reduce the costs. Alternatively, the space planting mitigations could be more targeted i.e., moving to wider spacing over the parts of each landscape unit that are less susceptible and focusing more densely planted interventions on the most erosion-prone parts of each landscape unit.

It is recommended that a further modelling exercise is done to understand the sediment mitigation and cost implications of a more targeted approach.

6 Evaluation

Based on the Tripartite working agreement we evaluated three dimensions of the project.

- *Success in upholding and supporting mātauranga Māori:* for this dimension we used the rubric supplied by Our Land and Water to assess the vision mātauranga status of projects (Appendix 3).
- *Success in our collaborative relationship:* for this dimension we used the evaluation for scientific collaborations: relationship and performance from the Collaboration and Team Science Field Guide (Bennett et al. 2018).
- *Likelihood of the project contributing towards impacts and outcomes:* for this dimension we used the categorisation by Wiek et al. (2014) to capture potential preliminary changes as a result of this project.

For each of these dimensions we captured participants' rating of the project and the supporting narrative. Eight members of the core group and place-based researchers were invited to participate in the evaluation, and seven participated.

Upholding and supporting mātauranga Māori

The first dimension of the evaluation is upholding and supporting mātauranga Māori. The assessment rubric has three sections: empowering Māori knowledge, empowering Māori resources, and empowering Māori people.

Empowering Māori knowledge

There are four aspects of empowering Māori knowledge: knowledge system equity, mātauranga Māori leadership, mātauranga Māori resources, and science expertise of Māori. Participant ratings are shown in Table 7.

Table 7. Participant ratings of project for empowering Māori knowledge

	Weak	Moderate	Strong
Knowledge system equity	0	0	6
Mātauranga Māori leadership	0	0	6
Mātauranga Māori resources	0	0	6
Science expertise of Māori	0	0	6

Note: One participant did not complete this part of the evaluation.

The comments from participants included:

> *The experience was a journey and all about learning.*
>
> *The project had got stronger in all dimensions as it progressed, moving from a moderate score at a mid-way point in the project.*

The project has shifted and reframed to achieve a more Te Ao Māori feel as it had been very science-framed at times.

I was impressed with how mātauranga Māori has been received and included and now it's in a strong position, not seamless, but strong.

The project has been a fusion of understanding, listening and learning.

Because the framework used was born here that means it now has legs.

Producing the knowledge in a different way brings about a better relationship with mātauranga Māori.

It is evident through our discussions within the Tripartite that the Councils can appreciate or have better understanding of how mātauranga Māori adds value in sitting alongside Western measurements. Some of what mātauranga Māori identified aligned with scientific indicators too.

Empowering Māori resources

There are five aspects of the empowering Māori resources: communications and engagement, intellectual property (IP) benefit and sharing, community/partners aspirations alignment, measures of excellence, and measures of impact. Participant ratings are shown in Table 8.

Table 8. Participant ratings of project for empowering Māori resources

	Weak	Moderate	Strong
Communications and engagement	0	3	3
IP benefit and sharing	0	0	5*
Community/partners aspirations alignment	0	1	5
Measures of excellence	0	0	6
Measures of impact	0	0	6

Note: One participant did not complete this part of the evaluation.

* One participant didn't feel they had enough knowledge to rate the project for this question.

The comments from participants included:

Project made every effort to not stand on toes when it comes to IP.

I've been really impressed with communications and engagement.

There is strong effort in the excellence and impact, but the real impact is still to come.

The circumstances of COVID and Cyclone Gabrielle have prevented the project in doing what it wanted sometimes.

There is a good balance of strong technical approach but making sure that it is usable.

We needed to bring together our expertise and work together.

If we'd have had too strong an academic lens, we'd have lost the project.

We didn't want to just produce something. We want the outputs to be a resource for all and are intended to benefit all.

We've had so many challenges!

We've had a reciprocity of knowledge in this project.

It was clear that the project would rather try and change contracts than be extractive of Māori knowledge.

