Te Kaunihera o Te Tairāwhiti
GISBORNE
DISTRICT COUNCIL

Tuhinga Whakamārama Mahere Kohinga Wai o Tairāwhiti ki te Tonga

Southern Tairāwhiti Catchment Plan Background Information Document

March 2025

CONTENTS

INTRODUCTION
HE KUPU ARATAKI

This document outlines the background and key technical information to support the development of the Southern Tairāwhiti Catchment Plan. It provides a starting point for understanding the catchments and a context for future discussions.

All New Zealand regional and unitary councils, including Gisborne District Council (Council) and Hawke's Bay Regional Council (HBRC), are preparing catchment management plans for their regions.

These are being developed under the National Policy Statement for Freshwater Management 2020 (NPS-FM) and will be supported by the Tairāwhiti Resource Management Plan (TRMP), and the Hawke's Bay Regional Resource Management Plan (RRMP).

While some catchments are entirely within Te Tairāwhiti Gisborne region, some catchments also flow into Te Mātau-a-Māui Hawke's Bay region . What we do in one region affects the other. Similarly, tangata whenua and community interests span across both regions. The Gisborne District Council and Hawke's Bay Regional Council (HBRC) are working closely together on this project

WHAT IS A CATCHMENT PLAN?

A catchment plan is a tool that focuses on managing freshwater and landuses at a catchment scale. Catchment plans provide a way to:

- identify and understand the freshwater values relevant to the catchment area,
- set a vision for how we want to see the catchment area in the future, and
- outline the requirements and actions needed for achieving that vision.

The Southern Tairāwhiti Catchment Plan will provide a pathway for managing freshwater quality and quantity into the future. This pathway will be set in conjunction with tangata whenua, stakeholders and the community and will help Council make better decisions about land and water use within this area.

WHERE DOES THE SOUTHERN CATCHMENT PLAN APPLY?

The Southern Tairāwhiti Catchment Plan area includes catchments that flow towards Te Mātau-a-Māui Hawke's Bay.

Catchments include:

• The Ruakituri, Hangaroa, Mangapoike, and Nūhaka River, and Kopuawhara Streams, which all form the south-western boundary of Te Tairāwhiti Gisborne and flow into Te Mātau-a-Māui Hawke's Bay.

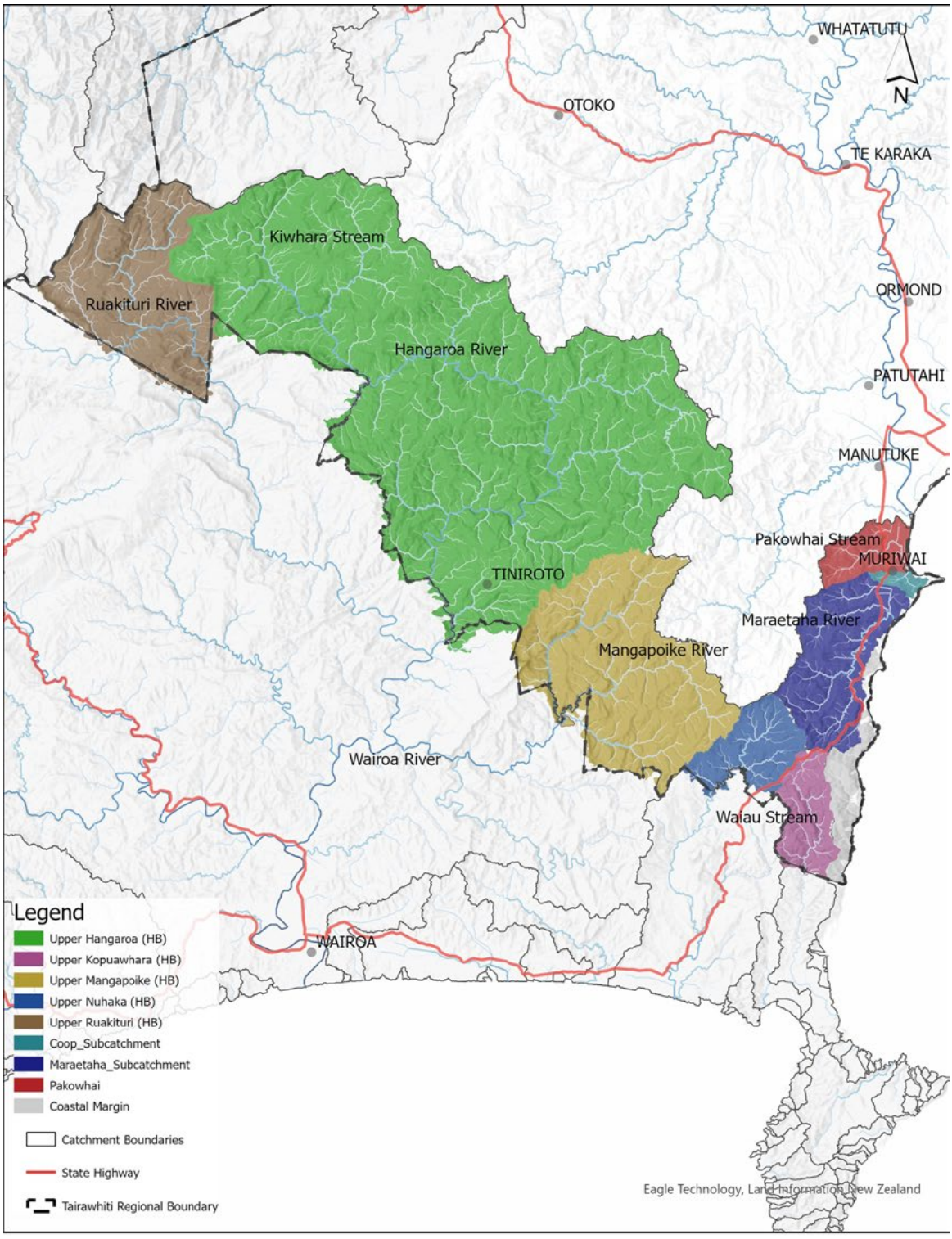
• The Maraetaha River beside State Highway 2 before flowing to the coast.

• The Pakowhai Stream that flows into Wherowhero Lagoon.

• Several smaller catchments located along the coastal margin between the Maraetaha catchment, State Highway 2, and the end of Mahanga Road (in Wairoa), including the Wharekakaho, Waikara, Tikiwhata, and Hauraki Streams, and unnamed streams.

Their total combined catchment area in Te Tairāwhiti Gisborne is 1,270 km2, the largest catchment area being the Hangaroa (726 km2), followed by Mangapoike (185 km2) and Ruakituri (130 km2).

Figure 1 shows the sub-catchments in the Southern Tairāwhiti catchment area. Figure 2 shows the rivers crossing Te Tairāwhiti Gisborne's jurisdictional boundary and into Wairoa District.



Southern Tairāwhiti Catchment

0 5 10 20 Km

Figure 1: Southern Tairāwhiti Catchment Area

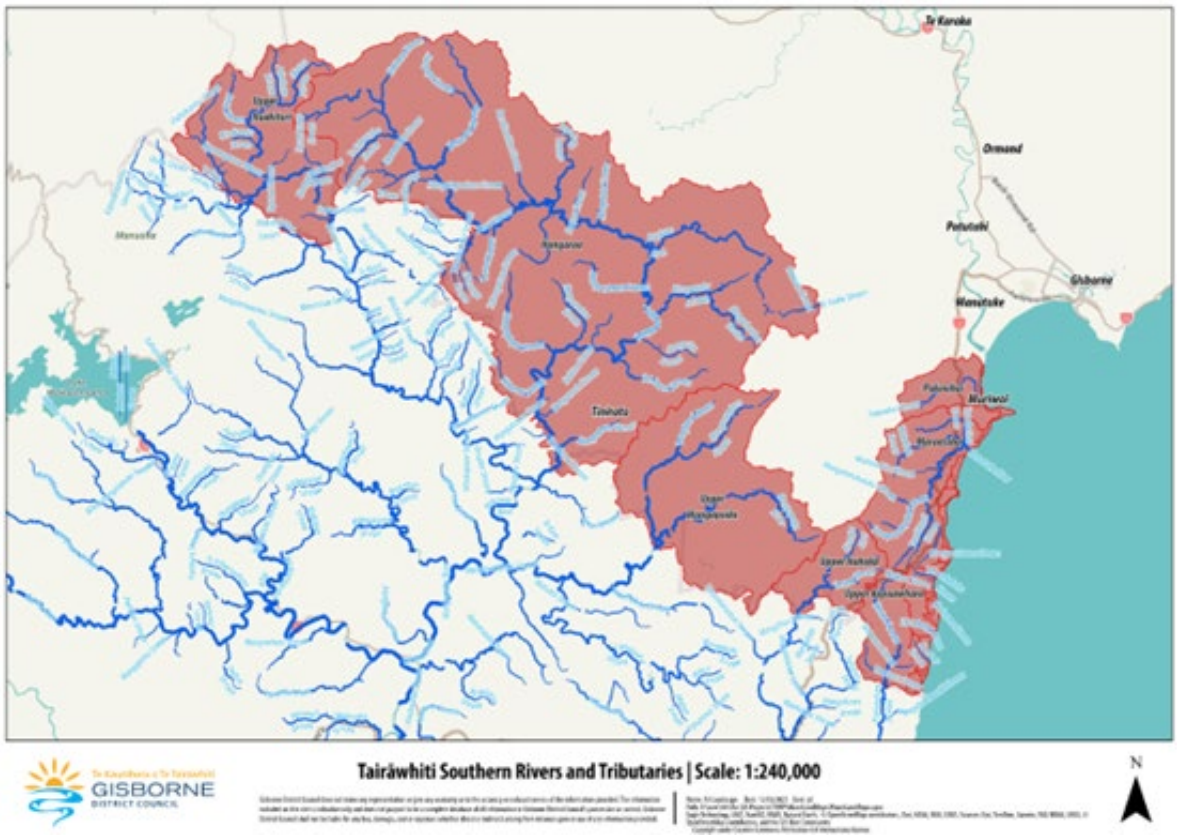


Figure 2: Rivers and tributaries in Southern Tairāwhiti catchment and in Wairoa district.

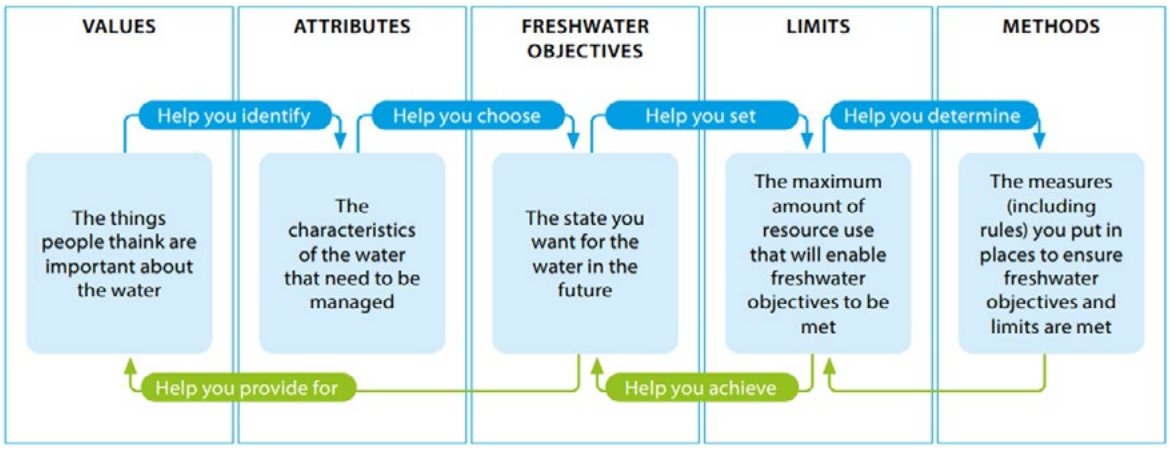
WHAT IS REQUIRED IN A CATCHMENT PLAN?

