



MANGAMAHAKI SUB-CATCHMENT PLAN DRAFT

TLC The Big Picture: Tackling the big issues sub-catchment by sub-catchment



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TUKITUKI CATCHMENT: THE BIG PICTURE

1. Introduction to The Big Picture

1.1. Purpose of The Big Picture

In 2024 Tukituki Land Care (TLC) launched The Big Picture, a six-month project designed to create independent, science-based catchment plans for the 17 sub-catchments of the Tukituki River in Central Hawke's Bay. The initiative identified each sub-catchment's unique environmental challenges and developed practical, cost-effective solutions to address them. As TLC Chair Richard Hilson explained, "We tackled the big issues sub-catchment by sub-catchment, to piece together the bigger picture."

The project employed a comprehensive research approach that combined field investigations, insights from local farmers, and an in-depth analysis of existing studies and data on the Tukituki catchment. Environmental planning consultancy, Environment, Innovation and Strategy Ltd (EIS), led by Matt Highway, undertook this work.

This project reflects TLC's dedication to improving environmental health and farm productivity, paving the way for a sustainable future for the Tukituki community.



1.2. Freshwater status of the Tukituki catchment

Summary of State of the Environment reporting

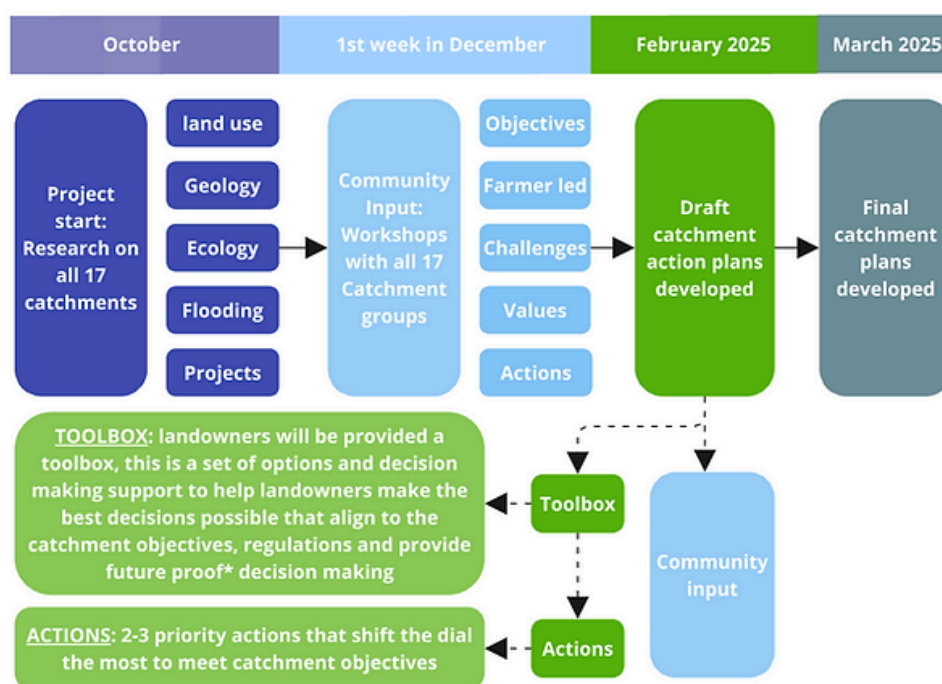
The Tukituki catchment faces water quality, land use, and climate challenges. The catchment, dominated by sheep and beef farming, has experienced significant modifications, leaving only about 10% of its land covered in indigenous vegetation. Water scarcity is a persistent issue, with decreasing river flows over the past three decades, exacerbated by droughts and climate change. Groundwater levels in the Ruataniwha Plains are under strict management to prevent further decline, but interannual variability and climate change pose ongoing risks.

Water quality is a major concern due to high levels of nitrogen, phosphorus, and sediment. The highest nitrogen concentrations in the region occur in streams draining the Ruataniwha Plains, and some areas exceed nitrogen targets by two to four times. Phosphorus and fine sediment issues, linked to erosion, contribute to poor water clarity and degraded aquatic habitats. Toxic algae, particularly *Phormidium* cyanobacteria, can proliferate in the river during low summer flows, posing a risk to both human and animal health. Despite these issues, the Tukituki River remains generally swimmable, except after heavy rainfall when contaminant levels rise.

1.3. Approach: creating priority actions in the Tukituki

The Big Picture project adopted a highly collaborative approach involving detailed catchment research, GIS mapping, and farmer engagement. Workshops were conducted with local farmers in each sub-catchment to better understand group dynamics, gather community values, and identify key issues and opportunities. Feedback from the workshops, survey results, and field investigations have been used to shape tailored catchment plans aligning with the local communities' specific landscape context and aspirations.

As part of the implementation phase, TLC introduced "THR3E"—three actionable steps designed for farmers in each sub-catchment to implement over three years. The TLC Farmer Toolbox was also launched, providing practical resources to help landowners make informed decisions and maximise the impact of their efforts. Additionally, monitoring strategies are to be implemented, and demonstration sites will be identified to help showcase best practices, ensuring that the plans remain relevant and actionable.



2. Tukituki's Overall Big Picture

2.1. Summary of sub-catchment challenges and priorities

The Big Picture project team has worked with farmers to identify challenges and opportunities in each of the 17 sub-catchments. While each sub-catchment has an individual plan, it is the big picture of the people, the land and the water within the Tukituki that we are trying to collectively support. The approach is reminiscent of a jigsaw puzzle where many pieces fit together and form something greater than themselves as an individual piece. Figure 1 below shows how the Tukituki sub-catchments fit together as a big picture, showing the sub-catchments that are aligned in similar top priorities. Note that the image only shows the proposed highest recommended priority area for each catchment, and all catchments will have multiple outcomes they are seeking.