Empowering Māori people

There are five aspects of empowering Māori people: programme leadership and decision-making, co-design and co-development, relationship maturity, role definition, and resourcing for Māori researchers. Participant ratings are shown in Table 9.

Table 9. Participant ratings of project for empowering Māori people

	Weak	Moderate	Strong
Programme leadership and decision-making	0	0	6
Co-design and co-development	0	0	6
Relationship maturity	0	0	6
Role definition and resourcing for Māori researchers	0	0	5*
Resourcing for Māori communities	0	3	3

Note: One participant did not complete this part of the evaluation.

* One participant didn't feel they had enough knowledge to rate the project for this question.

The comments from participants included:

There was always a strong space for Māori leadership, Tripartite leadership.

The relationships matured, but we benefited from there being good existing relationships between some group members.

The effort of the project was high, but in terms of resourcing for Māori communities – we just haven't got out there as much due to pandemics and floods.

We needed to be sensitive to COVID and Cyclone Gabrielle.

Collaborative relationship evaluation

The second dimension of the evaluation is the collaborative relationship within the project team. Participant ratings for the strength of the collaboration and relationships are shown in Table 10.

Table 10. Participant ratings of project for collaboration and relationships

	Weak	Moderate	Strong
Relationship indicators			
Communication	0	1	6
Cooperation	0	1	6
Use of appropriate tikanga in project	0	2	5
Process for resolving disputes	0	2	5
Adequate notice of problems	0	4	3
Ability to raise concerns	0	1	6
Responsiveness of parties to concerns raised	0	1	6
Level of trust among participants	0	0	7
Openness	0	0	7
Ability to work as a team	0	1	6
Performance indicators			
Availability of resources	0*	0	6
Keeping to schedule	1 **	5**	1
Willingness to adapt to circumstances	0	1	6
Commitment of participants	0	1	6
Attitude of participants	0	0	7
Expectations	0	3	4
Barriers (fewer barriers higher rating)	2	2	3
Synergy	0	1	6

Note: * One participant answered Not Applicable.

** Participants gave the caveat of circumstances beyond the project control.

Multiple participants described the efforts made at the beginning of the project to build the relationship as critical:

> *We took our time before we started. It took a year, but it [the project] built credibility because it got past that year.*
>
> *The preparedness to do the hard yards through the project built the trust.*
>
> *It took 12 months to get the project to a place where project partners felt committed and prioritised the programme.*

Other comments about the relationship included:

> *Team has been impressive.*
>
> *The commitment of the project lead has been outstanding.*
>
> *We aren't always easy – but you stuck around.*

It comes down to moments. For me there were 3 or 4 pivotal moments when the project could have gone one of two ways. It was the way those points were handled that strengthened the project.

The arrival of Benita was key – she cared enough about the subject matter and was brave enough to sing out when something wasn't right.

The leads of the project needed to be prepared to take some stick.

The project made every effort to accommodate the trials and tribulations and pivoted when necessary.

Kotahitanga – being of one mind.

Many projects come to Wairoa wanting to use Wairoa as a case study. Researchers come because it will make a good case study and be good for their academic careers. They are often extractive. They take something away something intrinsic to Wairoa. I always ask – what's in it for Wairoa? This project is different – it is home based.

Participants also noted there were 'spinoff benefits and opportunities that have arisen from the working relationship'.

Likelihood of contributing to impacts and outcomes

The third dimension of the evaluation is as an assessment of the likelihood the project will contribute towards impact and outcomes by creating usable products, enhancing capacity, enhancing networks, and creating structural changes and actions. Participant ratings for the likelihood of contributing to impacts and outcomes are shown in

Table 11.

