Mahere Whakamārama mo te Kohinga Wai o Mōtū

Mōtū Catchment Plan Background

OCTOBER 2020

NGĀ KAUPAPA
CONTENTS

INTRODUCTION
HE KUPU ARATAKI

This document outlines the background and key technical information to support the development of the Mōtū Catchment Plan.

The river and its tributaries play an important role in the community supplying water for stock and irrigation, habitat for a diverse number of species, and a nationally significant trout fishery. One of the two vision statements in the Matawai-Mōtū Township Plan 2011 is "A Healthy River for All to Share".

The Mōtū River is considered by Gisborne District Council to be the most at-risk river in the region. This is due to the combination of high natural values and ecological significance and a high potential for degradation as a result of land use intensification.

Current restoration of waterways within the catchment is being undertaken by land owners and farmers under the community led Mōtū Catchment Project. This project has so far included fencing, riparian planting and river health monitoring.

The catchment plan is being developed under the National Policy Statement for Freshwater Management (NPSFM) and the Tairāwhiti Resource Management Plan (TRMP). These documents set the high-level direction for Council to manage land and water resources.

Some of the key terminology from the NPSFM is attached as Appendix 1.

WHAT IS A CATCHMENT PLAN?

A catchment plan is simply a way to organise information on a particular area and then apply our vision and ideas about how to manage the resources within that area. In this case, the Mōtū Catchment Plan will set the objectives for the management of fresh water quality and quantity. This will help council make better decisions about land and water use.

WHERE DOES IT APPLY?

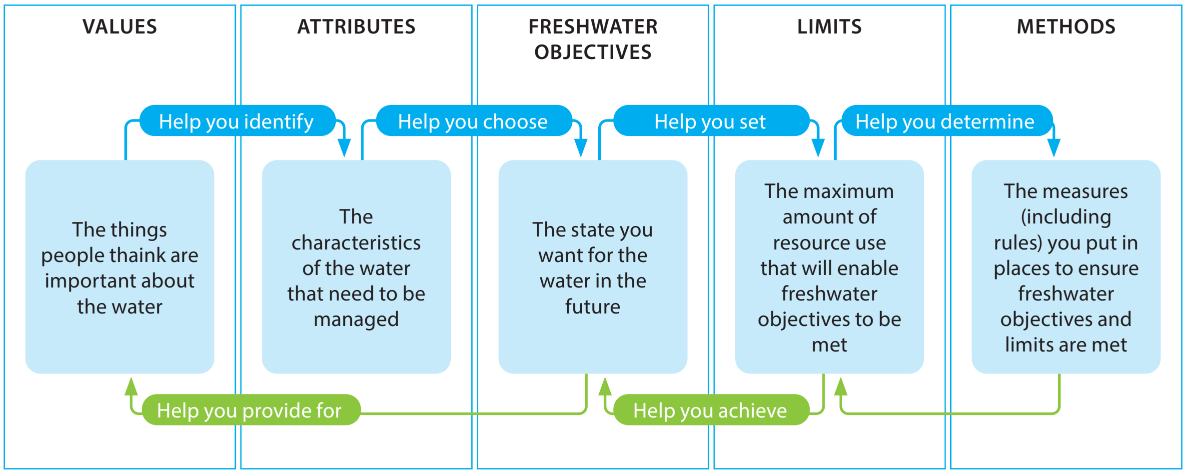
The Mōtū Catchment Plan will cover the upper Mōtū River where it is within the Gisborne-Tairāwhiti region. It will also cover the Opato Stream, Pakihi Stream and the Koranga River catchments where they occur within the region. For the most part, regional council boundaries are based on river catchment boundaries so the situation in this area is unique in that the council boundaries include part catchments.

WHAT'S REQUIRED?

The NPSFM includes a range of matters that regional councils are required to implement. Council has given effect to some parts of the NPSFM through policies and rules that apply across the region. However, Council is progressing other parts of the NPSFM through a series of catchment plans.

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 NPSFM 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 for recognising 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 for each value – and the Objectives to be included in the Regional Plan that arise from these;
- Identify water quality attributes for each value;
- Identify the baseline states for each attribute;
- Set target states for attributes – which become rules in the Regional Plan;
- Set target states for environmental flows and water levels – which become rules in the Regional Plan;
- Set limits for water quality attributes – which become rules in the Regional Plan;
- Develop Action Plans to achieve environmental outcomes.

The NPSFM 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
- Identify the catchment approach to giving effect to Te Mana o Te Wai
- Identify any Māori freshwater values that apply

NATIONAL REGULATIONS

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

COMMUNITY INPUT

The Mōtū Catchment Plan provides a vehicle for meeting Council's obligations under the NPSFM but also provides a way to recognise community and iwi values and the vision they have for the catchment.

The Council will use a range of ways to seek community views during the development of the catchment plan. This will include establishing community and iwi stakeholder groups to work through the detailed development of the catchment plan. A schedule of meetings and topics for these groups is attached as Appendix 2.

There are many different catchment groups working throughout New Zealand. Regional councils are engaging communities and iwi in the planning process as a way 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.

TIMELINE

October 2020
Public meeting and Hui with Iwi
- Introduce the catchment plan process
- Vision and values for the catchment

Monthly Nov 2020 – July 2021
Stakeholder Reference Group meetings

Monthly Nov 2020 – July 2021
Iwi consultation meetings

March 2021
Public meeting
- Update on progress

August 2021
Public meeting and Hui with Iwi
- Introduce the draft Plan and get feedback

November 2020
Questionnaire to organisational stakeholders

August 2021
Draft Catchment Plan

September 2021
Meetings with organisational stakeholders

October 2021
Final Draft Catchment Plan and Section 32

DESCRIPTION AND KEY VALUES HE WHAKAMĀRAMA ME NGĀ UARATANGA MATUA

CULTURAL LANDSCAPE

The Māori name Mōtū means “cut off” or “isolated”. Since ancient times, the area has been recognised as isolated because of the dense forests surrounding it.