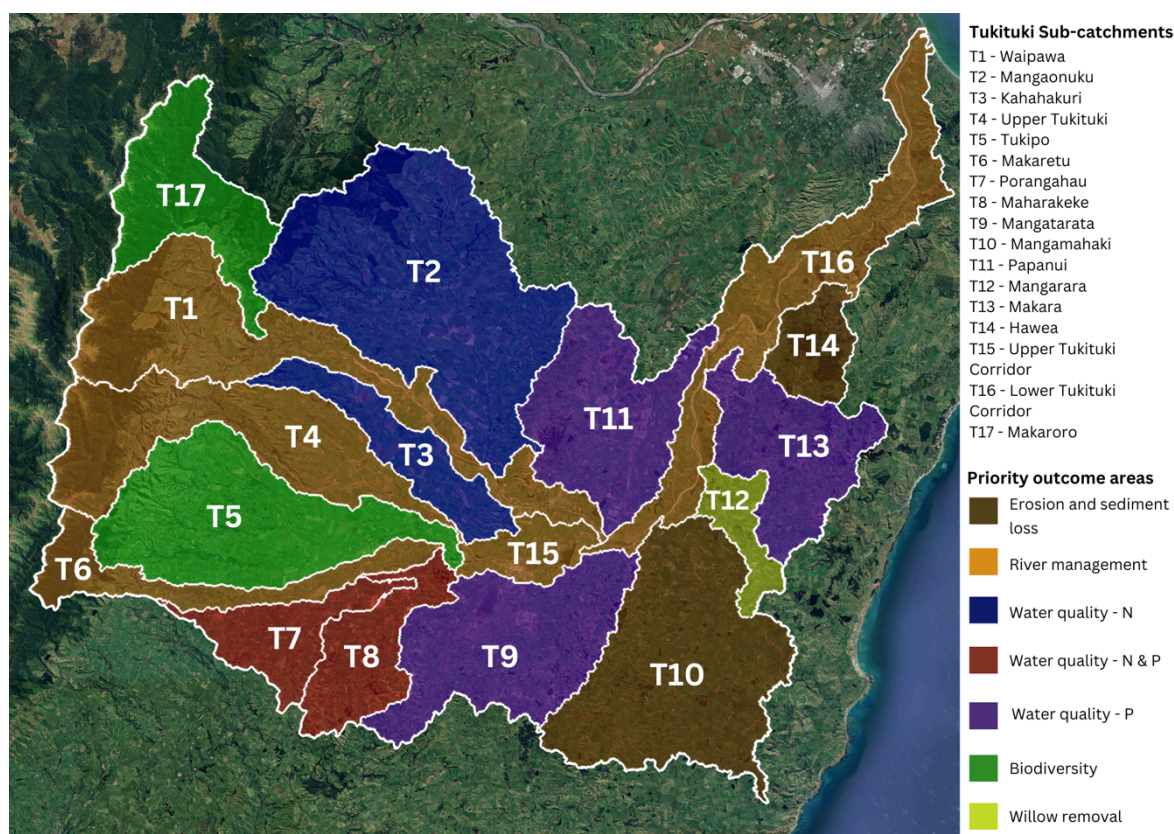


Figure 1 – sub-catchment map for the Tukituki. Coloured areas highlight the recommended priorities for each catchment.

2.2. Outcome areas most sought by farmers (from workshops)

During workshops, farmers were asked to vote on a selection of outcome areas. Below are the top five outcomes:

- Support landowners with the knowledge to make informed decisions to improve the environment
- Improve the flood resilience of the catchment, including upstream and downstream to reduce effects on community in adverse weather events
- Protect and enhance the economic viability of the area
- Protect and enhance the quality, ecology, mauri of waterways and wetlands
- Represent farmers interests in future regional government setting of rules and regulations

MANGAMAHAKI CATCHMENT: CONTEXT AND CHALLENGES

3 The Mangamahaki Catchment Context

3.1 Background

The Mangamahaki Catchment covers 26,418ha around Omakere. The area supports a mix of sheep and beef farming, cropping, and some forestry. In 2021, the community formed Omakere Land Care (Mangamahaki Community Catchment Group) to tackle the area's environmental and flood-related challenges, aiming to improve catchment health and resilience.

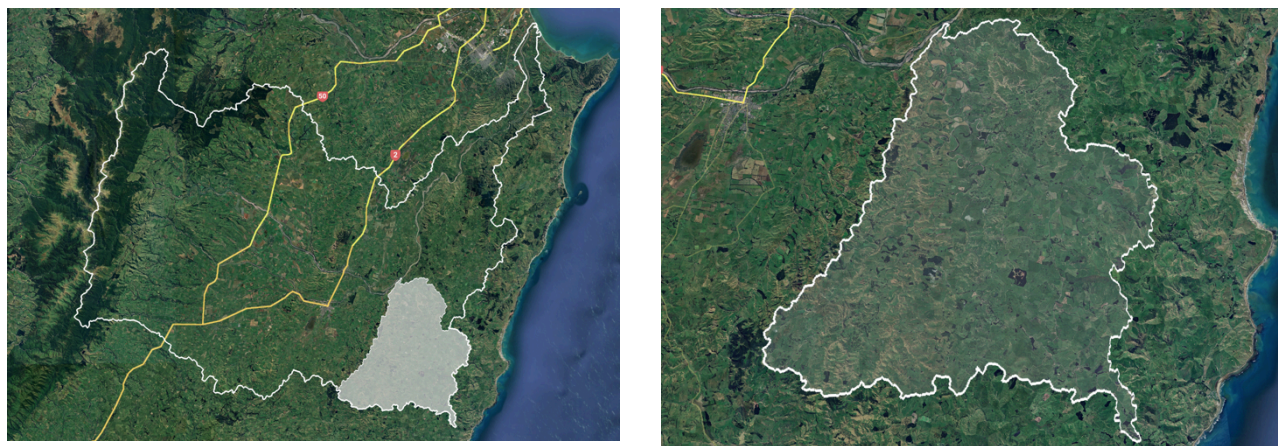


Figure 2 - Location of the Mangamahaki catchment in the wider Tukituki

Flooding is a major concern in the catchment as extreme rainfall events become more frequent and severe. A significant issue has been the congestion caused by dense willow infestations, which have blocked waterways, leading to flooding and streambank erosion, sediment loss, and poor water quality. These issues were raised at a meeting with HBRC in April 2022, with the community noting concerns about flood risks and ongoing stream degradation.

In response, HBRC has started a three-year willow removal project to clear trees and debris along the stream, between the Ōmakere Hall to its confluence with the Tukituki River, covering approximately 25.5km. This work aims to prevent further degradation and reduce the risks of flooding and sediment loss. It is now clear that this project will require more time and funds in order to clear the length of the stream.