Table 11. Participant ratings of the likelihood of project contributing to impacts and outcomes

How likely is this project to contribute towards:	Unlikely	Mod likely	Highly likely	Examples
Creating useful and usable products (e.g. products, publications, processes, frameworks, services)			7	Framework that can be used by whānau and hapū. Bicultural booklets. Journal paper that supports mātauranga Māori as a valid way of assessment of water
Enhancing capacity (e.g. new knowledge, new knowers, enhanced understanding and skills, greater understanding/appreciation of mātauranga Māori)		2	5	Increased capacity in the project team; increased capacity across participants who did the assessment. Many interviewees commented that they wanted to use the framework for themselves. Councils have better appreciation of mātauranga Māori and how it adds value. Framework assessment created new knowledge of current state of cultural values.
Expanding networks (e.g. created or expanded networks, increased trust, enhanced connections)		2	5	New relationships. Deepened existing relationships. Increase in trust. Collaboration beyond the programme. Enhanced connections within the community. Enhanced trust within the community that while their mātauranga was going to be safeguarded, it could be used to achieve outcomes.
Structural changes and actions (e.g. plans, implemented plans, decisions, new jobs, new ways of doing things)		4	3	Changes are yet to be measured, but we are making this as immediately usable as possible. The outcomes of this project will support progression towards catchment change. This will help the council when they get to their plan-making process.

Success factors

Several key factors for project success can be identified from this evaluation:

- the time spent at the beginning of the project to build relationships and to find a common area of interest
- the commitment to outcomes for Wairoa and investment in local people and local knowledge
- the strong Tripartite leadership.
- the resources for supporting mātauranga locally
- the intent to work across knowledge systems, and the preparedness to listen, learn and change, especially when scientific framing was too dominant
- the willingness to adapt to challenges, such as Covid and Cyclone Gabrielle, and to opportunities (e.g. pivoting some work in response to the cyclone)
- the disposition and commitment of the team members.

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Appendix 2 – Research relationship agreement

RESEARCH RELATIONSHIP AGREEMENT BETWEEN WAIROA TRIPARTITE AND WHITIWHITI ORA CROWN RESEARCH PARTNERS FOR THE OUR LAND AND WATER 'WAIROA TRIPARTITE AND WHITIWHITI ORA PROJECT' CASE STUDY.

1. Parties/Members

The Wairoa Tripartite comprises of Tātau Tātau o Te Wairoa, the Wairoa District Council and the Hawke's Bay Regional Council.

The Crown Research Institute partners comprise of representatives from Manaaki Whenua Landcare Research (MWLR) as representatives of Our Land and Water National Science Challenge.

2. Purpose

Te Wairoa Hōpūpū Hōnengenenge Mātangi Rau or the Wairoa River is significant to the iwi and hapū of Te Rohe o Te Wairoa and is valued ecologically and for recreation and māhinga kai. A significant threat to the health of the awa is from sediment entering the water. This project focusses on the awa, and in particular the impact of sediment on this taonga. Where we will develop deeper understanding (from science and mātauranga a iwi/ mātauranga a hapū) about relationship between sediment and multiple dimensions of māhinga kai, as well as understanding the implications of land use change and climate change on these values.

The long-term impact is to help improve the health of the awa. We will contribute to this by enhancing understanding about relationship of sediment and values, acknowledging value in knowledge from both science and mātauranga, providing important benchmarks about the river, influencing land and water policies and how the river is managed, and influencing the long-term monitoring network.

The purpose of this agreement to is to document our agreed ways of working together. The document covers principles, intellectual property and data, communications, project roles and responsibilities, conflict resolution, evaluation and a project description.

3. Partnership Principles

The Parties agree to the following relationship principles:

a) manaaki ki te tangata – ensuring the relationship is genuine, in good faith, and in the spirit of co-operation;

b) kaua e takahia te mana o te tangata – recognition of individual mana and aspirations;

c) commit to open, honest and transparent communication;

d) acknowledge that the relationship is an evolving one;

e) respect the independence of each other and their individual mandates, roles and responsibilities, as well as the collective role of the Tripartite;

f) Always maintain a best endeavours approach; and

g) ensure that engagement between all Parties occurs as early as possible on issues that will affect any individual or all the Parties. This includes issues of known collective interest.