It is important to recognise the significance of Maungahaumī, the southernmost peak of the Raukumara Ranges, which has its naming recorded in the pātere (chant) Haramai a Paoa. The mountain was found by Paoa, the captain of the Horouta waka, in his search for a suitable tree to make repairs to the Horouta. It is important culturally to all the iwi of Tairāwhiti who descend from the Horouta waka.

The Mōtū is an important awa for Te Aitanga ā Māhaki. A key marae for the Mōtū is Mātāwai (called Tapapa), which is important for the hapu of Ngā Pōtiki and Ngā Mātāwai.

Another iwi which has a close connection to the Mōtū is Ngā Ariki Kaiputahi. Though the Mangatu is their awa their rohe includes areas of the Mōtū, Mangaotane Blocks, Mangaotane, the Raukumara Ranges and the Mōtū River on the boundaries of Mangaotane.

Te Whānau a Kai also have interests in the Mōtū catchment. Their ancestral maunga is Maungahaumi.

As the Mōtū continues downstream to the Bay of Plenty, it is within the rohe of Te Whānau a Apanui, who, like Te Aitanga ā Māhaki, feature the awa in their pepeha. The Mōtū River acts a boundary between Te Whānau a Apanui and Te Aitanga ā Māhaki.

MŌTŪ RIVER CATCHMENT

The Mōtū River begins in the Matawai Conservation Area and flows northwards through the Raukumara Ranges to the Bay of Plenty. The total catchment area is 1373 km^2, and the river is 147km in length. Within the Gisborne – Tairāwhiti region, the catchment area is 700km^2 and covers areas of indigenous forest, plantation forest and pastoral farming. Mōtū and Matawai are the two main villages within the catchment, with fewer than 100 people living in Matawai and only 6 permanent residents’ houses in Mōtū.

The main land use within the catchment area is pastoral farmland covering 65% of the land area. There are small amounts of forestry. The remaining areas are dominated by indigenous vegetation cover. The different vegetation types and landcover are shown in Appendix 3.

Most farming is sheep and beef with some deer farming. There are two dairy farms in the catchment and several other farms provide dairy support for dairy farms in the Bay of Plenty. The beef farming that is present is often intensive, and also situated adjacent to the river. These land uses (with limited stock control) contribute to degrading water quality, however the natural geography of the area also contributes.

Major tributaries of the upper Mōtū River are the Matawai Stream, the Waiwhero Stream, Whakamaria Stream, the Kokopumatara Stream and the Waitangirua Stream. The Whakamaria, Kokopumatara and Waitangirua Streams are included within the Water Conservation Order area.

The Mōtū River was the first river in New Zealand to gain protection from a Water Conservation Order as a “wild and scenic river”. The Water Conservation Order says the river should be preserved as far as possible in its natural state from the Mōtū Falls to the SH35 bridge.

The area upstream of the Mōtū Falls and the Water Conservation Order is not protected. However, activities and impacts on the upper Mōtū River are felt within the protected area and impact upon its values.

Ecologically, the Mōtū is categorised as an upland river – the only one in the region. Interestingly, it is also the only area in New Zealand where weka and kiwi co-exist.

There are a number of significant wetlands within the catchment – most notably the headwater wetland at the Matawai Conservation Area, the Alcuin Wetland and the Mōtū Wetland.

The upper catchment of the river has a diverse range of native freshwater invertebrates, with a number of rare species. Longfin eel, shortfin eel, koaro, shortjaw kokopu and torrentfish are found in some of the tributaries.

The Mōtū Falls act as a major barrier to native fish, meaning that non migratory bullies, koura (freshwater crayfish) and eels are the main native fish species found in the upper Mōtū River.

Below the Falls, the Mōtū River and its tributaries have even more of threatened and at risk native fish species.

The Mōtū River and the Mangaotane Stream are also key habitats for Hochstetter's Frog and Blue Duck.

The Mōtū is a significant trout fishing river and is also recognised for its wilderness and recreational values.

Appendix 3 shows the key natural values in the catchment.

OPATO STREAM CATCHMENT

A small part of the Opato Stream catchment is within the catchment plan area. The stream is a tributary of the upper Waioeka River and flows into the Bay of Plenty, and is surrounded by forest. The Opato Stream is known for its clear water and its reasonable population of rainbow and brown trout. It is also an important habitat for native fish and other riverine species. The stream is located within the Waioeka Gorge Scenic Reserve. The Bay of Plenty reaches of the stream are scheduled as having a regionally significant trout fishery and being an important habitat for blue duck.

PAKIHI STREAM CATCHMENT

A small part of the Pakihi Stream catchment is within the catchment plan area. The stream flows into Bay of Plenty Region, through the Raukumara Forest Park and eventually joins the Otara River. The Pakihi Stream is also known for it's excellent water quality and population of trout. It is also an important habitat for native fish and other riverine species. The Mōtū Trails Pakihi Track follows the stream through to the Bay of Plenty.