The National Policy Statement for Freshwater Management 2020 (NPS-FM), specifies what is required in catchment plans. The government has already made changes to the RMA that resource consent applications must not be assessed against the hierarchy of obligations in the NPS-FM, it has signalled that further changes to the NPS-FM are likely, but the timing and content of that are currently unknown.

A key requirement of the NPS-FM is to identify long-term visions for catchments. Visions must be ambitious but achievable, have timeframes, and must give effect to Te Mana o Te Wai.

The catchment plans will identify the objectives, limits and targets that apply to waterways (or groups of waterways) within each catchment area. They will also set out any action plans and projects to achieve the objectives, limits, and targets.

The NPS-FM provides a framework that must be followed to achieve this - the National Objectives Framework (NOF). It is intended to be a nationally consistent approach to setting freshwater objectives, with flexibility to recognise and provide for local circumstances.



The following summarises the steps required to meet the NOF:

- Identify Freshwater Management Units (FMU) – whether and how we split up the Catchment Plan area for management.
- **Within each FMU identify:**
  - monitoring sites
  - swimming sites
  - locations of habitats of threatened species
  - outstanding waterbodies
  - natural wetlands
  - freshwater values for each FMU (e.g., ecosystem health, human contact, threatened species, mahinga kai, fishing, animal drinking water).
- Set environmental outcomes and objectives
  - Identify water quality attributes for each value.
  - Identify the baseline states for each attribute.

The NPS-FM also requires that long-term visions are developed for each catchment. This includes:

- Setting ambitious but achievable goals.
- Identifying a timeframe to achieve those goals.
- Identifying how to give effect to Te Mana o te Wai.
- Identifying any Māori freshwater values that apply values identified in the catchment.
- Enable a holistic approach to land and water management, and a variety of regulatory and nonregulatory methods.

MĀORI FRESHWATER VALUES

Mahinga kai is a compulsory value under the NPS-FM 2020 and is required to be implemented through the NOF process. This gives greater recognition to values that Māori hold for freshwater and provides for tangata whenua to meaningfully exercise their freshwater interests and obligations.

While mahinga kai is a compulsory value, the NPS-FM 2020 provides for identification of any Māori freshwater values. It also requires that tangata whenua are enabled to identify their freshwater values and are involved in implementing the NOF and in decision-making. Māori freshwater values are specific to tangata whenua, and they have not been described in any detail as these will be obtained through partnership with tangata whenua.

Accordingly, Council will partner with tangata whenua to ensure they are able to provide their Māori freshwater values (at a minimum, mahinga kai).

OTHER NATIONAL REGULATION

There is also a wider national context that will need to be considered as the plan develops. In September 2020, the Resource Management (National Environmental Standards for Freshwater) Regulations and the Resource Management (Stock Exclusion) Regulations were introduced.

The regulations cover a range of activities that may relate to the Southern Tairāwhiti Catchment including standards for dairy farming, winter intensive grazing, stock exclusion, fish passage, natural wetlands, and culverts. The impacts of these regulations and standards will be considered as we move through the process.

WHY ARE WE ENGAGING WITH THE COMMUNITY?

Council wants freshwater outcomes to reflect community aspirations. The NPS-FM requires engagement throughout the NOF process, and provides for community and tangata whenua involvement in implementing the NOF and decision-making.

There are many different catchment groups working throughout New Zealand. Regional councils are engaging communities and tangata whenua in the planning process to manage multiple interests and increasing demands on fresh water. A more collaborative approach emphasises the sharing of knowledge and working together at the front end of the planning process.

We have developed engagement plans which include tangata whenua, community groups, landowners, key stakeholders, and the community in general. This will enable everyone to provide their thoughts and ideas into the development of the freshwater plan.

CATCHMENT PLANNING TIMELINE

By law, Council must have completed its catchment planning development for the whole region by the end of 2027. We are working towards the timeline set out below.

March – December 2025

- Engagement with tangata whenua, communities and stakeholders

Early 2026

- Consultation on a draft Southern Tairāwhiti Catchment Plan

Mid-2026

- Public notification of Southern Tairāwhiti Catchment Plan and Section 32 Evaluation Report

DESCRIPTION AND KEY VALUES
HE WHAKAMĀRAMA ME NGĀ UARATANGA MATUA

CATCHMENT CONTEXT

The Southern Tairāwhiti catchment covers an area of 1,270 km2. The catchment area is where several iwi and hapū rohe intersect and overlap. This includes Te Aitanga-a-Māhaki, Te-Whānau-a-Kai, Rongowhakaata, Ngai Tāmanuhiri, Ngai Tuhoe, Ngāti Kahungunu ki Te Wairoa, Rongomaiwahine, Ngāti Rakaipaaka, and Ruapani ki Waikaremoana. There are strong connections between iwi and hapū within this catchment area, established through whakapapa, travel routes across and between Wairoa and Tūranganui-a-Kiwa, and historical alliances. River valleys were highways and waterways sustained the iwi and hapū. Statutory acknowledgement areas under Council are shown in **Map 4 of Appendix 3.**

The geology of the catchment is mainly mudstone and sandstone, with small pockets of gravel. There are small areas of siltstone in the Kiwhara catchment, limestone southwest of Pehiri, and mud and sand south of Muriwai. The area has a history of major and minor landslides, resulting in the Tiniroto Lakes and most recently forming the Mangapoike dam. The geology of the catchment is shown in **Map 1 of Appendix 3.**

Most of the catchment area is classified as having a cool-wet and cool-extremely-wet climate, with lower elevation areas adjacent to the coastline being warm-wet and warm-dry on some of the coastal plain areas . Historic landcover varies from northwest to southeast in this catchment area, largely based on elevation, rainfall, and distance from the sea. Historic landcover of the catchment is shown in **Map 2 of Appendix 3.**

There are now few remaining indigenous forest remnants and many of these are recorded as Protected Management Areas (PMAs), protected under QEII covenant and Department of Conservation (DOC) estate reserves, Nga Whenua Rāhui Kawenata, or part of Te Uruwera. Protected areas and land use and vegetation types of the catchment are shown in **Maps 5 and 6 in Appendix 3.**

Current land-uses are predominantly pastoral with large forestry blocks within the Hangaroa, Mangapoike, Nūhaka, Maraetaha, and Kopuawhara catchments. The largest forestry area is in the south-eastern corner of the catchment area. The catchment area is mainly in land overlay 2 and 3, with some areas of land classified in land overlay 1 .

There are significant areas of sandstone (class 7E, massive and bedded sandstone). Potential high production areas are limited to relatively scarce flat land associated with river flood plains and the coastal plain. **Map 3 in Appendix 3** shows the land overlay areas for the catchment area.

HANGAROA RIVER CATCHMENT

The Hangaroa River catchment within Te Tairāwhiti Gisborne is 72,586 hectares (ha) in area and has a maximum elevation of 1,108 m. This is by far the largest sub-catchment of this catchment plan area, draining much of the central highlands areas that flow to the south.

It flows southward where it converges with the Ruakituri River before becoming the Wairoa River.

The landscape within the overall catchment area is composed mostly of high, steep-sided V-shaped upland valleys. Alluvial floodplains are associated with the Hangaroa itself as well as the upper reaches of the Waikura River, although these are relatively scarce.

The Waikura River is the largest tributary of the Hangaroa River, with smaller tributaries including the Kiwhara Stream, Mutuera Stream, Ihumeka Stream, Mangatete Stream, Mangamoteo Stream, Mangawehi Stream, Kaikoura Stream, Mangapiopio Stream, and Whareti Stream. The Hangaroa includes several lakes at Tiniroto. Two wetlands - the Noble Campbell Wetlands and Tawaroa Wetland – are classified as regionally significant wetlands in the current TRMP .

Land use

The dominant land use in the catchment is extensive sheep and beef farming (79.20% of land area). There are no dairy farms or consented feedlots. There is very little indigenous forest apart from 9,826 ha of indigenous forest in the most upland part of the catchment (which continues into the Ruakituri catchment) and sections of river with fragmented indigenous riparian vegetation (including Broadleaved Indigenous Hardwoods). Small fragments of Kānuka - Mānuka shrubland are scattered throughout the catchment (4.20% of land area). Cropping is largely absent, and there are several large exotic forest parcels (7.70% of land area; the largest near Tahuna and Hangaroa).

Freshwater ecology

Known freshwater species in the Hangaroa River catchment include:

- **At Risk – Declining:** longfin eel, and freshwater mussel (kākahi).
- **Not threatened:** Shortfin eel, common bully, cran's bully, freshwater crayfish.

The above species are also in the Tiniroto Lakes and adjacent streams, including freshwater mussel (Kākahi). The lakes are important areas for waterfowl.

Te Reinga Falls and other waterfalls are natural barriers to non-climbing fish species.

Exotic fish species include goldfish, brown trout, and rainbow trout.

RUAKITURI RIVER CATCHMENT

The Ruakituri River catchment within Te Tairāwhiti Gisborne is 13,008 ha in area and has a maximum elevation of 1,366 m. It flows southward where it converges with the Hangaroa River before becoming the Wairoa River. The entire upper catchment is composed steep upland valleys.

Tributaries of the Ruakituri River include the Kopuapounamu Stream, Te Kei Stream, Anini Stream, and Okaura Stream.

Land use

The entire catchment within Te Tairāwhiti Gisborne is indigenous forest, where Te Uruwera extends into the upper Ruakituri catchment. Further down the catchment, where jurisdiction is held by HBRC, there is extensive farmland and some cropping. Intensive cropping is absent.

Freshwater ecology

Known freshwater species in the Ruakituri River catchment include:

- **At Risk – Declining:** longfin eel, and freshwater mussel (kākahi).
- **Not threatened:** Shortfin eel, common bully, cran's bully, freshwater crayfish.

Te Reinga Falls, and other waterfalls, are natural barriers to non-climbing fish species. Exotic fish species include brown trout and rainbow trout. This is a regionally significant trout fishing river.

The eDNA overall rating of river health is 'Average'.

MANGAPOIKE RIVER CATCHMENT

The Mangapoike River catchment within Te Tairāwhiti Gisborne is 18,468 ha in area and has a maximum elevation of 1,265 m. It is the second largest sub-catchment of this catchment plan area.

It flows southwest before joining the Wairoa River.

The landscape within the overall catchment area is composed mostly of high, steep-sided V-shaped upland valleys. Floodplains are generally narrow, with flat alluvial lands mostly associated with the Mangapoike and the Mangarangiora Stream, although these are uncommon.

The Mangarangiora Stream is the largest tributary of the Mangapoike River, with several smaller unnamed tributaries joining the river before it reaches the Wairoa River.

Land use

Exotic forestry (4,410 ha) and extensive sheep and beef farming (11,436 ha) are the dominant land uses, making up 85% of the catchment. There is very little indigenous forest (734.9 ha) in the catchment. Some significant remaining fragments of indigenous forest are found in the Mangarangiora Stream catchment, while considerable Kānuka - Mānuka shrubland is also found in this and the Mangapoike Stream catchments (2,081ha).

Kānuka - Mānuka shrubland wraps around the Waingake dams in the Mangapoike catchment, with some harvested exotic forestry areas draining into the dams to be planted into native forest species.

The catchment is critical from a drinking water perspective. Sections of river include fragmented indigenous riparian vegetation (including broadleaved indigenous hardwoods). Intensive cropping is absent.

Freshwater ecology

Known freshwater species in the Mangapoike River catchment include:

- **At Risk – Declining:** longfin eel, inanga, and freshwater mussel (kākahi).
- **Not threatened:** Shortfin eel, common bully, cran's bully, redfin bully, common smelt, grey mullet.

Exotic fish species include brown trout, and rainbow trout.

The eDNA overall rating of river health is 'Poor'.

NŪHAKA RIVER CATCHMENT

The Nūhaka River catchment within Te Tairāwhiti Gisborne is 4,000 ha in area and has a maximum elevation of 718 m. The catchment is composed of steep valleys, with small unnamed tributaries along its length.

The river flows southwest through the Nūhaka township and to the sea.

Land use

The catchment is almost entirely exotic forest, apart from small fragments of riparian forest with remnant Broadleaved Indigenous Hardwoods.