A demonstration project has been established with support from TLC, the Cyclone Gabrielle Appeal Trust, Omakere Hall, Omakere School, and HBRC to support these efforts. This project focuses on riparian planting and showcases best practices for stream health improvement following willow removal.

Over 3,000 native plants have been planted to help stabilise streambanks, filter nutrients, and enhance biodiversity. The project is a practical example of how targeted efforts can improve ecosystem health, reduce sediment runoff, and provide co-benefits such as recreational opportunities.

3.2 Mangamahaki Catchment Context

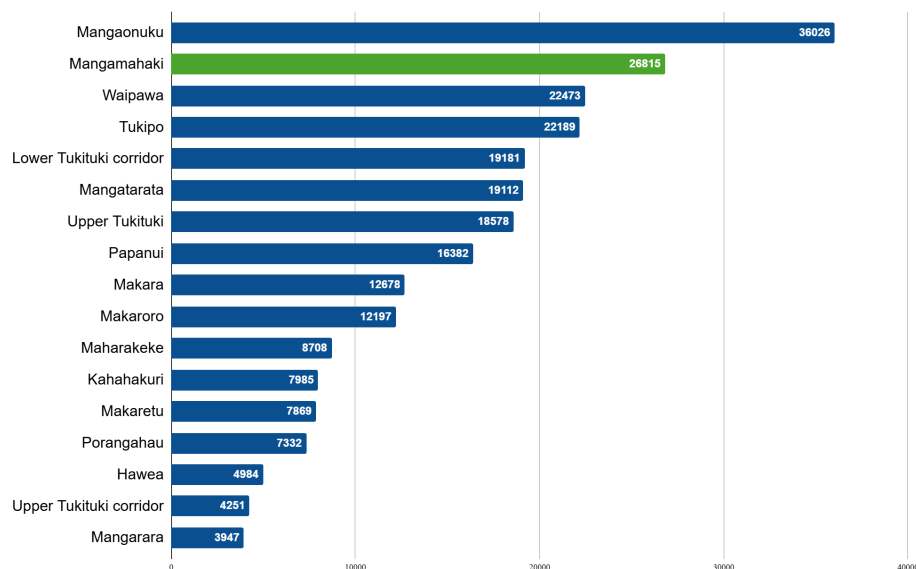


Figure 3 – Tukituki sub-catchment areas in hectares

The Mangamahaki catchment is 26,815ha, which amounts to 10.7 % of the wider 250,000ha Tukituki catchment. The Mangamahaki is the second largest sub-catchment of the Tukituki (figure 3).

Land use in the Mangamahaki is typical of the wider Tukituki catchment, with 94% of the catchment in the pasture and 4% in the exotic forest (figure 4).

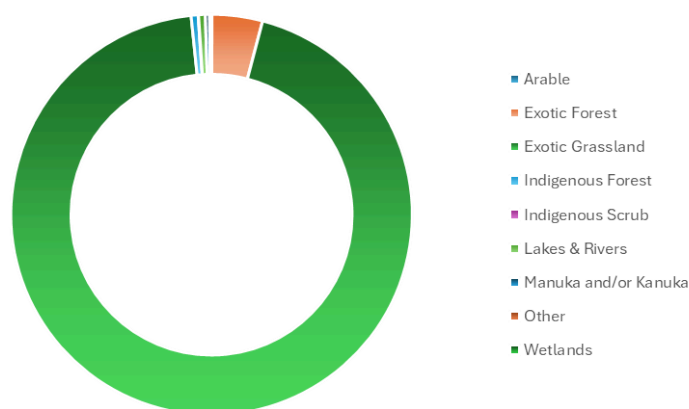


Figure 4: Land use in the Mangamahaki catchment.

3.3 Catchment Challenges and Key Focus Areas

The Mangamahaki Catchment workshop, in December 2024, focused on various environmental and land management issues facing the catchment. The demonstration project around the hall and the progress of the HBRC stream clearance project were discussed.

Attendees highlighted the continuing challenges of flooding and the impact this has on both the environment and the community, with past flooding events damaging farmland and infrastructure and frequently forcing the closure of Omakere School and Play Centre.

The need for the catchment to have a collective vision which would help support a more unified approach to their catchment planning and subsequent on-farm actions was discussed.

Several focus areas were highlighted throughout the workshop, including:

- Understanding the Emissions Trading Scheme (ETS)
 - Attendees would like easy-to-understand updates on the ETS, clarifying what is viable and who to contact for guidance.
- 'How-to' Toolboxes
 - Clear guidance on methods, timing, and costs for willow removal, riparian plantings, sprays and weed control including, second-stage planting and management.
 - Guidance on what is permitted within plan rules.
- Research on Elders and erosion control
 - Reviewing the success rates of using Alders for erosion control and whether it could be applicable in Mangamahaki as an alternative to traditional erosion control species.
- HBRC Grants
 - Clarifying what grants are available when they are open, and who can assist with the application process.

These focus areas reflect the group's desire for practical tools and clear guidance to improve the environmental health of the catchment while addressing erosion, water quality and flood risks.

3.4 Catchment Challenges

Erosion control was mentioned as one of the key actions by the attendees at the catchment group meeting. The soil in the catchment is prone to erosion, which shows up in the water turbidity data (table 1). The Mangamahaki has the highest level of suspended solid estimates in the catchment alongside the Mangarara (Figure 5).

From a water quality point of view phosphorus is likely to be the largest risk. It is likely to be related to the high levels of sediment loss in the catchment, both through landscape and riverbank erosion.

Table 1 - Mangamahaki catchment water quality indicators over a five-year rolling average.

Water Quality Parameter	Mangamahaki	Standard*
Nitrogen (DIN)	0.134 mg/ L	0.8
Phosphorus (DRP)	0.024 mg/ L	0.015
Bacteria (E.coli)	110 (count)	260
Freshwater invertebrates (MCI)	54.7 (index)	100
Sediment (Turbidity)	4 mg/ L	5.6 FNU (light)

* The standard represents water quality levels based on the Tukituki plan or national standards. See [Link to the Mangamahaki dashboard](#)¹ for more information.