KORANGA RIVER CATCHMENT

The headwaters of the Koranga River, and its tributary the Moanui Stream are within the catchment plan area. The Koranga River flows through the farmed Koranga Valley towards the Bay of Plenty before meeting the Moanui Stream and flowing through the Waioeka Gorge Scenic Reserve. The Koranga River is an important headwater tributary to the Waioeka River. The Koranga River is well known as a high value trout fishery for anglers, as well as a popular area for walkers. It is also an important habitat for native fish with bluegill bully, long and shortfin eel, koaro and torrentfish recorded in the river. It is also important for other riverine species and is a key habitat of Blue Duck. There are a number of wetlands within the catchment. The Bay of Plenty reaches of the stream are scheduled as having a regionally significant trout fishery.

HYDROLOGY
MĀTAI AROWAI

The Mōtū River is a 5th order stream with a catchment area of 246 km2 at the Mōtū Falls. The total area within the Gisborne-Tairāwhiti region is 700 km^2.

Continuous flow data has been collected by NIWA at Waintangirua from the 1970s to 2016 and regular gaugings have been taken by Gisborne District Council at the Kotare Station Bridge since 2007. Continuous telemetry monitoring has been installed at the Kotare Station site since 2016,

As part of a study on habitat and flow requirements undertaken in 2016 (Roil, Trevelyan and Duncan, 2016), the data from the existing monitoring sites was used to infer flow statistics at Alcuin Station. This is downstream from the Kotare site and upstream from the Waitangirua site.

The flow summary statistics for the period 2007-2016 for the two sites are shown below:

Flow summary statistics (m3/s) for Mōtū River at Kotare station (2007-2016)					
Mean	Median	d-MALF	Upper Quartile	Lower Quartile	95%
1.36	0.94	0.5	1.537	0.542	3.5

Flow summary statistics (m3/s) for Mōtū River at Alcuin Station (2007-2016)					
Mean	Median	d-MALF	Upper Quartile	Lower Quartile	95%
NA	NA	0.7	NA	NA	NA

This shows that the upper Mōtū is a relatively small river. By comparison, the 7 Day Mean Annual Low Flow (MALF) is only 30% of that found in the Waipaoa River at the main water monitoring sites

The long flow record at Waitangirua indicates that there is an average of 12.6 flushing events per year.

WATER QUALITY INFORMATION
HE WHAKAMĀRAMA KOUNGA WAI

MONITORING SITES

Gisborne District Council has four sites in the catchment area where monthly State of the Environment (SOE) water quality monitoring is undertaken. This involves a monthly collection of water quality samples using a standard 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.

These sites, plus five others in the catchment area, are also annual biomonitoring sites. Biomonitoring sites are visited annually in summer. A field assessment of the habitat quality, the amount of periphyton, types of algae and the number and types of macroinvertebrates (freshwater insects) are recorded.

In addition to the Council sites, there are 5 biomonitoring sites that are monitored as part of the Mōtū Catchment Project and 2 years of annual monitoring data for these sites.

2020 WATER QUALITY STATUS

An analysis of the monthly water quality monitoring data for 2015-2020 is shown in Appendix 4. This includes a comparison with the NOF. A summary table is provided on the following page.

WATER QUALITY OVERVIEW

- Many aspects of water quality in the Mōtū River are very good. The headwaters at Matawai Conservation Area has among the best water quality and fresh water insect life in the Gisborne District.
- However, some of the water quality attributes deteriorate downstream – particularly phosphate, dissolved inorganic nitrogen, dissolved oxygen, turbidity, E.coli and QMCI .
- There are some water quality attributes of the Mōtū River that fall below the National Bottom Lines and an Action Plan to address this is needed. Generally speaking, the water quality is very good at the top of the catchment and deteriorates further downstream. The most significant problems are found at the lowest site – the Mōtū Above Fall site. Key attributes of concern are:
  - Phosphate is below the National Bottom Line at the Kotare site: This also has a deteriorating trend over time;
  - Turbidity is below the National Bottom Line at the Kotare and Mōtū above the Falls sites and Turbidity has a deteriorating trend over time at both these locations;
  - Suspended sediment (clarity) is below the National Bottom Line at all sites;
  - E.coli bacteria is below the National Bottom Line at the Kotare and Mōtū Above Falls sites: This has a deteriorating trend over time at the Mōtū Above Falls site;
  - Macroinvertebrates (freshwater insects) are below the National Bottom Line for the QMCI measure at the Mōtū Above Falls site;
  - There is also a more widespread problem with blooms of the potentially toxic Phormidium algae during summer.

The water quality in the Matawai Stream is not as good as the Mōtū River. Specific problems are:

Phosphate has a deteriorating trend over time

- Dissolved inorganic nitrogen (DIN), Ammonia and Dissolved Oxygen and MCI are in the C band
- Turbity, suspended fine sediment (clarity), QMCI and E.coli are below the National Bottom Line.

- The annual biomonitoring of the Koranga River would suggest that it is in reasonable health, though there is no other water quality monitoring data.
- There is missing data for some of the NPSFM required water quality attributes. We have asked the Council if they can undertake some water quality monitoring over the period of developing this catchment plan to help give us an idea of the current state.

The degradation of water quality within Gisborne District has an effect throughout the rest of the river and into the Bay of Plenty. It is possible that Bay of Plenty residents and/or iwi would like to engage with planning around the future of the Mōtū river.