Freshwater ecology

Known freshwater species in the Nūhaka River catchment include:

- **At Risk – Declining:** longfin eel, bluegill bully, inanga, kōaro, and torrentfish.
- **Not threatened:** Shortfin eel, common bully, redfin bully, common smelt, and grey mullet.

Rainbow trout is found in the catchment.

The eDNA overall rating of river health is 'Average'.

KOPUAWHARA STREAM CATCHMENT

The Kopuawhara Stream catchment is made up entirely of the Waiau sub-catchment, is 3,314 ha in area and has a maximum elevation of 582 m.

The Waiau Stream flows southwards where it converges with several unnamed tributaries to become the Kopuawhara Stream and flowing on to the coastal plain associated with the Maungawhio Lagoon, Māhia.

The entire catchment in Te Tairāwhiti is composed of steep valleys. Main tributaries of the Waiau include the Waipawa Stream and Orataura Stream, and there are several small unnamed tributaries.

Land use

The catchment is almost entirely exotic forest, apart from small fragments of riparian forest with remnant Broadleaved Indigenous Hardwoods.

Freshwater ecology

Known freshwater species in the Kopuawhara catchment include:

- **At Risk – Declining:** longfin eel, bluegill bully, inanga, and torrentfish.
- **Rare:** Speckled longfin eel
- **Not threatened:** Shortfin eel, common bully, redfin bully, banded kōkopu, common smelt, and yellow eye mullet.

Rainbow trout is found in the catchment.

The eDNA overall rating of river health is 'Poor'.

The connectivity with the marine area, incl. the Maungawhio lagoon, also means the river provides habitat for species that live in the intertidal environment.

SMALLER COASTAL CATCHMENTS

The coastal catchments include all the small streams along the coast from north of Mahanga up to the Maraetaha River mouth. This includes a total land area of 25,916 ha. Each individual catchment has a relatively small catchment area.

Kānuka - Mānuka shrubland (7,269 ha) and exotic grassland (6,212 ha) associated with extensive sheep and beef farming are the dominant land uses, making up 59.70% of the catchment. Exotic forestry makes up 6.50% of the land cover, with large parcels near Whareongaonga. There is very little indigenous forest (1,628.3 ha) in the catchment.

These streams are all first and second order streams, apart from the Tikiwhata Stream (third order).

MARAETAHA RIVER CATCHMENT

The Maraetaha River catchment is 7,878 ha in area and has a maximum elevation of 628 m.

It flows northward from the Wharerata mountains in high, V-shaped valleys descending steeply into broader river valleys and flowing through a coastal plain into a lagoon before reaching the sea. Lowland hills frame the Maraetaha river valley and Wherowhero Lagoon. Alluvial floodplains are associated with the Maraetaha, which are particularly extensive in the lower reaches.

The Purupuruwhaka, Mangakaiwharanga, Manganuiawea, Mangakotukutuku, and Wairakaia Streams are the largest tributaries of the Maraetaha River, with smaller tributaries including the Tarakihinui Stream, Haungatata, Waihinehine, Tauwhatinui and smaller unnamed tributaries.

The river system includes several wetlands, including an intermittently closing and opening lagoon and coastal wetland. Significant archaeological and waahi tapu sites are recorded in this catchment.

Land use

Dominant land uses in the catchment are exotic forestry and extensive sheep and beef farming (88.80% of land area), while there are also significant short-rotation croplands (3.10% of the land cover) associated with alluvial floodplains and the coastal plain and small areas of horticulture (313 ha).

Indigenous forest is almost absent, apart from upland sections of river with fragmented indigenous riparian vegetation (including Broadleaved Indigenous Hardwoods). The catchment includes a substantial area of Kānuka - Mānuka shrubland (323 ha), primarily in the Manganuiawea stream catchment in the headwaters of the Maraetaha catchment.

Freshwater ecology

Known freshwater species in the Maraetaha River catchment include:

- **At Risk – Declining:** longfin eel, kōaro, and inanga
- **Not threatened:** Shortfin eel, common bully, and freshwater crayfish

The eDNA overall rating of river health is 'Good' or 'Excellent'. However, the eDNA samples were taken relatively high up in the catchment and it is expected that the overall stream condition rating will be poorer in the lower catchment.

The connectivity with the marine area also means the river provides habitat for species that live in the intertidal environment. The lagoon at the river mouth and coastal wetlands are important areas for waterfowl.

WHEROWHERO LAGOON CATCHMENT

The Pakowhai River (2,435 ha) and Coop (525 ha) catchments flow into the Wherowhero Lagoon.

The Pakowhai flows northwest from an elevation of 177 m down moderately steep upland valleys quite quickly reaching lowland valleys and alluvial floodplains, before flowing through the coastal plain into the Wherowhero Lagoon.

The Coop catchment includes a small tributary flowing from the west and water from the wetland complex southwest of Te Kuri and Te Rerengaotukiriahi, also known as Young Nick's Head. The watercourse and wetland flow into modified watercourses (constructed channels or drains) that flow through the coastal plain eastwards to where the Wherowhero Lagoon flows into Tūranganui a Kiwa Poverty Bay.

The system includes wetlands, streams, and the regionally significant lagoon. Significant archaeological and waahi tapu sites are recorded in this catchment.

Land use

Dominant land uses in the catchment are extensive sheep and beef farming (83.80% of land area) and short-rotation croplands (29.80% of the land cover) associated with alluvial floodplains and the coastal plain. The area includes 7.2 ha of exotic forestry and small areas of horticulture (162 ha). Indigenous forest is almost completely absent, although re-vegetation efforts are underway by tangata whenua and some landowners.

Freshwater ecology

Known freshwater species in the Wherowhero catchment include:

- **At Risk – Declining:** longfin eel, and inanga
- **Not threatened:** Shortfin eel, common bully, banded kōkopu, and yellow eye mullet.

The eDNA overall rating of river health is 'Poor'.

Connectivity with the estuarine area also means the river provides habitat for species that live in the intertidal environment. The Wherowhero Lagoon and wetland in the Coop catchment are regionally significant for waterfowl.

HYDROLOGY
MĀTAI AROWAI

Rainfall

Council monitors rainfall at Wharerata at Radio Track Road, Mangapoike at Reservoir, and Maraetaha River at No. 3 Bridge. Rainfall gauges near to the catchment include Te Arai River at Pykes Weir, Waerenga-o-Kuri, and Wharekopae School.

HBRC has rainfall gauges at Mount Manuhoa, Waimaha, Bushy Knoll, Hangaroa at Donerailles Park, Ruakituri River at Tauwharetoi, Fairview, Pukeorapa Station, Wairoa River at Marumaru and Kopuawhara at Railway Bridge. Rainfall summary statistics are provided in **Table 1.**

Table 1. Summary of rainfall data for various sites linked to the Southern Catchment.

Site	Mean Annual Rainfall (mm)	Rainfall record	No. of years discounted from analysis
Hangaroa River at Donerailles	1364	31-May-1974 to 7-Mar-2023	9
Ruakituri River at Tauwharetoi	1506	3-Jul-2013 to 8-Mar-2023	2
Wairoa River at Marumaru	1347	15-Feb-1980 to 18-May-	8
Kopuawhara at Railway Bridge	1436	29-Apr-1981 to 23-Mar-2023	15
Ruakituri River at Tauwharetoi	1503	1-Jan-2014 to 1-Jan-2023	-
Waimaha (HBRC)	1294	1-Jan-2001 to 22-Mar-2023	2
Bushy Knoll (HBRC)	1389	1-Jan-1987 to 22-Mar-2023	5
Fairview (HBRC)	1902	1-Jan-2000 to 22-Mar-2023	1
Pukeorapa Station (HBRC	2576	1-Jan-1997 to 23-Mar-2023	1
Mount Manuhoa (HBRC)	3010	1-Jan-1990 to 23-Mar-2023	8
Mount Misery (HBRC)	1307	1-Jan-2014 to 22-Mar-2023	1
Nga Tuhoe (HBRC)	1727	1-Jan-1986 to 8-Mar-2023	8
Aniwaniwa Park HQ (HBRC)	2219	1-Jan-1978 to 9-Mar-2023	25
Maraetaha River at No3 Br (GDC)*	1119	1-Jul-1997 to 9-Jun-2023	2

Table 1 uses the data available in GDC's database as of 9-Jun-2023. GDC carries out periodic reviews of these data and the values may change.

Flows

Council collects continual river flow data at one site in the catchment area, on the Maraetaha River at No3 Bridge. HBRC monitors flows at Hangaroa River at Doneraille Park, Ruakituri River at Tauwharetoi, Wairoa River at Marumaru, and Kopuawhara at Railway Bridge. HBRC does not have any continuous flow at Mangapoike River.

Flow data is collected to understand river discharge levels and river flows.

Flow summary statistics are shown in Table 2. The Mean Annual Low Flow (MALF) has been estimated using hydrological years (July to June), due to periodicity associated with river flows and climate.

Table 2: Summary of flow data (m3/s) for various sites linked to the Southern Tairāwhiti Catchment.

	River Flow							
Site	Mean (m^3/s)	Median (m^3/s)	7-Day MALF (m^3/s)	Upper Quartile (m^3/s)	Lower Quartile (m^3/s)	Q5 (flow exceeded 5% of the time) (m^3/s)	Years of record used for flow statistics	No. of years
Hangaroa River at Doneraille Park (HBRC)	15.28	6.18	0.808	14.54	2.45	55.47	31-May-1974 to 7-Mar-2023	18
Ruakituri River at Tauwharetoi (HBRC)	20.17	12.06	3.102	21.88	6.60	60.62	3-Jul-2013 to 8-Mar-2023	3
Wairoa River at Marumaru (HBRC)	64.80	30.22	6.097	65.02	14.54	219.14	15-Feb-1980 to 18-May-2023	9
Kopuawhara at Railway	2.22	0.97	0.246	1.92	0.51	7.12	29-Apr-1981 to 23-Mar-2023	22
Marqetaha River at No3 Br (GDC)*	1.178	0.437	0.087	1.050	0.190	3.915	12-Jul-1997 to 9-Jun-2023	4 (for MALF)

Table 2 uses the data available in GDC's database as of 9-Jun-2023. GDC carries out periodic reviews of these data and the values may change

Water takes

There are two consented water takes in the Maraetaha catchment and the catchment is fully allocated. There are no other consented water takes in the Southern Tairāwhiti catchment area.

FRESHWATER MONITORING
HE WHAKAMĀRAMA KOUNGA WAI

MONITORING SITES

Councils routinely collect environmental data (e.g., for water quality) as part of State of the Environment (SOE) monitoring. This SOE monitoring data is used to detect changes in environmental conditions and trends.

The monitoring involves a monthly collection of water quality samples using national standardised methodology. Samples are sent to a lab for analysis of a range of chemical, physical, and bacterial parameters. Field data such as water temperature and clarity are recorded at the same time.

Council has SOE sites on the Hangaroa River at Waimaha Station, the Maraetaha River at No3 Bridge and Wherowhero Lagoon.

HBRC undertakes monthly SOE water quality monitoring on some Tairāwhiti waterways the flow down into their region. HBRC monitors water quality at Mangapoike River at Suspension Bridge, Hangaroa River at Doneraille Park, Ruakituri River at Sportsground, Nūhaka River at Nūhaka Valley Road, and the Kopuawhara Stream.

Biomonitoring sites are included in both councils' monitoring networks. Field assessments and laboratory analyses are carried out.

A map of monitoring sites is attached in Map 7 of Appendix 3.

GAPS IN MONITORING DATA

Water quality and ecosystem health is assessed at representative rivers across Te Tairāwhiti Gisborne and Hawke's Bay Te Mātau-a-Māui as it is not feasible or affordable to collect this information everywhere. It is also noted that assessing attribute states under the NPS-FM can require monitoring to be undertaken differently to that collected in current monitoring programmes.

While a relatively high level of monitoring information is available for catchments draining into Hawke's Bay Te Mātau-a-Māui, there are gaps in information on catchments flowing northwards into Te Tairāwhiti Gisborne.