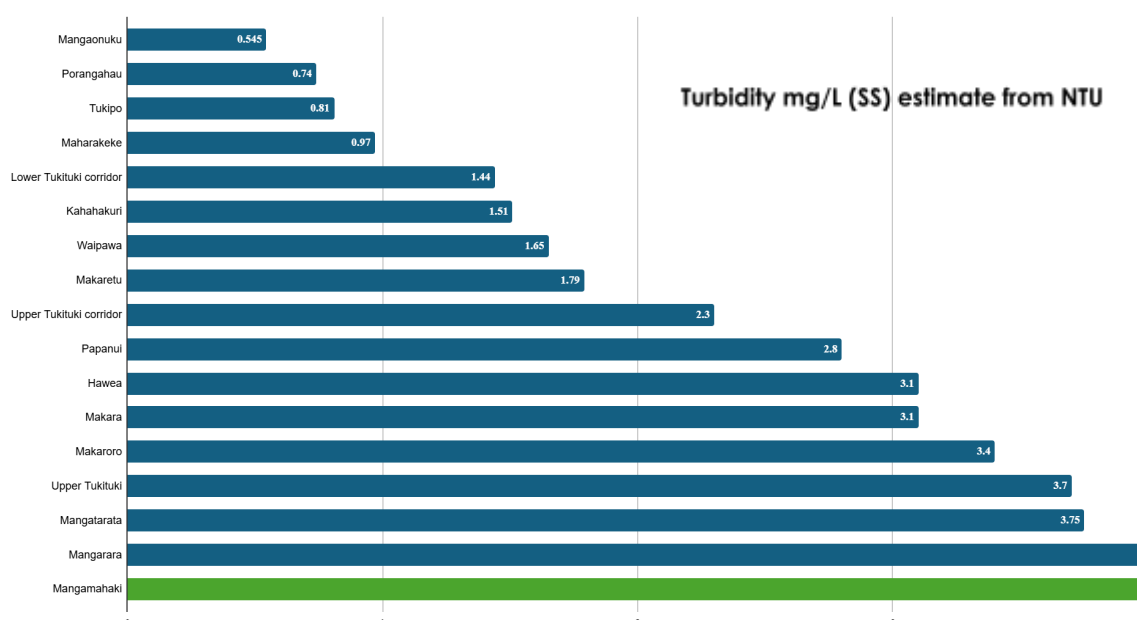


Figure 5 – Suspended solids estimate for sub-catchments in the Tukituki.

The main channel has significant challenges post flooding events (figure 6). Invasive willows are adding to the challenges around riverbank protection and flood plain management.

¹<https://www.hbrc.govt.nz/environment/farmers-hub/in-the-tukituki-catchment/tukituki-dashboard/mangamahaki-dashboards>



Figure 6 - The main channel of the Mangamahaki. Typically crack willows and unfenced streams have led to riverbank erosion (google maps images).

3.5 Landscape Constraints

The Mangamahaki catchment is dominated by flat country in the centre of the catchment with rolling to steep country in the west. Historically, the central catchment would have been wetland areas, which has left behind fertile Gley soil (figure 7). The topography and soils have a particular way that they interact with nitrogen and phosphorus. The soils left behind by wetlands will have a low nitrogen loss profile and will often denitrify nitrogen rich water. However, they have a reduced ability to bind phosphorus to the soil, meaning phosphorus will easily leave the soil once in contact with water. The soils in the catchment are also susceptible to erosion, further increasing phosphorus in waterways.

The western part of the catchment is categorised as hill-country, and highly susceptible to erosion. Much of the phosphorus lost in a catchment will be attached to soil and dung and be released as erosion occurs in rainfall events

SMAP Soil Order - Mangamahaki

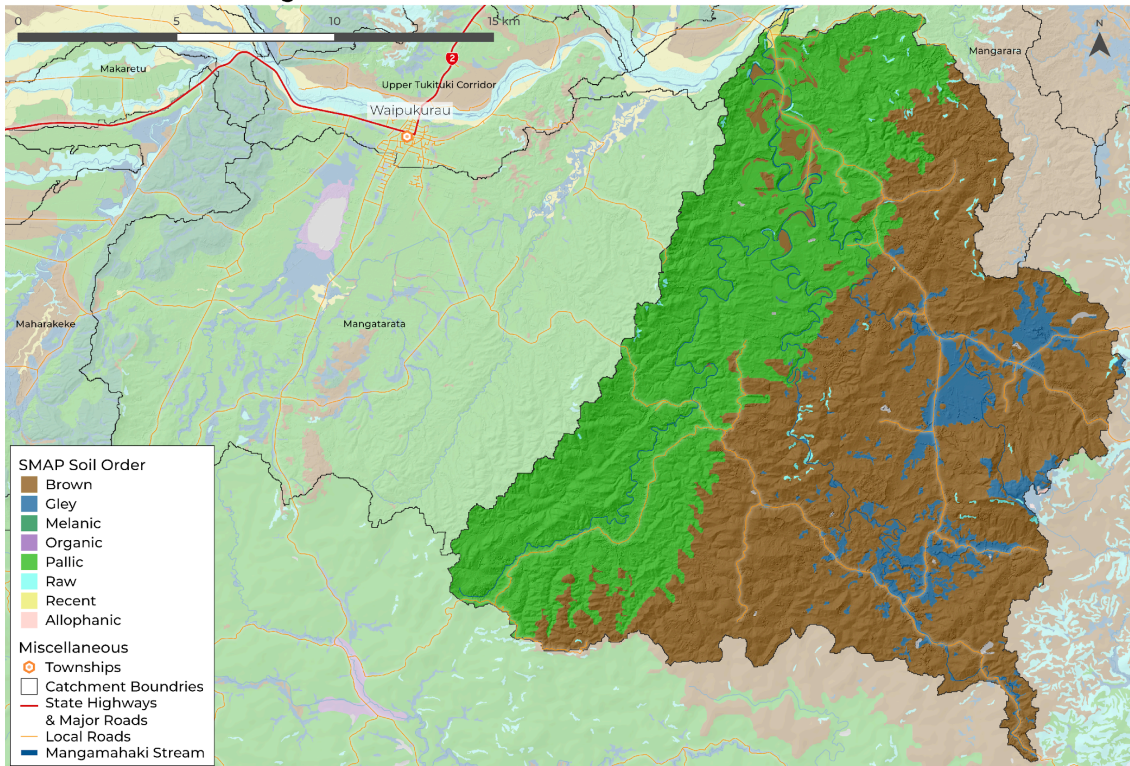


Figure 7 – Soil orders of the Mangamahaki catchment.