The Parties confirm that they will act in a manner that:

a) respects the mana whakahaere of Mana Whenua;

b) is consistent with the principles of Te Tiriti o Waitangi / The Treaty of Waitangi;

c) enables the protection, management and access to mātauranga, cultural sites and values;

d) allows the concerns of all parties to be heard and acknowledged; and

e) allows for the sharing of collectively beneficial information where agreed and appropriate.

It is anticipated that all representatives participating within the research programme will conduct themselves in a professional manner. There is no expectation that the representatives will agree on all matters. However, it is anticipated that all representatives will respect each other's respective positions and the reasons for their position, if presented.

Given the above statements, all parties affirm that they are committed towards establishing and maintaining a positive, co-operative and enduring relationship which is collectively beneficial.

4. Decision-making

All decisions about the project will be made using a consensus model.

5. Intellectual property management

The Wairoa Tripartite and Crown Research Institute partners recognise the need to manage Intellectual property (IP). Project participants realise that information and knowledge sharing is a key to this project. IP includes, but is not limited, to:

- Māori knowledge systems/frameworks/concepts/mātauranga Māori/Kaupapa Māori approaches and methods
- Scientific methods, knowledge, data, tools, models
- Printed and electronic publications
- Māori and western assessment tools and systems
- Know-how, tikanga and protocols

Ownership principles

The parties will be guided by the following principles governing the ownership, use and beneficiaries of any intellectual property, either existing or potentially being developed, as follows:

- All parties will respect and work within agreements and existing relationships regarding use of knowledge, information data, publications, release, publicity and confidentiality of all material;
- Ownership of all existing proprietary data and information (including cultural/mātauranga) used for the project remains with the originating party, and subject to agreement otherwise, such existing data and information may only be used for the project itself.
- Agreements with individuals, whānau, hapū and other iwi/hapū organisations participating in the research will determine the methods for eliciting this information, its form, and transfer mechanisms and what can be released to various audiences and in various forums. Sensitive or confidential knowledge will not be used or released into the public domain;
- Information will be made available through meetings, workshops, hui, reports, case studies, peer reviewed scientific publications, web sites, and presentations at conferences;
- Any framework, other tools, concepts or methodologies generated in whole or in part from the use of farm, local or Māori knowledge during the course of the research project will acknowledge the community of origin and the owners of such knowledge;
- No party will disclose or distribute any information that is supplied and marked, or stated to be 'in-Confidence', or 'culturally sensitive' by the originating party, except as, and to the extent authorised by the originating party;
- New data and information obtained during the Work shall be jointly owned by developing parties. Methodological approaches developed by either party shall be the property of the developing party;

The parties will explicitly recognise that cultural intellectual property contributed or developed because of collaboration on this project, will remain with iwi, hapū and whānau ownership. Publications and media publicity will acknowledge iwi, hapū and whānau as appropriate, as kaitiaki of mātauranga Māori, and ensure adequate protection of information identified as confidential is maintained. The parties will give effect to the principles and due regard to the Treaty of Waitangi as well as the Waitangi Tribunal WAI 262 report's finding on ownership of indigenous flora and fauna (including living and dead collections).

Clauses on IP management that reflect the above are also included in the contracts between Tātau Tātau o Te Wairoa and Manaaki Whenua on behalf of Our Land and Water National Science Challenge.

6. Data Management

The Our Land and Water national science challenge will not be the ultimate repository for any data produced and used in this project. Any data produced by the WWO team will be made available to the Tripartite in a usable form.

7. Communication Plan or Protocol

Communications about the project will be discussed and agreed with the Tripartite.

In these communications we will use TTOTW's key Guiding Principles for Ngā tūmomo reo:

SIMPLE: Clear and concise language

HUMBLE: Confident and determined – using local 'flavour'

INCLUSIVE: Language that takes people on a journey

ASPIRATIONAL: Long-term goals wherever possible.