In developing catchment plans, the best available information is utilised – including applying relevant and applicable information from similar catchments elsewhere and undertaking modelling. As the catchment planning process progresses, key information gaps will be identified and programmes to collect the information will be put in place to help inform future versions of the catchment plan.

Potential information gaps are identified below, recognising that not all this information is required to develop the catchment plan.

- **Water quality** data for Council monitoring sites in the Southern Tairāwhiti catchment.
- **Continuous dissolved oxygen and water temperature** data for the Maraetaha River and Pakowhai Stream to enable grading against the NPS-FM attribute states.
- **Periphyton** is not monitored monthly at any Te Tairāwhiti Gisborne monitoring sites, which is required to enable periphyton bands to be set as per the NPS-FM. Currently the periphyton levels in this report are based off annual one-off samples.
- **Deposited sediment:** To enable accurate site grading as per the NPS-FM, monthly deposited sediment measurements are required from 5 years' worth of data. Monthly monitoring would be recommended to ensure accuracy with site grading and to understand trends going forward.
- **Fish data** was used from the available data in the New Zealand National Fish database (NZFFD) as well as existing eDNA records. The data used from the NZFFD is not an exhaustive list and many data were one off observations and not targeted fish surveys. There is no SOE monitoring undertaken for fish monitoring in Te Tairāwhiti Gisborne. There is no Fish Index Biotic Integrity (F-IBI) data for the catchment area.
- **Wetlands:** There are possibly more wetlands in the catchment that have not been identified. Council is currently undertaking work to identify and map all wetlands across the region, which includes this catchment.
- **Tiniroto lakes:** Council needs to establish a lake monitoring programme.

Future monitoring requirements will need to be confirmed and prioritised through the catchment plan process.

WATER QUALITY INFORMATION
HE WHAKAMĀRAMA KOUNGA WAI

Modelled water quality data has been summarised in Tables 3, 4, 5 and 6. The tables include a 'traffic light' system showing how the state of these waterbodies compares to national guidelines (the NPS-FM 'attribute' states). Where possible this is based on measured water quality, otherwise it is based on predicted (modelled) data.

The NPS-FM attribute states provide a nationally consistent reference for a range of water quality and ecosystem health indicators. Attributes are graded into a series of bands – Band A is the best score. The lower the band the poorer the water quality or ecosystem health. Band D represents a level that is unacceptable nationally – these are below the national bottom line.

Where a site is indicated as being below a national bottom line, Action Plans are required to improve water quality or ecosystem health over time.

Please note:

- The water quality assessments are draft at present.
- We have used modelled and monitored water quality information because of the limited number of monitoring sites in the catchment.

WATER QUALITY OVERVIEW

A site may have good water quality for some parameters, but poor water quality for others. This may reflect the nature of the contributing catchment and its geology and land use.

Table 3: Modelled water quality attribute states for each sub-catchment. Bands: Green (best) - Yellow - Orange - Red (worst)

Location	Ammonia (NH4)	Nitrate (NO3)	Dissolved Oxygen	Suspended Fine Sediment (SFS)	Dissolved Reactive Phosphorus (DRP)
Upper Ruakituri sub-catchment	A	A	N/A	A	B
Upper Hangaroa sub-catchment	B	A		A	C
Upper Mangapoike sub-catchment	B	A		A	A
Upper Nūhaka sub-catchment	B	A		A	A
Upper Kopuawhara sub-catchment	B	A		A	A
Maraetaha sub-catchment	B	A		A	B
Coop sub-catchment	B	A		B	C
Pakowhai sub-catchment	B	A		B	C

Table 4: Monitored water quality attribute states sub-catchment monitoring sites. Bands: Green (best) - Yellow - Orange - Red (worst)

Location	Ammonia (NH4)	Nitrate (NO3)	Dissolved Oxygen	Suspended Fine Sediment (SFS)	Dissolved Reactive Phosphorus (DRP)
Ruakituri at Sports Ground	A	A	B	B	B
Hangaroa at Doneraille Park	A	A	A	D	C
Hangaroa at Waimaha Station	A	A	N/A	N/A	N/A
Mangaotara at Tiniroto Road	A	A	N/A	N/A	N/A
Papokeka at Pehiri Road	A	A	N/A	N/A	N/A
Haupapa Stream (at Tahora Settlement)	A	A	N/A	N/A	N/A
Mangapoike at Suspension Bridge	A	A	A	A	A
Mangapoike at Rabbit Road	A	A	N/A	N/A	
Nūhaka at Nūhaka Valley Road	A	A		A	A
Kopuawhara at at Lower Rail Bridge	A	A	B	A	A
Maraetaha (at No. 2 Bridge)	A	A	N/A	N/A	N/A

SUMMARY OF WATER QUALITY IN THE CATCHMENT

- In general, water quality is good across the Southern Tairāwhiti Catchment.
- The exception is suspended fine sediment in the Hangaroa, which falls below the national bottom line. While the modelled data suggests suspended fine sediment is not an issue, the monitoring data shows that it is.
- Ammonia and Nitrate levels are overall low, unlikely to be having effects even on sensitive species.
- Dissolved reactive Phosphorus (DRP) achieves the national bottom line in all catchments although the Coop, Pakowhai, and Hangaroa sites have moderately elevated levels of DRP.
- Dissolved Oxygen levels are good.
- All sites that fall below the national bottom line require Action Plans to improve ecosystem health.

AQUATIC LIFE AND PHYSICAL HABITAT

Various biological and physical indicators of ecosystem health are assessed.

Table 5: Modelled aquatic life and physical habitat attribute states for each sub-catchment. Bands: Green (best) - Yellow - Orange - Red (worst)

Location	Periphyton (Trophic State)	Macroinvertebrate (MCI, QMCI)	Deposited Fine Sediment (DFS)
Upper Ruakituri sub-catchment	N/A	A	A
Upper Hangaroa sub-catchment		B	D
Upper Mangapoike sub-catchment		B	D
Upper Nūhaka sub-catchment		B	D
Upper Kopuawhara sub-catchment		B	D
Maraetaha sub-catchment		B	D
Coop sub-catchment		D	N/A
Pakowhai sub-catchment		C	D

SUMMARY OF AQUATIC LIFE AND PHYSICAL HABITAT IN THE SOUTHERN TAIRĀWHITI CATCHMENT

- Periphyton levels achieve the national bottom line across the Southern Tairāwhiti Catchment. However, there is insufficient data available across the catchment to consider this attribute appropriately. Monitored sites are all fairly high up in the catchment and may not reflect conditions further downstream.
- Macroinvertebrate scores fall below the national bottom line in the Maraetaha, Coop, Nūhaka and Mangapoike sites, and are generally degraded cross the catchment, particularly as one moves down the catchments. Low scores reflect high levels of pollution (organic or nutrient pollution). All sites in the D band will require an Action plan to enhance stream habitat and water quality.
- The ASPM Macroinvertebrate score which encompasses the amount and diversity of sensitive macroinvertebrate species also reflects severe stream degradation in the Maraetaha, Coop, Nūhaka, and Mangapoike.
- Levels of deposited fine sediment are generally very high according to modelled data, with much of the catchment not achieving national bottom lines. Monitored sites are all fairly high up in the catchment and may not reflect conditions further downstream.
- All sites that fall below the national bottom line require Action Plans to improve ecosystem health.

LAKES OVERVIEW

The catchment area includes many lakes. Historically water quality of these lakes has not been monitored.

However, vegetation and bird surveys of lakes have been undertaken. The lakes provide habitat for the protected dabchick or weweia, which is classified as At Risk Recovering. No nationally endangered species are known to be in these lakes. However, a large population of the At Risk – Declining kākahi or freshwater mussel is found in Lake Rotokaha.

Waterbodies with large areas of invasive aquatic plant species include Te Aroha Station Bush (gypsywort) Lake Karangata, Lake Ruakaka, Green Lake, and Lake Rotokaha (invasive hornwort). Pondweed is prevalent to a lesser extent. Reed sweet grassis found in Roadside Pond (Tiniroto Road), and parrot's feather in Lake Kaikiore.

Past studies have shown that the Tiniroto lakes have high nutrients and evidence of eutrophication.

Lake trophic status has been assessed by Lakes 380 (https://lakes380.com/). The Trophic Level Index (TLI) has been reported, which is a good indicator of water quality, integrating phytoplankton, nitrogen, phosphorus, and water clarity.

The range of TLI scores can be divided into categories in Table 7 below.

- **Table 7: Lake Trophic Level Index scores. Source: Land, Air, Water Aotearoa (LAWA) - Lake Trophic Level Index**

LAWA Icon	TLI Score	Description
VERY GOOD	0 – 2	Microtrophic: The lake is very clean with very low levels of nutrients and algae. The lake can have snow or glacial sources.
GOOD	>2 - 3	Oligotrophic: The lake is clear and blue, with low levels of nutrients and algae.
FAIR	>3 – 4	Mesotrophic: The lake has moderate levels of nutrients and algae.
POOR	>4 – 5	Eutrophic: The lake is murky, with high amounts of nutrients and algae.
VERY POOR	>5	Supertrophic: The lake has very high amounts of phosphorus and nitrogen, and can be overly fertile and often associated with poor water clarity. Excessive algae growth can occur. Suitability for recreational purposes is often poor.

- Swimming is not recommended when lakes are supertrophic and should be avoided when lakes are hypertrophic.
- The trophic state of lakes in this catchment are summarised in Table 8 and Figure 3. Lakes are overall in a poor to very poor state, with a handful in a fair state. Action Plans are required for degraded lakes.

Table 8: Trophic state of measured Tiniroto lakes.

Lakes	Trophic State
Rotokaha	Supertrophic
Karangata	Supertrophic
Kaikiore	Supertrophic
Kaikereru	Supertrophic
Waihau	Supertrophic

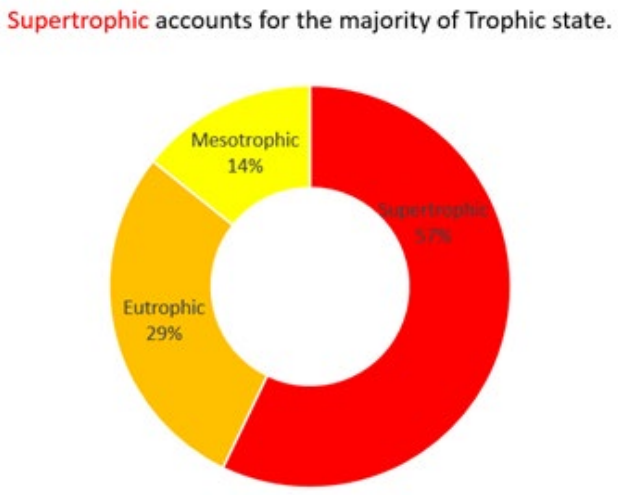


Figure 3: Measured and modelled trophic state of lakes in the Southern Tairāwhiti catchment.

HUMAN CONTACT OVERVIEW

Escherichia coli (E. coli) is an indicator of health risks for humans.

Table 9: Modelled human contact states relative to NPS-FM 2020 attribute states. Bands: Green (best) - Yellow - Orange - Red (worst).

Location	E. coli (human contact)
Upper Ruakituri sub-catchment	A
Upper Hangaroa sub-catchment	D
Upper Mangapoike sub-catchment	C
Upper Nūhaka sub-catchment	C
Upper Kopuawhara sub-catchment	C
Maraetaha sub-catchment	D
Coop sub-catchment	E
Pakowhai sub-catchment	D

Location	E. coli (human contact)
Ruakituri at Sports Ground	D
Hangaroa at Doneraille Park	D
Hangaroa at Waimaha Station	N/A
Mangaotara at Tiniroto Road	N/A
Papokeka at Pehiri Road	N/A
Haupapa Stream (at Tahora Settlement)	N/A
Mangapoike at Suspension Bridge	D
Mangapoike at Rabbit Road	N/A
Nūhaka at Nūhaka Valley Road	B
Kopuawhara at at Lower Rail Bridge	B
Maraetaha (at No. 2 Bridge)	N/A

Half of the catchments do not achieve the national bottom lines for E. coli and will require Action Plans. The primary contact site at Doneraille Park also does not achieve national bottom lines.