The high energy stream and erodible soil coupled with a probable lack of riparian fencing and riparian planting is likely to exacerbate bank erosion and sediment levels. The below image (figure 8) is a desktop survey of the riparian fencing condition in the catchment. While this information is over 10 years old, the indication is that it had some of the poorest conditions from a stock disturbance point of view.

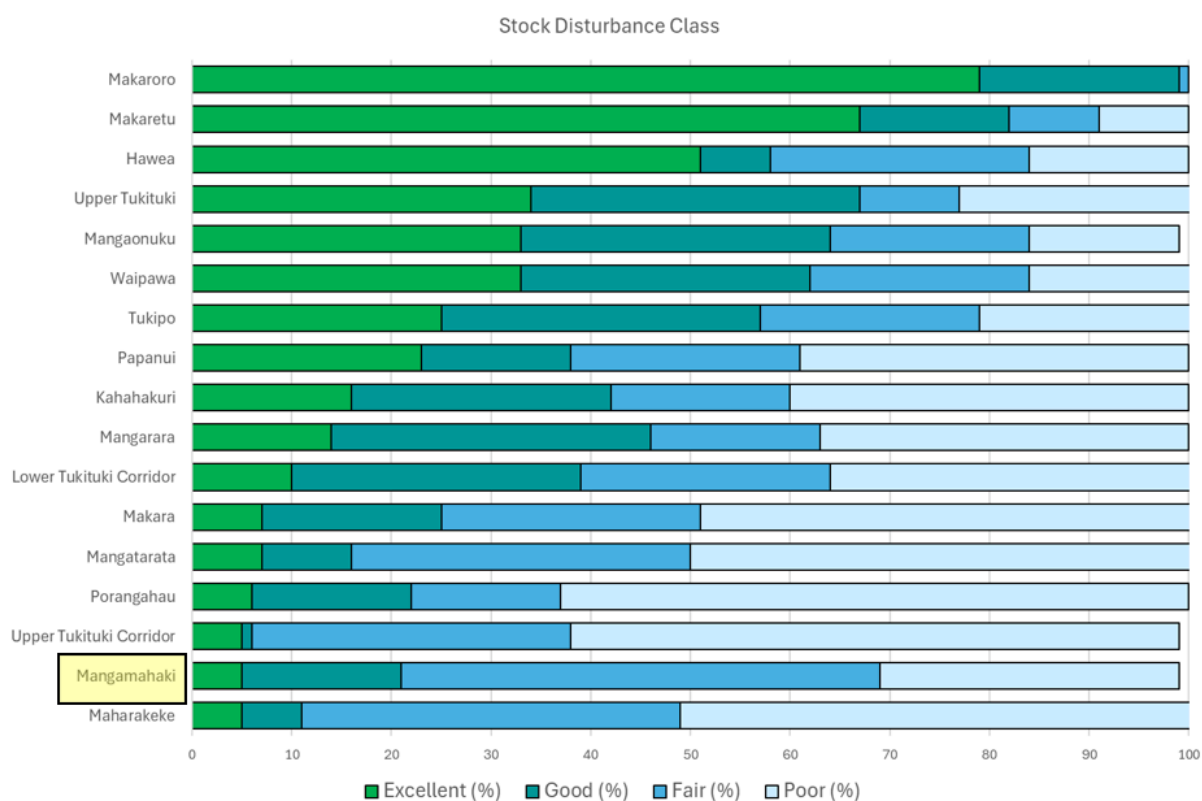


Figure 8 - Riparian stock disturbance class for catchments in the Tukituki. Sourced from HBRC as part of a desktop survey in 2014.

MANGAMAHAKI CATCHMENT: OPTIONS ACTIONS AND RECOMMENDATIONS

4 Summary of Challenges, Impacts and Priority Actions

Objective area	Land use and appropriate planting	Understand funding and support	Erosion and sediment loss	Implement good practice on farm
Challenge	Planting is a key activity to reduce soil loss, build alternative revenue through the ETS and increase flood resilience. However information is lacking to aid decision making.	The landowners in the catchment are motivated to implement change, but are unsure of the advice and funding available.	Erosion and sediment loss is likely to be widespread in the catchment.	The major challenge is to support landowners to make the most desired outcomes.
Impact	Poor decision making can lead to investment in afforestation that doesn't meet catchment or landowners objectives.	Without appropriate advice and funding, actions will likely be delayed or reduced in effectiveness.	Loss of productive land. Impact on water quality. Erosion and sedimentation is a major driver of flooding.	The evidence is clear. Farm planning can make a marked difference for water quality.
Priority action	Build and communicate a decision support tool for planting to meet multiple outcomes. Additionally Work with TLC reps to understand HBRC grants.	Work with TLC coordinators to build relationships and communication with HBRC and other funders. Use the funding options tool developed as part of The Big Picture project.	Using the highly erodible land map and the plant selection tool from The Big Picture project, work with farmers to plant highly erodible land and riparian margins.	Promote the use of TLC On-Farm Action Planning Tool and expert advice where needed.

Figure 9 – Summary of the challenges, impacts and recommended priority actions for the Mangamahaki catchment, framed against the four major objective areas

5 Mangamahaki Implementation

5.1 Implementation to meet priority objectives

In order to meet these outcomes areas, the group seeks clear guidance on effective riparian planting, willow removal, and weed control while exploring alternative erosion control species. Additionally, they want accessible information on available funding and grants and to support their efforts.

5.2 Clarifying grants and funding

There are two priority actions for this objective. Firstly, to work with TLC coordinators to seek understanding from HBRC on funding priorities and how farmers can access funding to meet catchment goals - including the status of the willow clearing work underway. Secondly to use the funding document created as part of The Big Picture project and seek funding where catchment programmes help meet farmer goals.