POTENTIAL CONTRIBUTIONS

The water quality problems can be categorised into three groups - sediment (turbidity, suspended fine sediment and phosphate which attaches to sediment), aquatic ecosystem health and E.coli bacteria;

- Stock access to waterways and run off from paddocks is the most likely source of the E.coli bacteria. Sources of E.coli and ways to reduce this have been studied in the nearby Wharekopae Catchment. You can read more about sources and ways to reduce E.coli on the Ministry of Environment website: www.mfe.govt.nz
- Sediment sources are likely to be more diverse – riverbank erosion from stock access and insufficient riparian vegetation, cultivation for cropping, land disturbance for track and culvert construction and quarrying, as well as wider erosion in the catchment. What proportions each of these are contributing is not clear. You can read more about sedimentation and typical sources of sediment in hill country on the NIWA website: niwa.co.nz.
- Aquatic ecosystem health is complex and influenced by sediment, nutrient levels and the amount of shading on the river. You can read a bit more about what the different indicators mean – and the context in the rest of New Zealand What is a river report – www.Cawthorn.org

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Mōtū at Conservation Area (SS)	Mōtū at Kotare Station (VA)	Mōtū above Falls (SS)	Matawai Stream (SS)
DRP Median mg/L	A <0.006 B 0.006 -0.010 C 0.010 -0.018 D >0.018	0.013 C Band	0.019 D Band	0.016 C Band	0.013 C Band Increasing trend
DIN Median mg/L	A <0.24 B 0.24 -0.50 C 0.5- 1.0 D >1.0	0.23 A Band	0.27 B Band	0.29 B Band	0.56 C Band
Ammonia (Toxicity) Median mg NH4-N/L	A <0.03 B 0.03 -0.24 C 0.24 - 1.30 D >1.30	0.012 A Band	0.012 A Band	0.026 A Band	0.052 B Band
Nitrate (Toxicity) Median mg/L	A < 1.0 B 1.0 -2.4 C N/A D >2.4	0.013 A Band	0.23 A Band	0.25 A Band	0.44 A Band Decreasing trend
Dissolved Oxygen mg/L 7 day mean minimum (1 Nov – 30 April)	A >8.0 B 7.0-8.0 C 5.0 – 7.0 D <5.0	8.03 A Band	7.96 B Band	7.15 B Band	5.48 C Band
Turbidity (NTU) (Suspended Sediment Attribute Class 9)	A <1.2 B 1.2 -1.4 C 1.4-1.6 D >1.6	1.3 B Band Increasing trend	2 Below national bottom line Increasing trend	4.7 Below national bottom line	4.6 Below national bottom line Increasing trend
Suspended Fine Sediment (Class 1) Visual Clarity in metres	A >1.78 B 1.78 -1.55 C 1.55-1.34 D >1.34	0.853 Below national bottom line	0.763 Below national bottom line	0.715 Below national bottom line	0.713 Below national bottom line
Human health E.coli/100mL 95th Percentile	A <130 Swimming / Wading/ Boating B 130-260 / 130-1000 C 260-540 / 260-1200 D >540 / >1200	888 B Band (not a swimming site)	1640 E Band	6480 E Band Increasing trend	5480 E Band
Macroinvertebrates QMCI (abundance) (Mean 2016 -2018)	A >6.5 B 6.5-5.5 C 5.5-4.5 D <4.5	7.2 A Band	6 B Band	5.4 Below national bottom line	4.3 Below national bottom line