POTENTIAL CONTRIBUTORS TO WATER QUALITY AND ECOSYSTEM DEGRADATION

There are several issues in the catchment area that are adversely affecting water quality and freshwater values. The main drivers for degraded water quality are sediment and E. coli.

The aquatic ecosystem health results reflect the degraded water quality and habitat. The following are contributors to the degraded water quality:

Land use

- Land use in the catchment has changed from indigenous forest to predominantly agricultural use. Extensive sheep and beef farming is the dominant land use, followed by exotic forestry, and cropping on alluvial floodplains and the coastal plain. Horticultural activities are very limited. Urban land use is absent, however there some small rural settlements. Changes in land use effect hydrological processes, stream morphology, degrade water quality, reduce woody debris, increase sediment loads and nutrients, and reduce levels of leaf litter instream. These changes cause fundamental changes in habitat structure for freshwater fauna and water quality.
- Loss of riparian vegetation de-stabilises riverbanks, increases sediment inputs and reduces stream shading.

• cropping, stock crossings, culvert maintenance and construction, track maintenance, and dam maintenance are all potential sources for sediment to enter the catchments.

- Livestock farming disturbs soils on the land and in unfenced riparian areas, especially in the wet season, resulting land instability and in sediment runoff.
- Many of the catchments have exotic forest, especially in the headwaters. Afforestation is known to improve and stabilise erosion; however, forestry harvesting, especially clear fell harvest is known to contribute large sediment loads to rivers. Sediment mobilisation following clear fell forestry harvest is likely a large contributor to sediment loads in the catchments.

POTENTIAL CONTRIBUTORS TO WATER QUALITY AND ECOSYSTEM DEGRADATION

Sediment

- The catchments are all situated in soft sedimentary geology and in some areas of the catchments the land is severely erosion prone (land overlay 3 or 3a). The erodibility of the land coupled with the land use can result in large areas of erosion, and transportation of sediment into the streams and rivers.

- Land use activities such as land clearance, cropping, stock crossings, culvert maintenance and construction, track maintenance, and dam maintenance are all potential sources for sediment to enter the catchments.

- Livestock farming disturbs soils on the land and in unfenced riparian areas, especially in the wet season, resulting land instability and in sediment runoff.

- Many of the catchments have exotic forest, especially in the headwaters. Afforestation is known to improve and stabilise erosion; however, forestry harvesting, especially clear fell harvest is known to contribute large sediment loads to rivers. Sediment mobilisation following clear fell forestry harvest is likely a large contributor to sediment loads in the catchments.

- Replacement of natural forested catchments with pasture for livestock grazing reduces land stability, resulting in increased landslips, and increased sediment loads.

- Similarly, landslips are more likely in clear-felled exotic forestry areas and in young plantations.

E. coli

- High levels of E. coli in the catchment are likely because of runoff from livestock crossings and land grazed by livestock, and livestock having direct access to waterways.

- Human sources of E. coli are unlikely to be significant issue in this catchment.

Hydrology

- The change in landcover from native forest into pasture has significantly altered catchment hydrology. Similarly, harvesting of forest plantations significantly alters hydrology.

Periphyton

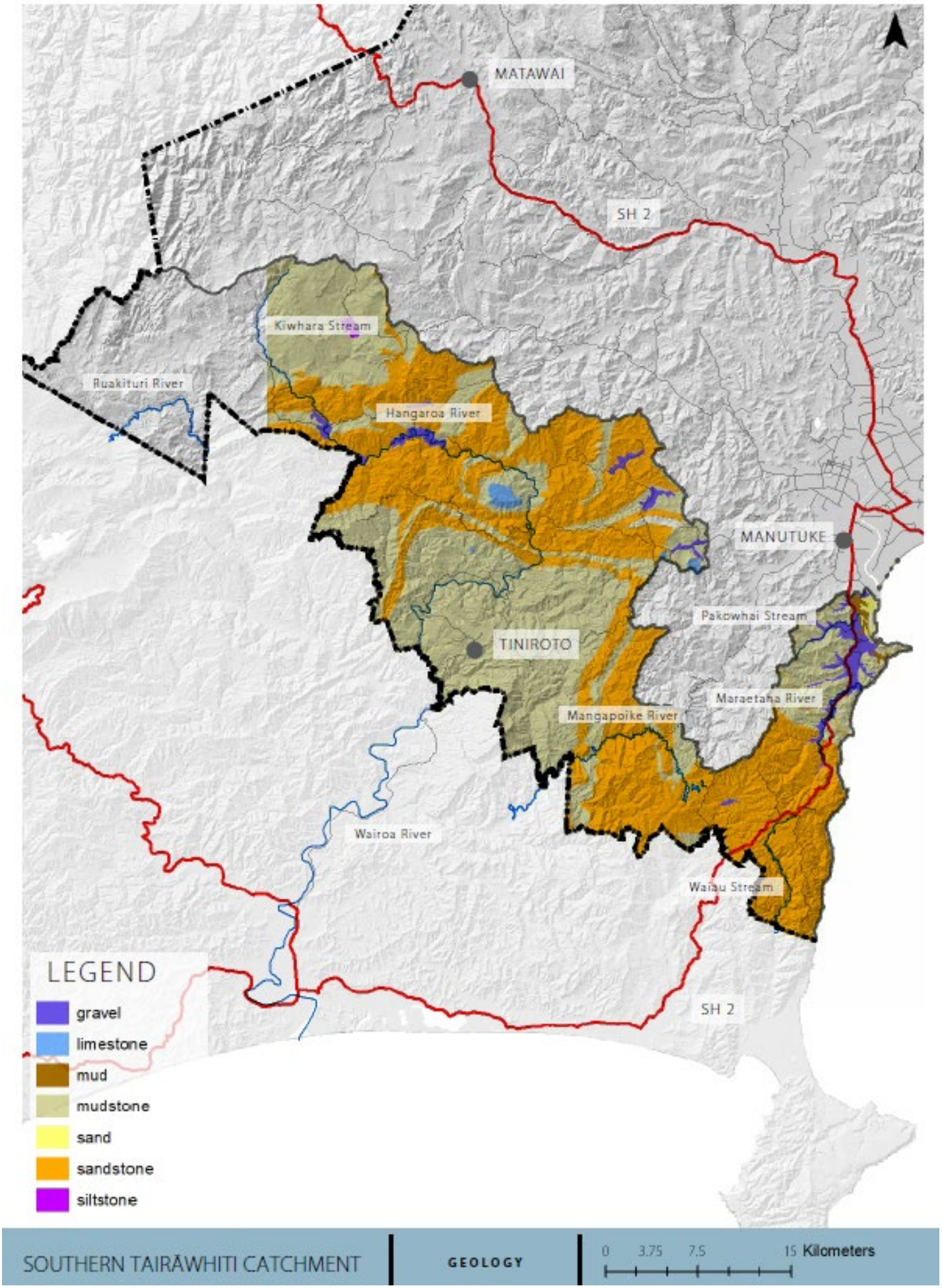
- Excess nutrients, a lack of shading over waterways, and increases in water temperature promote periphyton growth. Nutrients enter waterways from farms, while the removal of riparian vegetation allows more light to reach waters and streams to warm up.

HE KUPU PITI
APPENDICES

APPENDIX 1: GLOSSARY OF TERMS

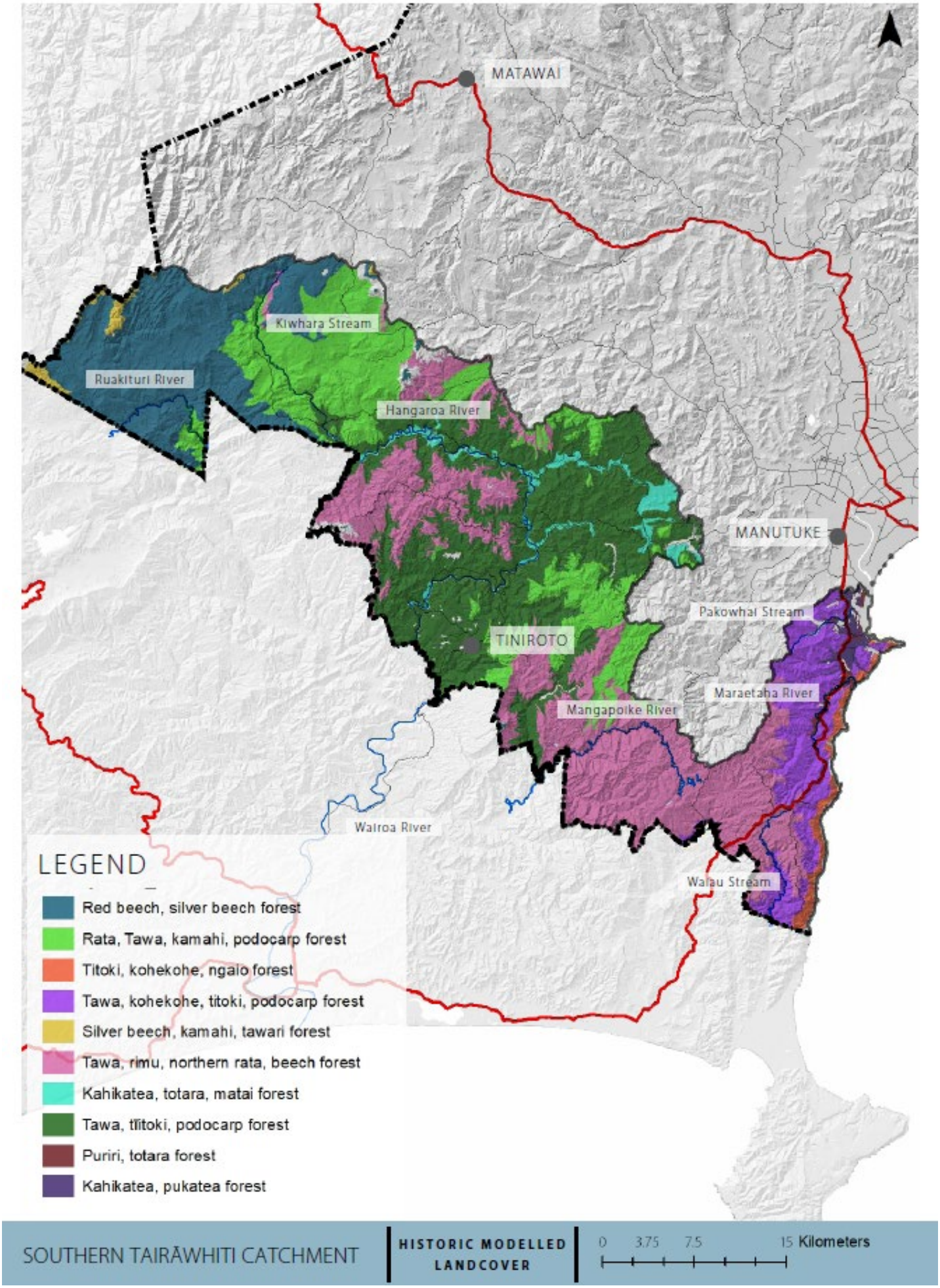
Action Plan	A part of the Catchment Plan which identifies how we are going to get attributes that are degraded from their current state to where we want them to be. Can include rules or other types of methods.
Attribute	A water quality indicator used to help us understand if the values of the water are being provided for e.g. the amount of E.coli bacteria in the water tells us if it is safe for swimming. This will be measured in a standard way. E.g. E.coli is measured in cfu/100 mL of water.
Target Attribute state	What we want the water quality to be like for that indicator.
Baseline state	What the water quality was like on 7 September 2017.
Catchment Plan	A regional plan under the Resource Management Act that determines how freshwater and land uses within specific catchment areas are managed.
Degraded	Water quality that is below a national bottom line or is not achieving a target attribute state.
Degrading	Water quality that is showing a deteriorating trend.
Environmental outcome	A desired outcome that a regional Council identifies for a freshwater value and then includes as an objective in its regional plan.
Freshwater Management Unit (FMU)	A management area (e.g. site, river reach, water body, part of a water body or groups of water bodies). They are often quite big – for example the Waipaoa Catchment has 4 Freshwater Management Units.
Freshwater values	The sorts of things and uses we value waterbodies for. e.g. ecosystem health, human contact, threatened species, mahinga kai, fishing, animal drinking water.
Limit	A type of rule for water. Can be the amount of pollutant allowed in the water e.g. amount of nitrate nitrogen, or a flow limit –e.g. a minimum flow below which water takes cannot occur.
National Bottom Line	An attribute state that we are not allowed to let water quality fall below.
Outstanding waterbody	A water body or part of a water body that has outstanding values and is identified for special protection.
Over-allocation	Where resource use exceeds a limit or where an FMU is degraded or degrading.
Primary contact site	An area where lots of people swim or do things which mean they are likely to end up drinking the water or getting spray in their mouth.