5.3 Erosion control and Afforestation

The below section on general approaches to soil conservation notes the options that could be explored through the catchment group or with individuals to achieve better soil management. Additionally, using the high-risk erosion mapping provided to TLC (appendix 2) and the list of erosion control and sediment reduction actions alongside their application and effectiveness (appendix 4), will help prioritise both the key areas and the key actions to take within the catchment to reduce erosion.

5.4 General approaches to soil conservation

Fencing and native afforestation: Significant reduction in erosion, up to 74% less slips occur in native forest compared to pasture. Native species are a great long-term approach but can be very costly and hard to establish in dry exposed hill country. Hardy species like manuka and kanuka have been used in the past as an initial coloniser species to increase canopy cover and reduce costs. This has been used for decades in New Zealand and more recently described as the Tīmata method in an Our Land and Water project.

Space planted poplars: Space planted poplars are one of the most common forms of slope stabilisation in New Zealand and are readily accessible through regional council soil conservation programmes. During cyclone Bola land planted with space planted trees had 22% less erosion than pasture areas without trees.

Afforestation with pines: Established pine forest had 87% less erosion scars than pasture alone in the Manawatu events in 2004. However, pine trees have limited benefit in gully erosion and for stabilising stream banks.

Space planted kanuka: A study on a Hawke's Bay farm found 108% more pasture growth under kanuka trees on sloping summer dry hill country pastures compared to open pasture. The study found: 49% more organic matter, 116% more Olsen-P and 9% greater porosity under the trees. Perennial ryegrass and cocksfoot dominated the pasture under the trees and browntop dominated the pasture away from the trees. The researchers surmised that these differences are mainly due to livestock preferentially spending more time under the trees grazing, and the trees adding organic matter to the soil.

Mānuka only planting: Mānuka planted for erosion control were found to be unlikely to provide effective erosion mitigation on steep land until significant root mass develops below the depth of the shear plane at which most landslides occur. Increasing the planting density, reducing early seedling mortality by better management of weed competition, and/or their replacement (blanking) would probably improve the erosion mitigation effectiveness of low-density manuka plantings. The time (years after planting) to attain canopy closure and root occupancy, if stands of mānuka were to remain fully stocked, varies between landforms and would likely occur between 6.5 and 9 years after planting. However, variable rates in planting density, and of plant mortality, resulting in under-stocking would significantly delay this, particularly on landslide-affected slopes.

Grazing under exotic trees: Several studies have found that pasture production can be between 17% and 53% higher under Holm oaks in dry areas of Spain and Portugal. The studies suggested that the reasons for this improvement were either increased availability of nutrients under the tree, or microclimate modifications for conserving water².

Another study found that pasture production was 45% higher in southern beech silvopastures compared to open pasture in Argentina. The researchers suggested that the reason for these effects was that there was 80% less wind in areas with the trees compared to areas without trees, resulting in less evapotranspiration under the trees³.

Timata method: The Timata method refers to afforestation using low-cost techniques. This technique significantly reduces challenges associated with affordability, supply of trees and labour, while retaining the ecological and economic benefits of establishing native forest. The principles are: A) 2m spacing (2,500 stems/ ha), B) 70% manuka or kanuka, C) Small forestry grade trees, D) Careful land preparation including weed and animal pest control.

Fencing and sowing legumes: Rapid establishment of productive pastures on erosion scars in Wairarapa and similar hill country can be achieved by retiring areas from grazing for 2-3 years, and oversowing with white clover and lotus.

Over sowing legumes only: Where spelling from grazing is not an option, significant (but reduced) improvements in rate of slip revegetation and subsequent productivity can be made through oversowing white clover seed.

6 Estimated costs for implementation options

Before actions can be costed for this catchment, agreement on the highest priority actions should be discussed and agreed by the catchment group. Given the scale of opportunity, there is a very wide range of costs that could be incurred across the catchment. Having said that, focussing on planting highly erodible land is likely to provide one of the biggest returns on investment given the economic and environmental outcomes.

² <https://verdantiaresearch.co.nz/>

³ <https://verdantiaresearch.co.nz/>

APPENDICES

1. Appendix 1- TLC On-Farm Action Planning Tool

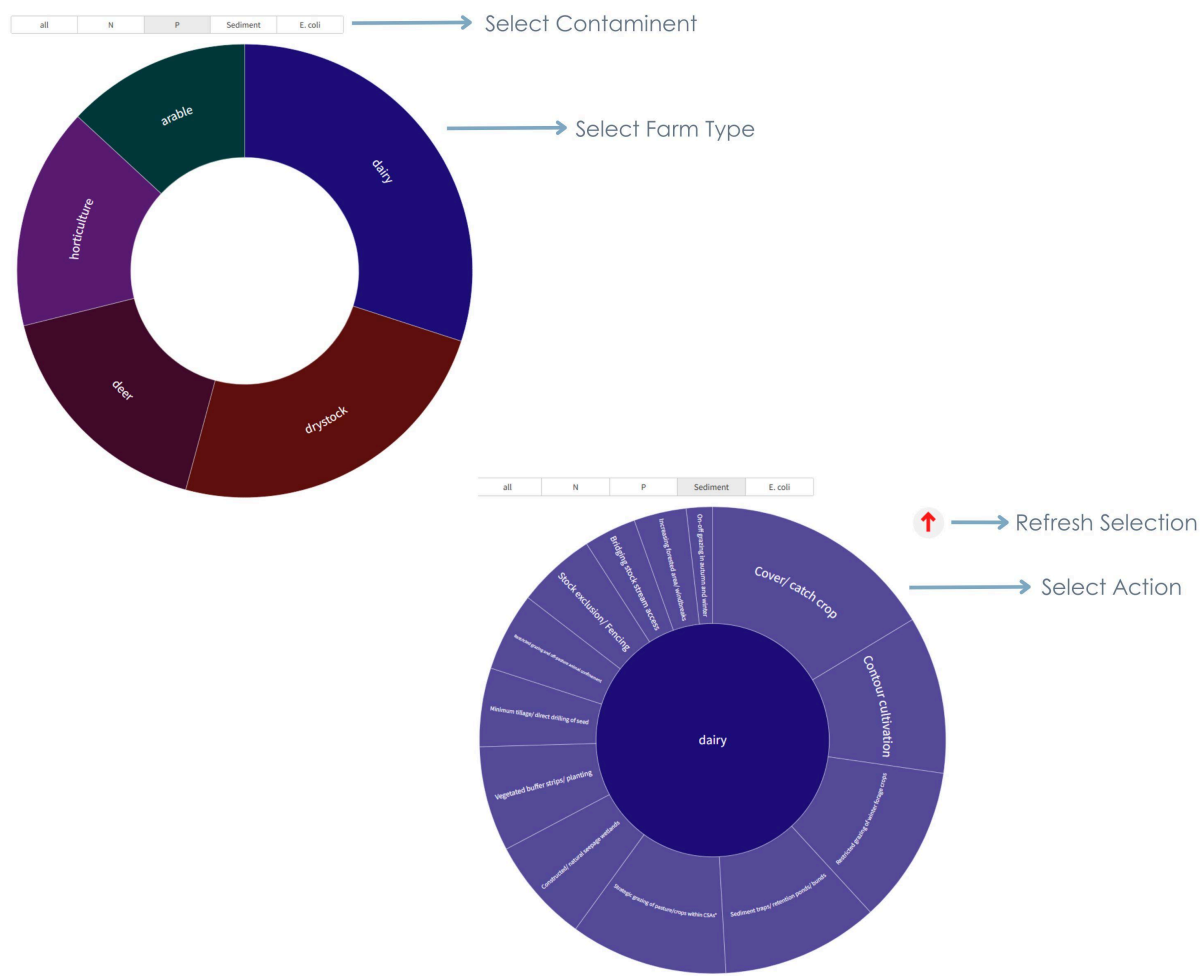
This decision-support tool is designed to help farmers identify and prioritise cost-effective environmental actions on their farms. Use the filters to explore mitigation options by contaminant and farm type.