HE KUPU PITI
APPENDICES

APPENDIX 1: GLOSSARY OF TERMS

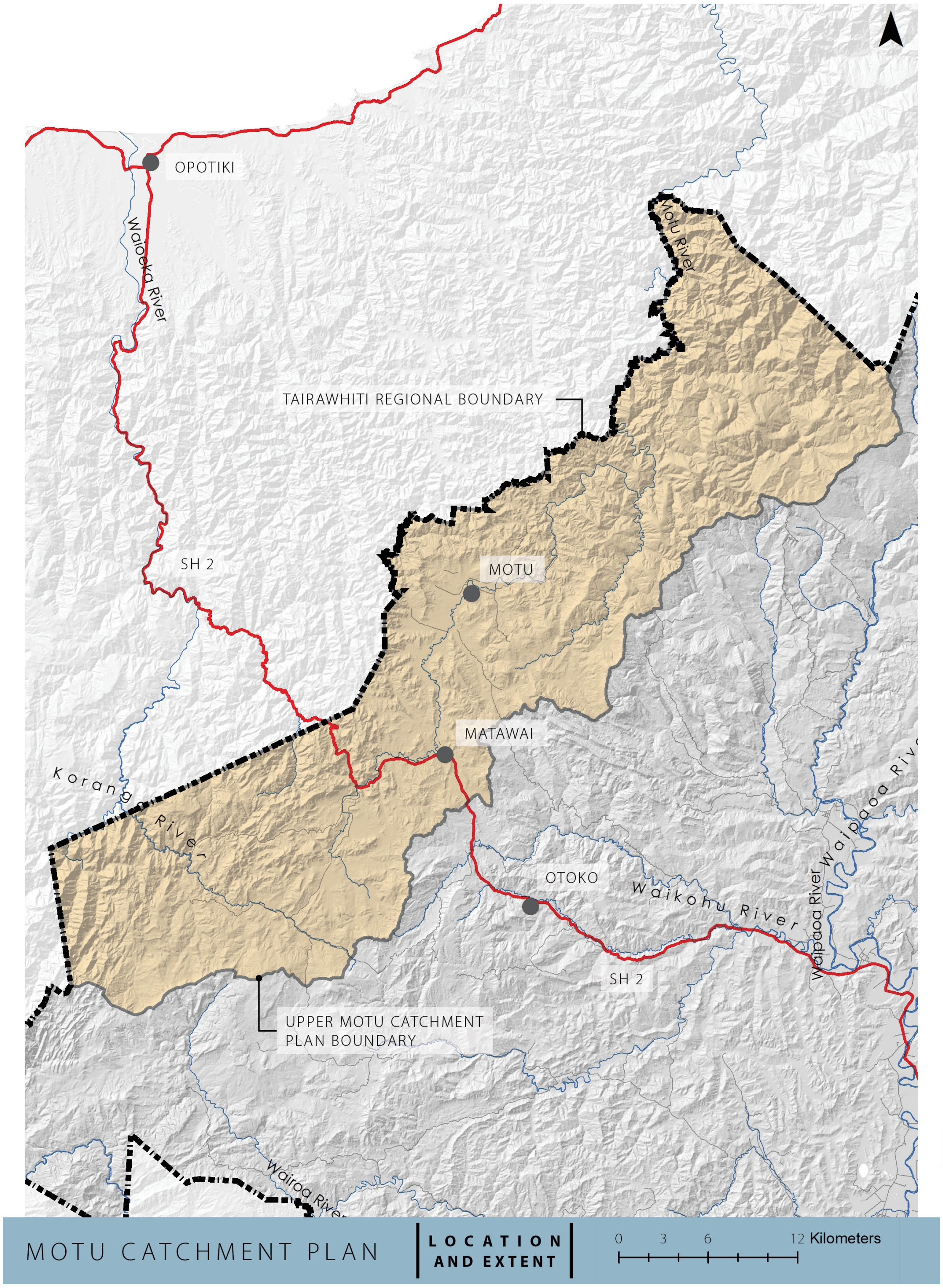
Action Plan	A part of the Catchment Plan which identifies how we are going to get areas that are degraded from their current state to where we want them to be. Can include rules or other types of methods.
Attribute	water quality indicator used to help us understand if the values of the water are being 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.
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 the water and land uses which affect water 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	Relates to a value. E.g. for the contact recreation value, the environmental outcome could be that during the summer swimming season (1 October – 30 April) it is always safe to swim and the E.coli levels don't exceed 540 cfu/100mL
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 expect the waterbody to be able to provide. 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. The Water Conservation Order area on the Mōtū is already identified as an Outstanding Waterbody.
Over-allocation	Where resource use exceeds a limit or where an FMU is degraded or degrading.
Primary contact site	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
Target state	What we want the waterbody/FMU to be like in the future but it isn't now – these end up being rules in the catchment plan

APPENDIX 2: STAKEHOLDER MEETINGS SCHEDULE AND TOPICS

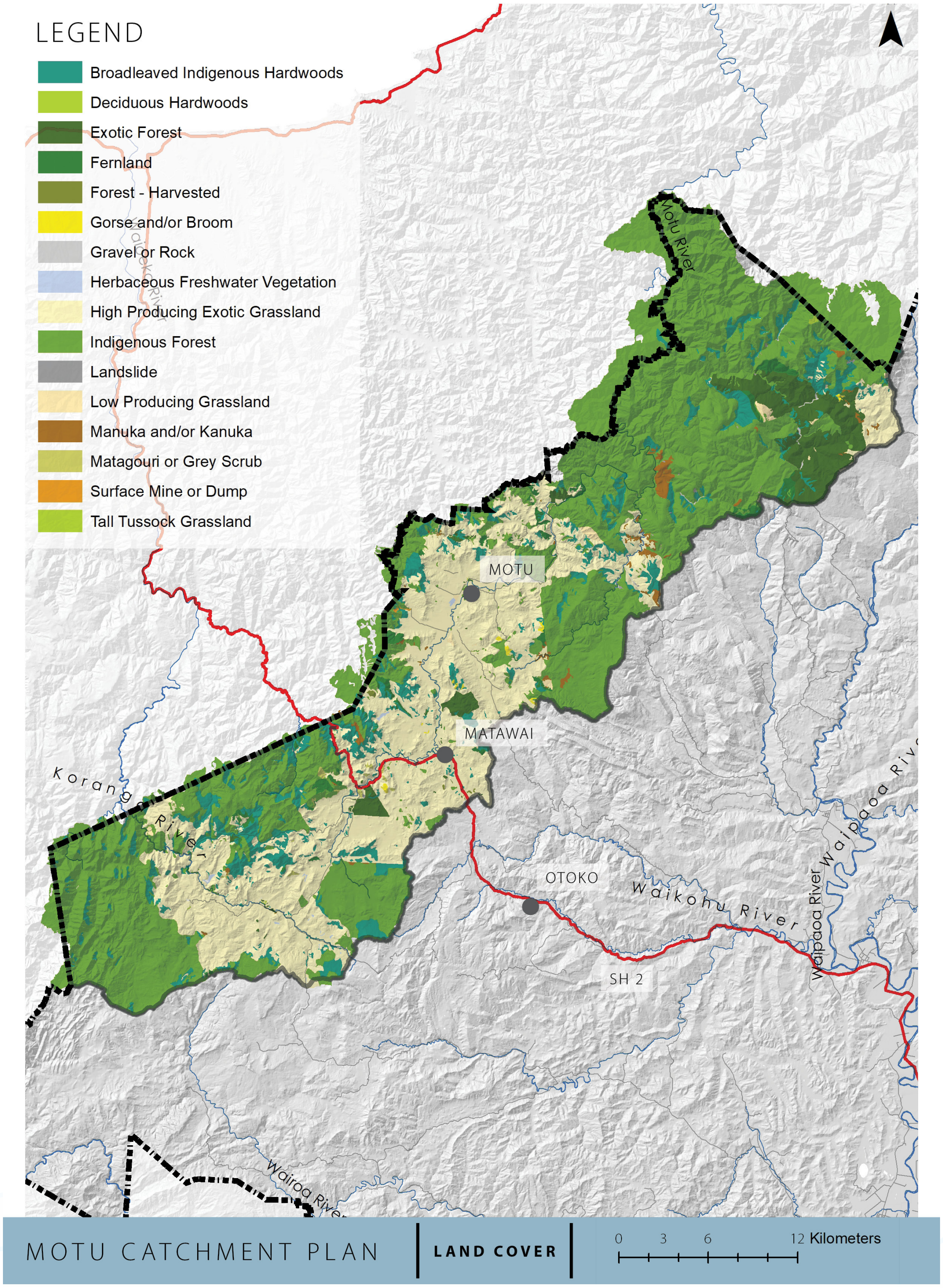
MEETING	DATE	CONTENT
Meeting 1	November 2020	Overview of the process Vision and values Freshwater management unit (FMU) identification (Based on values)
Meeting 2	December 2020	Confirming vision and values by FMU Discussion on outcomes and objectives
Meeting 3	January 2021	Outcomes and Objectives Outstanding waterbodies – potential list Swimming sites Locations of habitats of threatened species Natural wetlands Water quantityw
Meeting 4	February 2021	Water quality – potential attributes and how they relate to values and objectives
Meeting 5	March 2021	Water quality – current state and trends for attributes. Implications for Limits
Meeting 6	April 2021	Discussion on where Objectives are not met. Potential targets Action Plans to achieve Objectives
Meeting 7	May 2021	Further discussion on methods Monitoring requirements Start recommendations to Council
Meeting 8	June 2021	Complete recommendations. Group wraps up
Meeting 9	July 2021	Spare in case can’t get through in 8 meetings