APPENDIX 2: MAPS



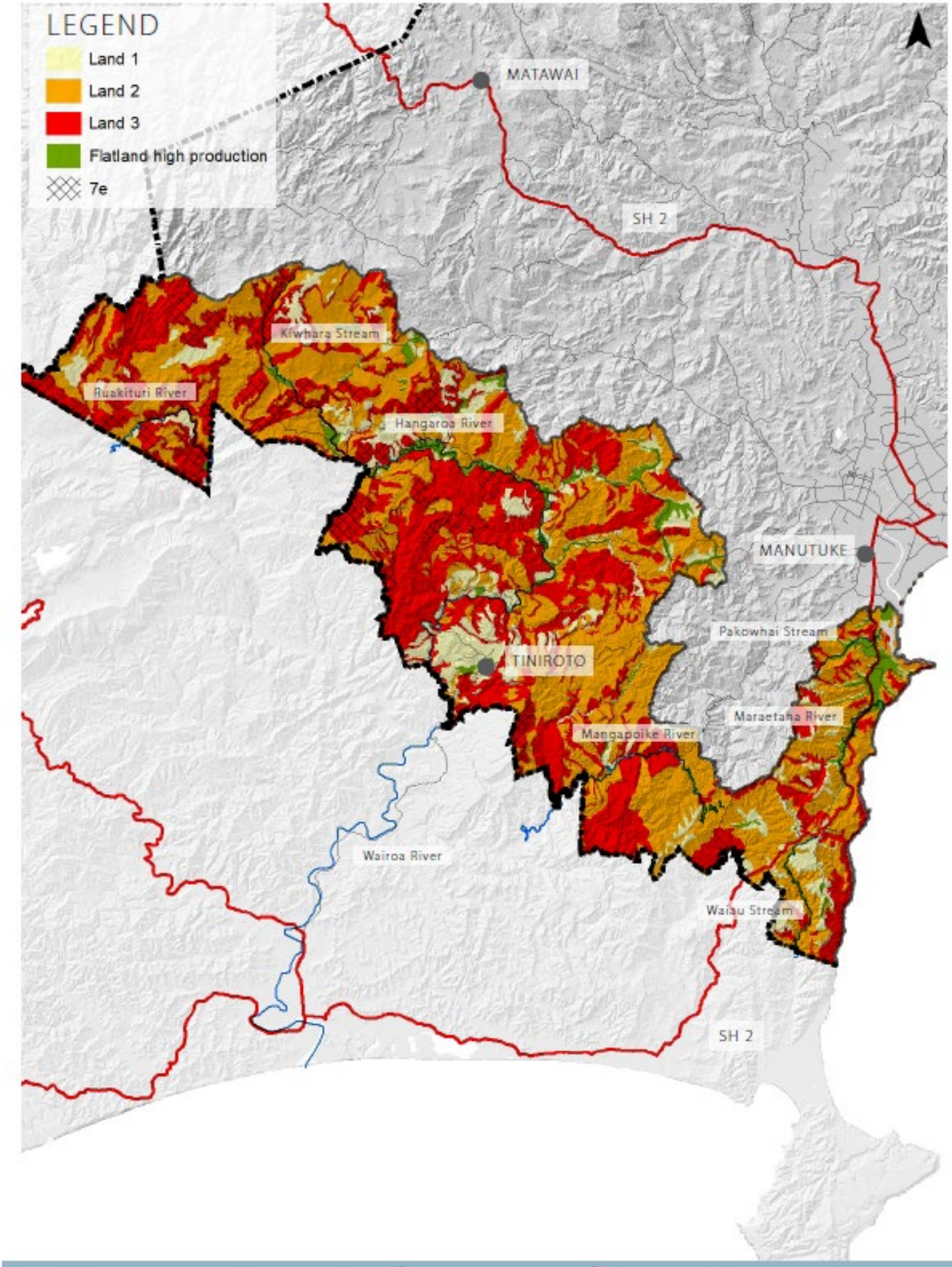
Map 1: Geology

APPENDIX 2: MAPS



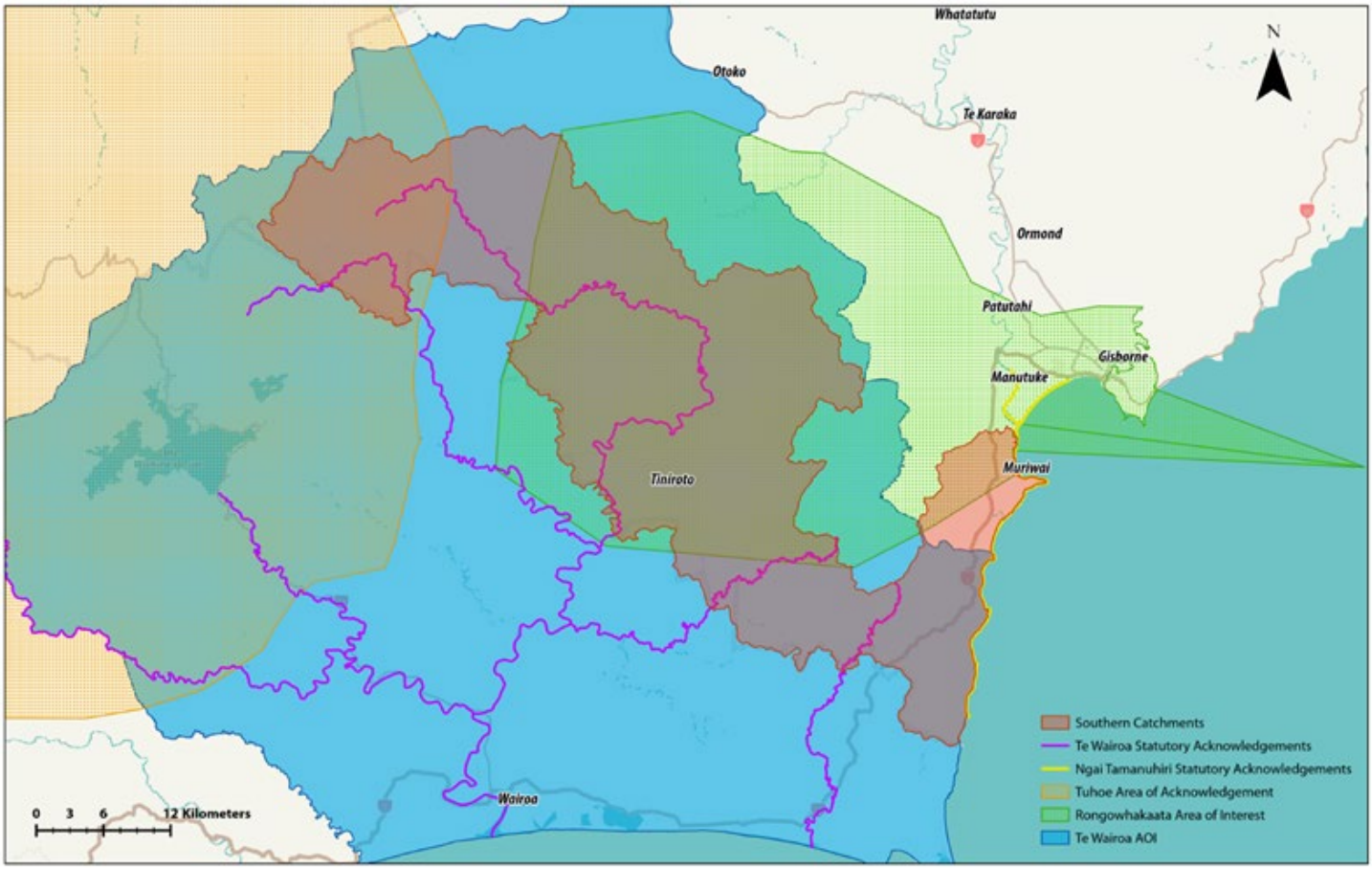
Map 2: Historic indigenous vegetation types