The larger the section, the greater the impact and cost-effectiveness of the mitigation. Recommended actions are displayed in descending order, starting from the top and progressing clockwise around the circle.

How to use the tool:

Visit the TLC Farmer Toolbox at www.tukitukilandcare.org/toolbox, select the On-Farm Action Planning Tool and follow these steps:

1. Select a contaminant.
2. Choose your farm type.
3. Select an action to view more details.
4. Click the red arrow to reset your selections.



2. Appendix 2 - Understanding Highly Erodible Areas

2.1. Highly erodible areas using mapping

Each catchment in the Tukituki has been mapped using LiDAR and the revised universal soil loss equation (RUSLE) has been applied. The equation, described in IECA as having the following form: $A=R \cdot K \cdot LS \cdot C \cdot P$ where A is the annual soil loss due to erosion (t/ha year); R the rainfall erosivity factor; K the soil erodibility factor; LS the topographic factor derived from slope length and slope gradient; C the cover and management factor; and P the erosion control practice factor. The limitations of RUSLE are that it only accounts for soil loss through surface erosion (sheet and rill erosion) and ignores the effects of gully erosion.

This model enables understanding of the highest risk areas within the catchment, where soil loss is mostly likely and where to prioritise soil conservation measures

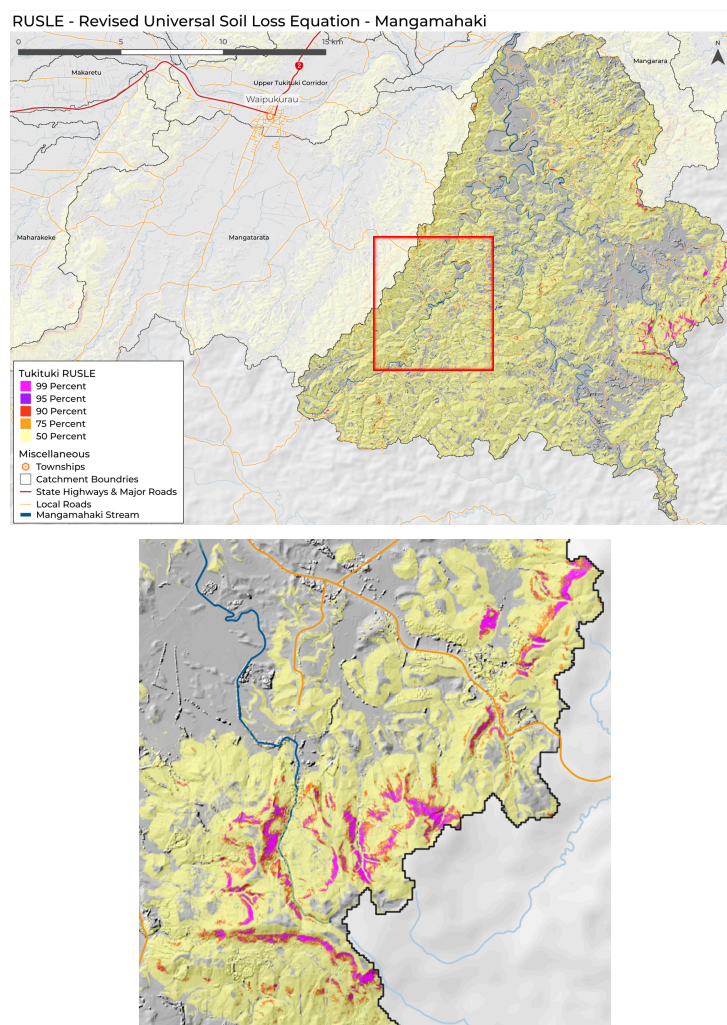


Figure 10 – RUSLE model at sub-catchment scale. High risk erosion is mapped at 99%, 95%, 90%, 75% and 50%, throughout the Tukituki catchment.

2.2. Farm planning using RUSLE

As HBRC's high resolution LiDAR data set enables high resolution mapping and prioritisation of action at Tukituki, sub-catchment and farm scale. If erosion, sediment or phosphorus is a priority for the sub- catchment, using this model will help find the areas to prioritise.

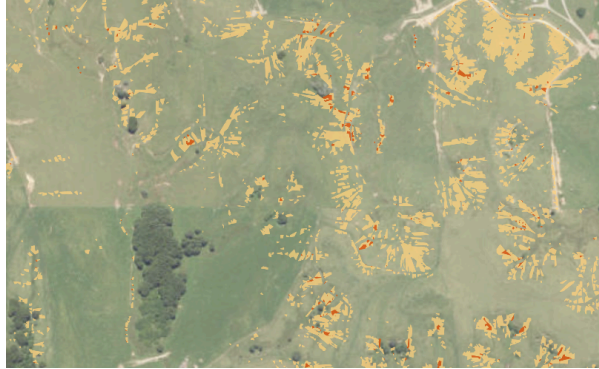


Figure 11 – From a farm planning point of view the RUSLE can be used to prioritise areas to implement soil conservation measures.