APPENDIX 3: MAPS

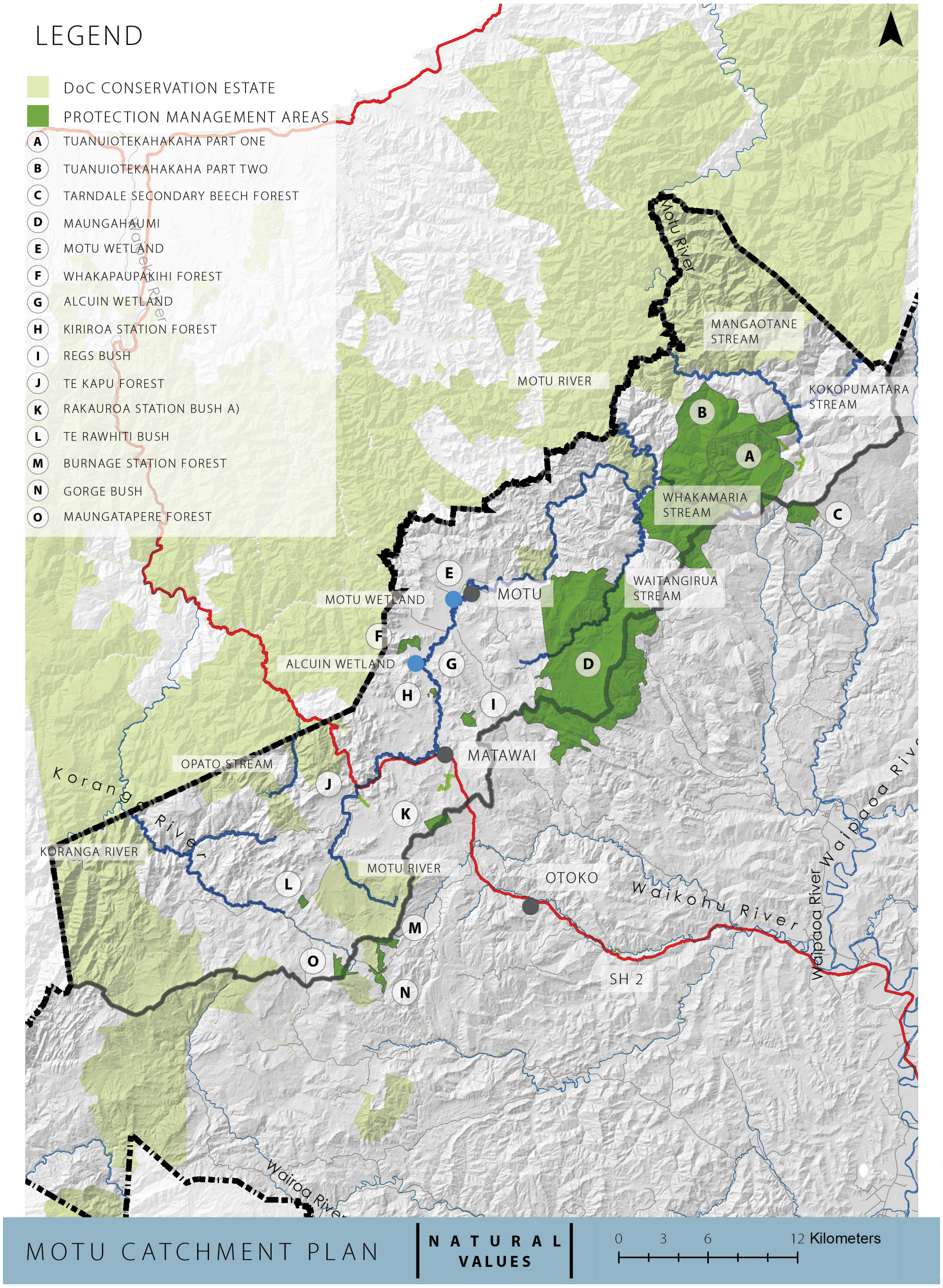
Map 1: Area covered by Mōtū Catchment Plan