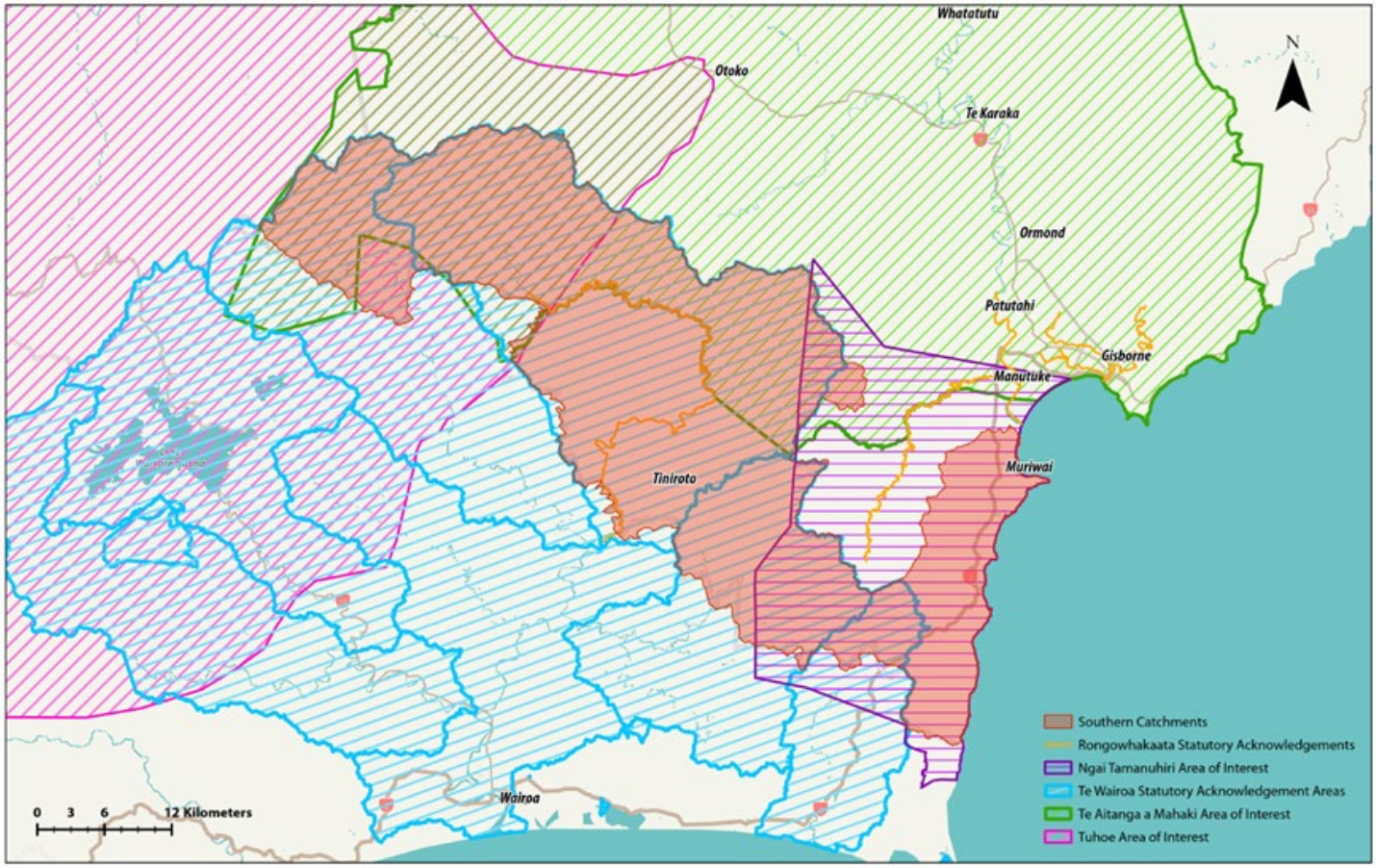
APPENDIX 2: MAPS



Map 3: Land overlay and LUC classification map

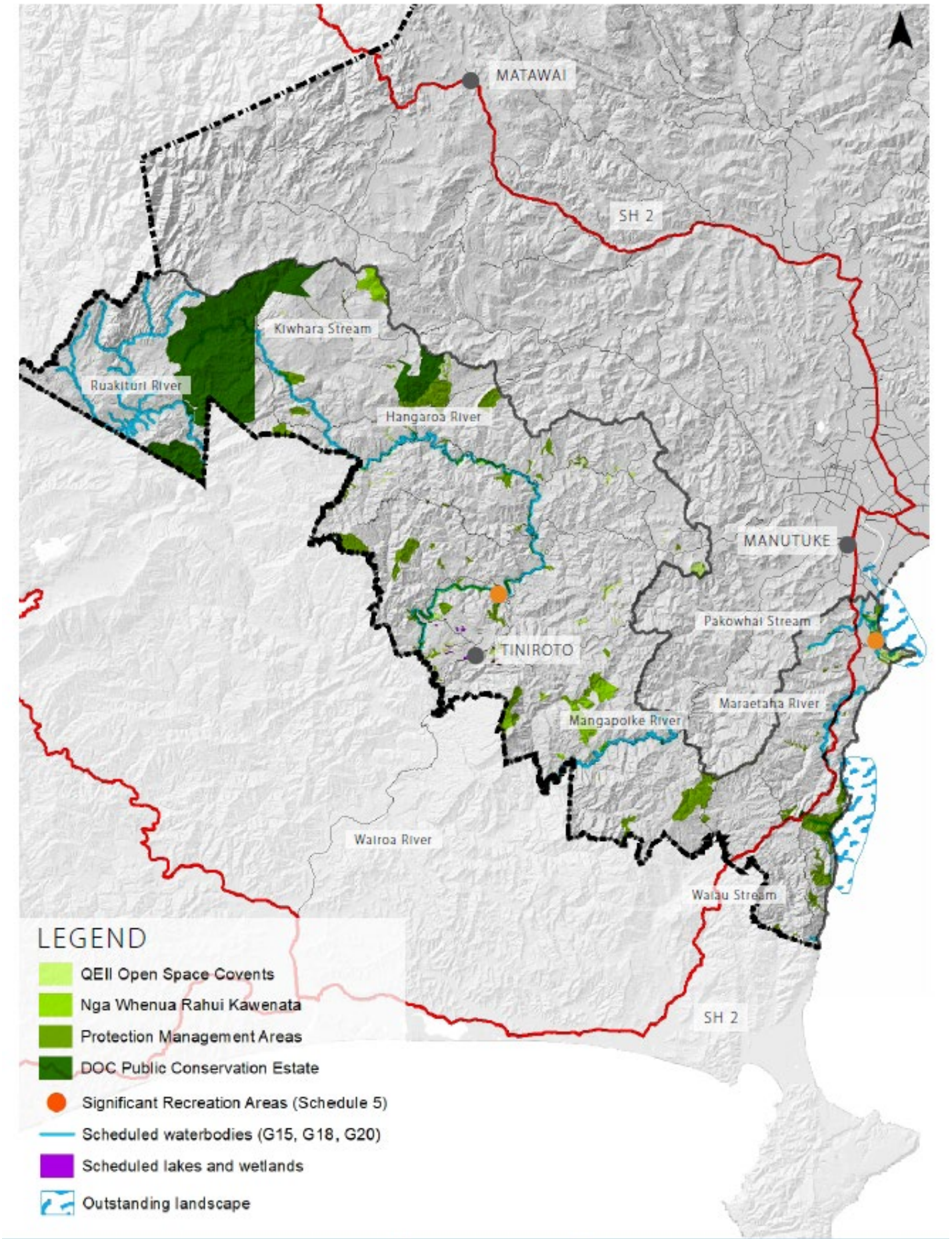
APPENDIX 2: MAPS





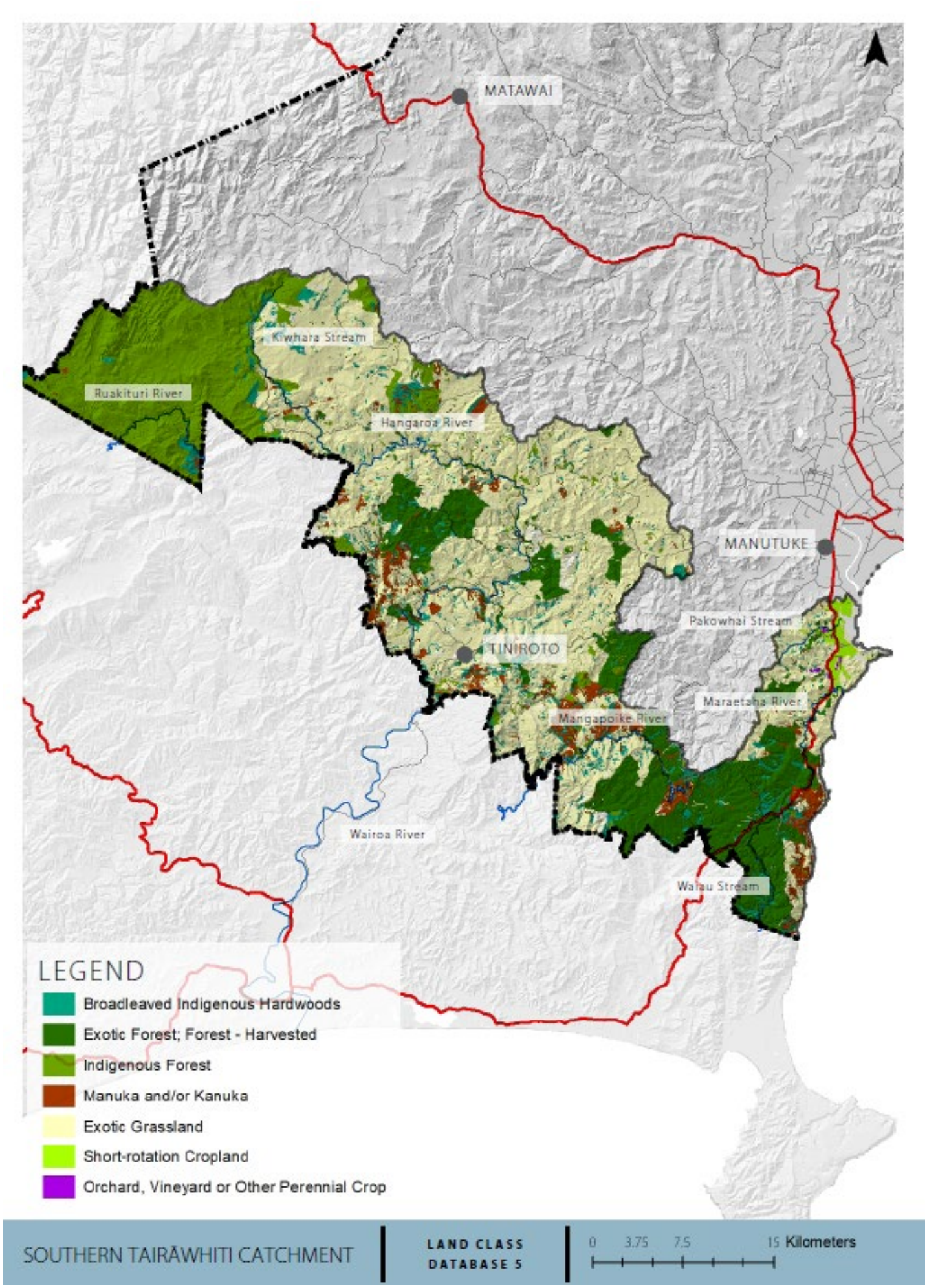
Map 4: Statutory acknowledgement areas

APPENDIX 2: MAPS



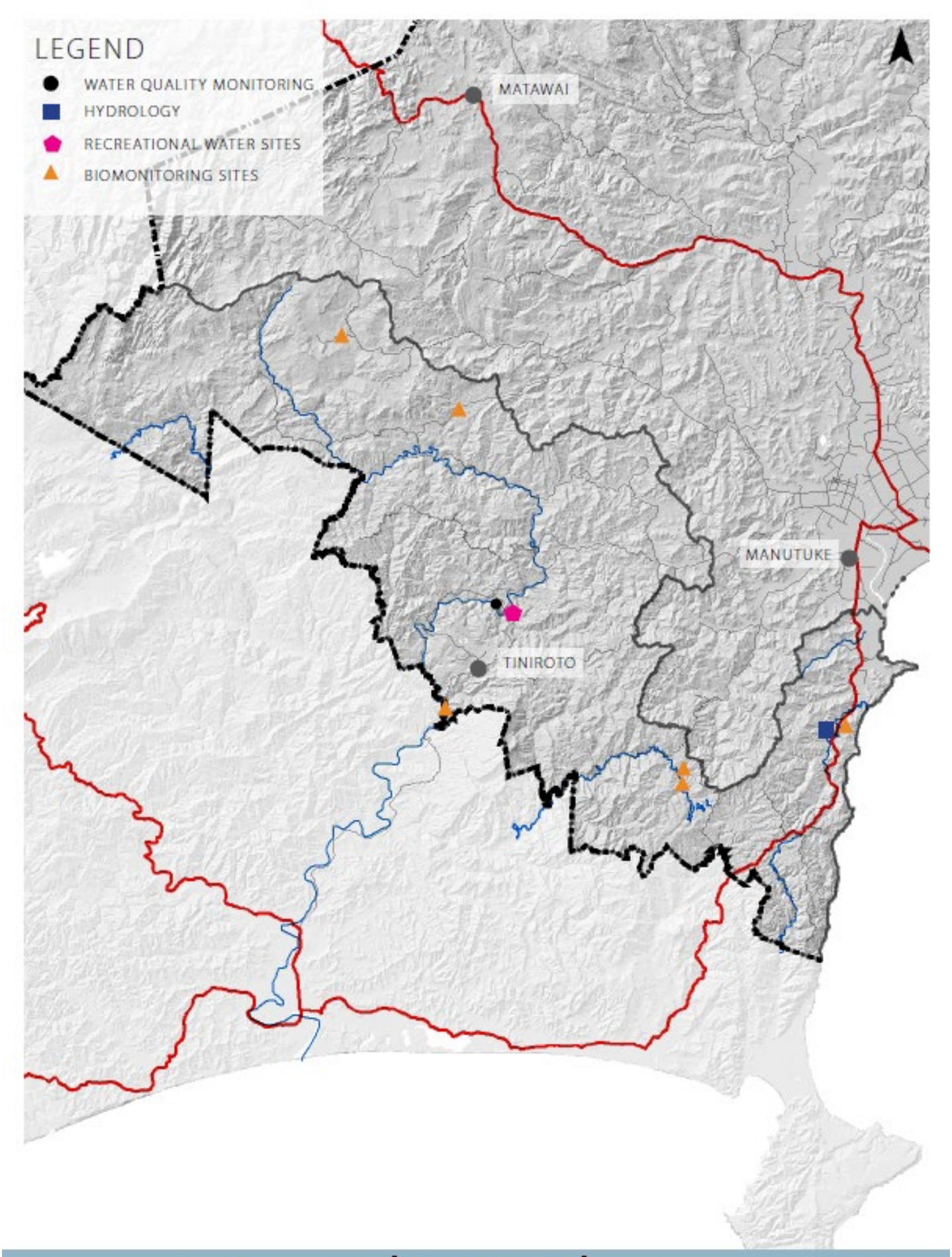
Map 5: Protected Areas

APPENDIX 2: MAPS



Map 6: Land use and vegetation types

APPENDIX 2: MAPS



Map 7: Water quality and quantity monitoring sites

APPENDIX 3- WATER QUALITY EXPLANATIONS

Parameter	Explanation
Phosphorus	Phosphorus is an element with the symbol P that attaches to soil particles and is naturally present in water in low concentrations. Together with nitrogen, it is an essential nutrient for plant life and is measured as either total phosphorus (TP) or dissolved reactive phosphorus (DRP).
Dissolved Reactive Phosphorus	This is a measure of the dissolved (soluble) phosphorus compounds that are readily available for use by plants and algae. Dissolved reactive phosphorus concentrations are an indication of a waterbody's ability to support nuisance algal or plant growths (algal blooms).
Nitrogen	Nitrogen is a naturally occurring substance, with the chemical symbol N. In its gas form (N2), nitrogen makes up about 80% of the Earth's atmosphere. In other forms it is one of the most important fertilisers for plant growth. It is also found in amino acids that make up proteins, in nucleic acids (that make up DNA) and in many other organic and inorganic compounds. Nitrogen is a great fertiliser but too much of it can cause aquatic weeds and algae to grow too fast. This increased plant growth can reduce oxygen in the water during nighttime when dead plant material decomposes. This can eventually remove the oxygen present in lakes, posing a threat to aquatic life. Nitrite-nitrogen and ammonia become toxic at high concentrations which are more likely under certain temperature and pH conditions. This can cause direct harm to fish and macroinvertebrates. The most common sources are wastewater treatment plants, run-off from pasture, croplands and fertilised lawns, leaky septic systems, run-off from animal manure/urine, and industrial discharges.
Nitrate	A highly soluble molecule made up of nitrogen and oxygen with the chemical formula NO32-. It is a very important plant fertiliser but because it is highly water soluble, it leaches through soils very easily, particularly after heavy rainfall. It is one of the most common contaminants in waterways in rural and urban areas. NO3-N can be transformed to other forms of nitrogen. Sources of NO3-N include excessive application of inorganic fertilizer, septic tanks and leaking sewage systems. Nitrate also enters waterways as a result of nitrification of the ammonia in animal waste by bacteria in soil.
Nitrite	Nitrite-nitrogen is an ion with the chemical formula NO2-. Concentrations of nitrite-nitrogen are normally low compared to nitrate-nitrogen and ammoniacal nitrogen. However, too much nitrite-nitrogen can be toxic. In drinking water it can be harmful to young infants or young livestock.
Ammoniacal Nitrogen	Also called total ammoniacal nitrogen, covers two forms of nitrogen; ammonia (NH3) and ammonium (NH4). NH4-N can be transformed to other forms of nitrogen and is a very important plant fertiliser but is less mobile in the soil than nitrate-nitrogen. It enters waterways primarily through point source discharges, such as raw sewage or dairy shed effluent. It is toxic to aquatic life at high concentrations.
Dissolved Inorganic Nitrogen	This is the sum of nitrite (NO2), nitrate (NO3) and ammonia (NH3).

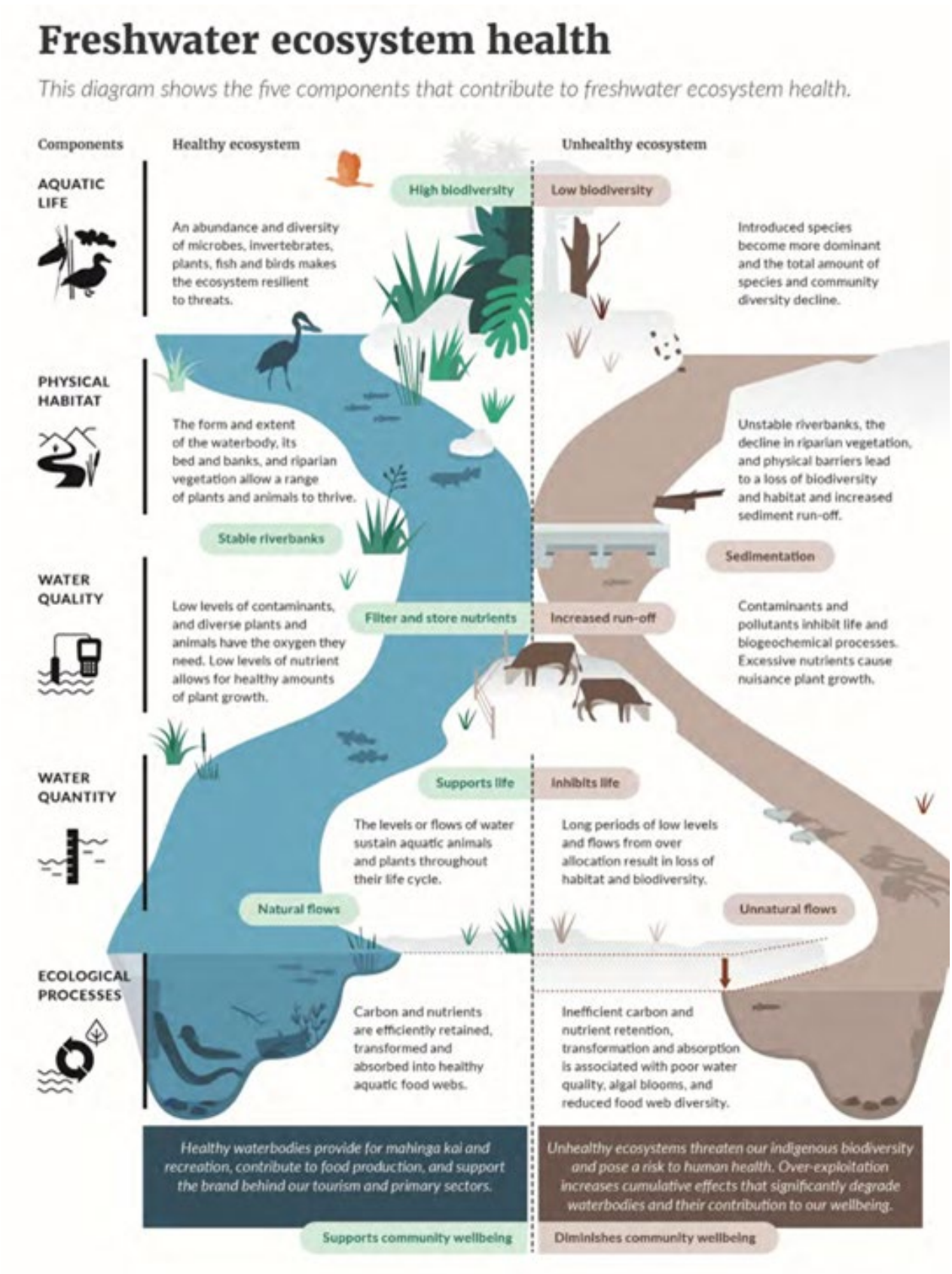
APPENDIX 3- WATER QUALITY EXPLANATIONS

Parameter	Explanation
	Water clarity refers to the ability of light to travel through water and has two important aspects: light penetration and visual clarity. Light penetration is important as it controls the amount of light in the water needed for aquatic plants to grow. Visual clarity indicates how much suspended sediment (soil) is in the water. Poor water clarity can have many adverse effects on stream and lake ecosystems. For example, murky water can make the water unsuitable for drinking by stock and make areas unsafe for swimming. High sediment can also harm aquatic life by clogging their gills which reduces their ability to take up oxygen. As fine particles settle in slower-moving downstream areas, the spaces between rocks and gravel are filled making the bottom habitat unsuitable for fish and other aquatic species. Poor water clarity will also affect the amount of light reaching the river bottom, potentially limiting plant growth.
Turbidity	Turbidity is an index of cloudiness of water and measures how light is scattered by fine particles in waterways. Turbidity is an alternative measurement for suspended sediment and/or visual clarity and is measured in nephelometric turbidity units (NTU).