3. Appendix 3 - Flow maps for sediment trapping sites

3.1. Identification of sites for edge of field mitigations (wetlands, dams, bunds)

Topographic Wetness Index (TWI) is a measure of how likely an area is to accumulate and retain water based on its slope and contributing upslope area. TWI identifies wet or poorly drained areas in a landscape, making it useful for understanding placement of edge of field⁴ mitigations like bunds and wetlands.

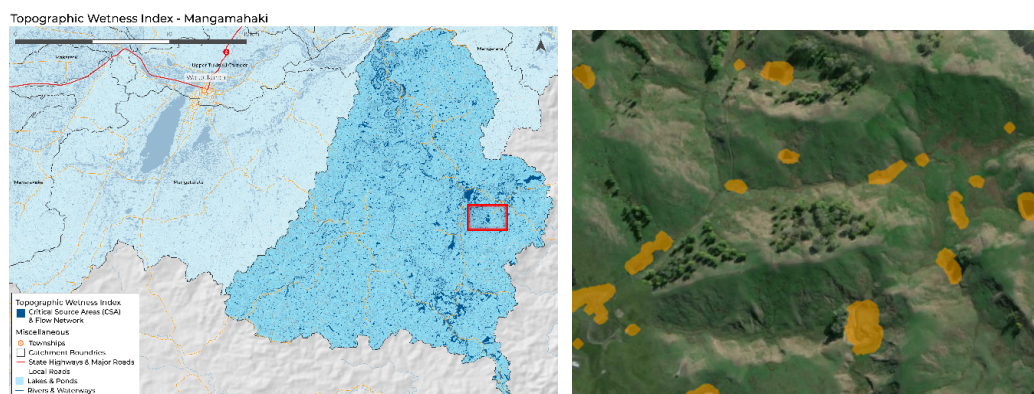


Figure 11- TWI example in a sub-catchment. Using the data layers supplied by EIS will enable exploration of the data using GIS or Google Earth.

TWI can be a very useful tool in catchment and farm planning for those wanting to implement over and above farm actions. It does need ground truthing but can be useful in finding appropriate sites, with an estimate of water accumulation areas and volumes.

It is important to note that the edge of field mitigation needs to suit the outcome each catchment is seeking. TLC will have to be aware of single focus edge of field, which has become a common narrative in New Zealand. For example, promotion of single solutions like installing only constructed wetlands or detention bunds (detainments bunds) was common in freshwater management during the 2010s.



Figure 12 – Examples of edge of field mitigations, from large detention bunds, large wetlands through to in-line or off-line sediment traps.

⁴ Edge of field tactics are a group of mitigations that operate downstream of a contaminant source, and capture water to treat it. They are normally placed in overland flow path channels before water enters main waterbodies.

4. Appendix 4 - Erosion control and sediment capture actions and effectiveness

4.1. Erosion control

There is a wide range of tactics that can be used in hill country landscapes. Table 2 below outlines the typical soil conservation tactics available for deployment in rural landscapes. The table outlines each tactic's application, and the probable sediment loss reduction based on relevant literature.

Table 2 – Summary of the effectiveness and application of soil conservation treatments. In general, reduction percentage described below outlines the improvements possible from deploying that tactic compared to undertaking no actions at a site.

SOIL CONSERVATION TACTICS	Mass wasting (deep e.g. earth flows)	Mass wasting (shallow e.g. soil slips)	Sheet and Rill	Waterway Erosion	Gully	Tunnel gully	Erosion reduction
Space planted trees (poplars & eucalypts)	✓	✓	✓	□	✓	✓	14-70%;
Afforestation -Exotics (pines)	✓	✓	✓	□	✓	✓	87% vs pasture 19-66% in gullies 50% catchment wide
Afforestation - Manuka	✓	✓	✓	□	✓	✓	90% fewer landslides vs pasture
Afforestation - Kanuka	✓	✓	✓	□	✓	✓	65% vs pasture
Afforestation -Natives	✓	✓	✓	□	✓	✓	74% less landslides 87% less volumetric

4.2.

Sediment capture

Sediment reduction and edge of field approaches to reduce the impact of soil loss have been researched less in New Zealand than afforestation and soil conservation. The below list outlines the known major interventions that can be applied in the rural landscape. The interventions exclude good management practices like stock exclusion of waterways, pasture and grazing management.

Table 3 below outlines the typical sediment attenuation tactics available for deployment in rural landscapes. The table outlines each tactic's application and the probable sediment loss reduction based on relevant literature.

Table 3 – Summary of the effectiveness and application of sediment reduction treatments that are typically applied. In general, reduction percentage described below outlines the improvements possible from deploying that tactic compared to undertaking no actions at a site.

SEDIMENT REDUCTION TACTICS	Mass wasting (deep e.g. earth flows)	Mass wasting (shallow e.g. soil slips)	Sheet and Rill	Waterway	Gully	Tunnel gully	Sediment attenuation
Grass buffers (see filter strips also) pastoral farming	☐	☐	✓	☐	☐	☐	20-30% (channelised flow) 40-80% (non channelised)
Critical Source Area management	☐	✓	✓	☐	☐	☐	20-30% (pastoral farming - channelised flow)
Grass filter strips (see buffers also)	☐	☐	✓	✓	☐	☐	90% (Tss reduced). Grass 90% better than bare soil (AC)
Detention bunds	☐	✓	✓	☐	☐	☐	70% 23-79% (Decanting earth bund)
Sediment traps (land based)	☐	☐	✓	☐	☐	☐	50-60%
Wetlands	✓	✓	✓	✓	☐	☐	60-80%
Sediment trap and wetland	☐	✓	✓	✓	☐	☐	70%
Sediment Traps (Inline waterway)	☐	☐	☐	✓	☐	☐	50%
Sediment retention pond	☐	✓	✓	☐	☐	☐	33%
Debris dams	☐	☐	☐	☐	✓	☐	80%