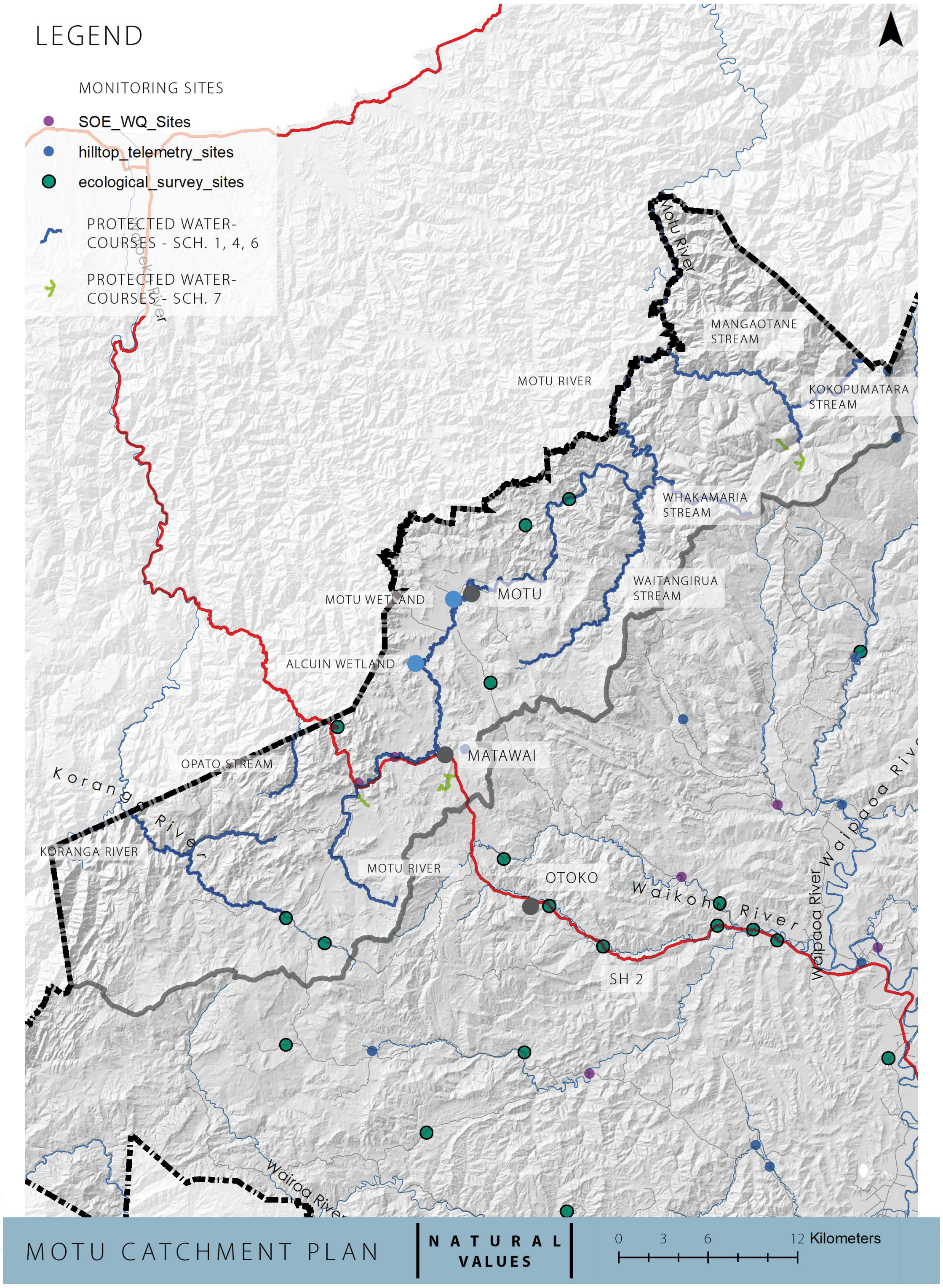
Map 2: Landcover and vegetation types



Map 3: Key natural values



Map 4: Water quality and quantity monitoring sites



APPENDIX 4: WATER QUALITY DATA

Values Based on water quality monitoring data 2015-2020

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Mōtū at Conservation Area (SS)	Mōtū at Kotare Station (VA)	Mōtū above Falls (SS)	Matawai Stream (SS)
DRP Median mg/L	A <0.006 B 0.006 -0.010 C 0.010 -0.018 D >0.018	0.014 C Band	0.019 D Band	0.016 C Band	0.013 C Band Increasing trend
What does this mean?	Phosphate is naturally high in the Mōtū Catchment. It clings onto sediment. So the more sediment that enters the river the more phosphate. Phosphate in combination with nitrogen is a key nutrient to drive periphyton growth. With naturally high levels of phosphate in the catchment, it means controlling sediment loss to streams is a high priority. The D Band result at Kotare Station means we are required to include an Action Plan to address Phosphate. The increasing trend at the Matawai Stream is also a concern.				
DRP 95th Percentile mg/L	A <0.021 B 0.020-0.030 C 0.030-0.054 D >0.054	0.0198 A Band	0.026 B Band	0.027 B Band	0.0252 B Band
What does this mean?	Given the naturally high levels of phosphorus in the catchment, these results are pretty good. They show that we are not getting major events where phosphorus is being discharged.				
DIN Median mg/L	A <0.24 B 0.24 -0.50 C 0.5- 1.0 D >1.0	0.23 A Band	0.27 B Band	0.29 B Band	0.56 C Band
What does this mean?	Inorganic nitrogen comes from fertiliser. With the naturally high levels of phosphate in the catchment, this is probably driving the amounts of periphyton in the water. The B Band for the Mōtū River median levels will reflect the amount of fertiliser ending up in the tributaries as well as the main river. The Matawai Stream looks pretty impacted and this could be indicative of other small streams.				
DIN 95th Percentile mg/L	A <0.56 B 0.56-1.10 C 1.10-2.05 D >2.05	0.17 A Band	0.545 A Band	0.586 B Band	1.29 C Band
What does this mean?	This shows that there are times when very large amounts of inorganic nitrogen enter the Matawai Stream in particular.				
Ammonia (Toxicity) Median mg NH4-N/L	A <0.03 B 0.03 -0.24 C 0.24 - 1.30 D >1.30	0.012 A Band	0.012 A Band	0.026 A Band	0.052 B Band
What does this mean?	Ammonia is incredibly toxic to fish. It will come from both animal manure and fertiliser. Ammonia levels in the Matawai Stream are double that of the Mōtū River.				

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Mōtū at Conservation Area (SS)	Mōtū at Kotare Station (VA)	Mōtū above Falls (SS)	Matawai Stream (SS)
Ammonia (Toxicity) Annual Maximum mg NH4-N/L	A <0.05 B 0.05 - 0.40 C 0.40 -2.20 D >2.20	0.047 A Band	0.037 A Band	0.046 A Band	0.116 B Band
Nitrate (Toxicity) Median mg/L	A < 1.0 B 1.0 -2.4 C N/A D >2.4	0.013 A Band	0.23 A Band	0.25 A Band	0.44 A Band Decreasing trend
What does this mean?	From the data we can see a lot of nitrate enters the river between the Conservation area and Kotare Station (a 20 fold increase) While comfortably in the A band, the nitrate levels in the Matawai Stream are double that of the main Mōtū River. The decreasing trend is positive however.				