Suspended Sediment	As erosion occurs, tiny particles of clay, silt or small organic particles are washed into waterways. These tiny particles can be supported in the water current and are termed suspended sediment. The faster the water is moving the larger the amount and size of suspended sediment particles it can carry. Soil type in the catchment can affect the amount of suspended sediment.
Deposited Sediment	Deposited sediment is a measure of the percentage of the stream bed covered in fine sediment. Deposited sediment smothers the stream bed and can change and degrade habitat, change the assemblage of macroinvertebrate species and reduce fish habitat and fish species.
Dissolved Oxygen	The oxygen content of water. Dissolved oxygen is important for fish and other aquatic life to breathe. For example, water quality guidelines recommend that water should be more than 80 percent saturated with DO for aquatic plants and animals to be able to live in it.
E.coli	E. coli (Escherichia coli) is a type of bacteria commonly found in the guts of warm-blooded mammals (including people) and birds. High E. coli concentrations in freshwater can be harmful to humans. Common sources of E. coli bacteria are untreated human wastewater discharges, stormwater run-off and animal waste. E. coli survives outside the body and can survive for up to four to six weeks in fresh water making it a useful indicator of faecal presence and therefore of disease-causing organisms in a river or lake. Faecal concentrations are typically higher in pastoral streams but even near-pristine streams are not totally free from E. coli because of faecal deposition by birds and wild animals.
Macroinvertebrates	Any organisms without a backbone or internal skeleton large enough to be visible to the naked eye (>500µm), such as insects, worms, and snails. Macroinvertebrates are sampled to provide an indication of stream water quality. Generally, the greater the diversity, the better the water quality in the stream. Macroinvertebrate communities are widely used as indicators of stream ecosystem health because they include a wide range of species, each with relatively well-known sensitivity or tolerance to stream conditions. The most common stream health indices are taxa richness, percentage of EPT taxa and the macroinvertebrate community index (MCI).

APPENDIX 3- WATER QUALITY EXPLANATIONS

Parameter	Explanation
MCI (Macroinvertebrate Community Index)	MCI stands for Macroinvertebrate Community Index which is an index where macroinvertebrates are used for monitoring and reporting on stream health in New Zealand. The MCI assigns a score to each species or taxon (from 1 to 10), based on its tolerance or sensitivity to organic pollution, then calculates the average score of all taxa present at a site. It is a semi qualitative sampling method, which means it will tell you which species are present or absent in your sample. The MCI is based on the tolerance or sensitivity of species (taxa) to organic pollution and nutrient enrichment. For example, mayflies, stoneflies and caddis flies are sensitive to pollution, and are only abundant in clean and healthy streams, whereas worms and snails are more tolerant and can be found in polluted streams. Most benthic invertebrate taxa were assigned a tolerance value ranging from 1 (very tolerant) to 10 (very sensitive). An invertebrate sample is typically collected from within a representative section of a stream (a reach). Higher MCI scores indicate better habitat and water quality at the sampled site. In theory MCI values can range between 0 and 200, but in practice it is rare to find MCI values greater than 150 and only extremely polluted or sandy/muddy sites score under 50.
QMCI (Quantitative Macroinvertebrate Community Index)	Similar to MCI but includes an assessment of the abundance of the different species.
% EPT Taxa	The invertebrate community is usually dominated by three orders of insects: the mayflies, stoneflies, and caddis flies. Together, these insects are known as EPT, referring to their scientific names Ephemeroptera, Plecoptera and Trichoptera, respectively. These freshwater insects are generally intolerant of pollution, so the fewer found in a sample, the poorer the stream health. The percentage of EPT-taxa (or %EPT) is most commonly calculated by counting the total number of mayfly, stonefly and caddis fly taxa in a sample, then dividing that number by the taxa richness and multiplying by 100. This is known as the %EPT by taxa. A high percentage of EPT taxa indicates good stream health. However, in some New Zealand streams there are naturally few mayflies, stoneflies, or caddis flies present. Ecologists need to be aware of these factors when using the %EPT to assess the ecological health of a river or stream
ASPM (Average Score Per Metric)	The Average Score Per Metric is made up of a combination of metrics that are found to have low variability among undeveloped reference sites in native forest: number of sensitive species: mayflies + stoneflies + caddisflies (EPT), percentage of sensitive taxa -%EPT, tolerance of taxa to pollution – MCI.

APPENDIX 4: FRESHWATER ECOSYSTEM HEALTH EXPLANATION



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