AUDIENCE: Styles that suit the intended audience

8. Conflict Resolution

The purpose of establishing a process for resolving issues in this relationship agreement is to provide a method of open communication and early resolution of issues.

An approach to addressing disputes will be characterised by the following approach:

- Respectful - There is no expectation that the representatives will agree on all matters. However, it is anticipated that all representatives will respect each other's respective positions and the reasons for their position, if presented.
- Proactive — Early intervention leads to smaller problems and is best implemented by understanding the outcomes we are collectively trying to achieve and by regularly checking on progress.
- No surprises –parties will keep one another informed of both potentially contentious issues and issues that may have a significant impact on the project
- Positive— The approach is positive with each party conveying a sincere desire for a more positive future relationship in which all parties benefit from one another.

Conflict Resolution Process

Step 1 Request a kanohi a kanohi meeting for identified issue. This hui to be held in a safe place for all parties. Any party may request a meeting with other parties and raise the issue/question(s). The hui will start with a karakia. The issue should be presented in written form to all parties in advance and issues are presented orally at the meeting; equal time is spent hearing from all 'sides' of a dispute. By sitting down and talking, it is hoped that a resolution can be reached, and no further action needs to be taken. Resolution is documented at close of meeting, followed by a karakia.

If no resolution is found proceed to step 2.

Step 2 If no resolution in is reached in step 1, request a meeting between the Tripartite and the Director plus Director Māori of the OLW Challenge. The issue should be presented in written form at least 72 hours before meeting. This group will make a recommendation/s to the project on resolution.

9. Project description

There are two phases to this project described below. We note that these set the broad direction, however there are likely to be iterations to the exact work. We will make these decisions collectively in the Tripartite core group.

We also note that when trying to manage complex problems, we need to pay attention to the limitations to our knowledge. To help our Tripartite partners in this, we will supply notes on all the information we produce and use, covering estimations of uncertainty and appropriate use.

Understanding values and how sediment affects these values

This part of the project is to understand values related to the awa and how they are affected by sediment.

- Understand values of hapū (focus on māhinga kai and sites of cultural significance). With two local community-based facilitators, we seek to understand from hapū what values they hold with respect to the awa, focussing on māhinga kai and sites of cultural significance in the Wairoa River. We seek to understand how sediment affects these values, where these values are, and what a good condition for these values looks like.
- Building knowledge on sediment sources from different sources of knowledge and knowledge systems around sediment/soils. This will help understand the history of the awa and provide a reference point in time based on local knowledge. Based on insights from wānanga and further data collection/groundtruthing, we would support the development of mātauranga Māori around risk of sediment loss
- Building knowledge on the effects of sediment on ecological and cultural values. From the discussion with hapū during hui, we will build knowledge on the values dear to them, and how and where these have changed in time due to sediment. Through building on this and on existing knowledge, we would construct conceptual models of the relationships between sediment and values, focussing on linking sediment, ecological health, and cultural values. We will also determine what reductions are needed in order to make a positive difference to these values.

Targeting sediment

This part of the project would involve running intervention scenarios and exploring how far we need to go in reducing sediment to make a difference to values around māhinga kai and sites of cultural significance in the face of climate change.

- How far do we need to go now and in the future? We will model the impacts of climate change scenarios to test the likely impact of climate change on sediment loads, and the added efforts that might be necessary to achieve the targets. Based on the climate change in formation and the required reduction in sediment from part 1 of the project, we will co-develop scenarios with the Tripartite to test the impact of different intervention scenarios on sediment and values

The project is also looking to support and build local capability. We propose to do this through the following measures:

- Contracting two local community facilitators to support engagement and understanding values and examine data from various sources related to land and sediment, for example from wānanga and hui whakatoke, karakia.
- Supporting the development of mātauranga Māori by local experts about sediment/soils and the impacts on the awa, with support from kairangahau.
- The better understanding around māhinga kai values and the impact on sediment resulting from this project could provide important benchmarks into the future, that would potentially justify extending HBRC's longer term monitoring network.