Nitrate (Toxicity) 95th Percentile mg/L	A <1 .5 B 1.5 -3.5 C N/A D >3.5	0.126 A Band	0.49 A Band	0.54 A Band	1.09 A Band
Dissolved Oxygen mg/L 7 day mean minimum (1 Nov – 30 April)	A >8.0 B 7.0-8.0 C 5.0 – 7.0 D <5.0	8.03 A Band	7.96 B Band	7.15 B Band	5.48 C Band
What does this mean?	These results will arise from a combination of lack of shading of the water and periphyton growth. The Matawai Stream results will mean a number of fish species won't be able to live in the stream during summer. This will include trout and most native fish except for eels.				
Dissolved Oxygen mg/L 1 day mean minimum (1 Nov – 30 April)	A >7.5 B >5.0 C >4.0 D >4.0	7.1 B Band	7.82 A Band	6.54 B Band	5.1 B Band
Turbidity (NTU) (Suspended Sediment Attribute Class 9)	A <1.2 B 1.2 -1.4 C 1.4-1.6 D >1.6	1.3 B Band Increasing trend	2 BELOW NATIONAL BOTTOM LINE	4.7 BELOW NATIONAL BOTTOM LINE	4.6 BELOW NATIONAL BOTTOM LINE Increasing trend
What does this mean?	Turbidity is the amount of sediment suspended in the water and has a big impact on fish and freshwater insect health. The results at both the Mōtū above the Falls and Matawai Stream sites are below the National Bottom Line which means we are required to include an Action Plan to address Turbidity. The increasing trend at the Matawai Stream is a further concern.				

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Mōtū at Conservation Area (SS)	Mōtū at Kotare Station (VA)	Mōtū above Falls (SS)	Matawai Stream (SS)
Suspended Fine Sediment (Class 1) Visual Clarity in metres	A >1.78 B 1.78 -1.55 C 1.55-1.34 D >1.34	0.853 BELOW NATIONAL BOTTOM LINE	0.763 BELOW NATIONAL BOTTOM LINE	0.715 BELOW NATIONAL BOTTOM LINE	0.713 BELOW NATIONAL BOTTOM LINE
What does this mean?	This data is based on a short data set (less than 5 years) so is indicative not a definitive rating of the sites. While there is a deterioration in visual clarity as we move through the catchment. Given the reference (unimpacted site) visual clarity is so poor we can conclude that there is a natural condition of lower visual clarity in the catchment. However there is a relationship between visual clarity, turbidity and deposited sediment. All these indicators are looking bad, so we need to consider how to improve them together.				
Deposited Sediment (Class 2 at Kotare, Class 4 at other sites) - % cover	A <10 <13 B 10-19 13-19 C 19-29 19-27 D >29 >27	22% C Band	46% BELOW NATIONAL BOTTOM LINE	0% A Band	No data
Human health E.coli/100mL median	A B C <130 D >130 E >260	120	200 D Band	370 E Band Increasing trend	300 E Band
What does this mean?	These results mean an Action Plan for E.coli is required . The increasing trend at the Mōtū site above the Falls is a further concern.				
Human health E.coli/100mL 95th Percentile	A <130 Swimming / Wading/ Boating B 130-260 130-1000 C 260-540 260-1200 D >540 >1200	888 B Band (not a swimming site)	1640 E Band	6480 E Band Increasing trend	5480 E Band

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APPENDIX 5 - 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 night time 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).

PARAMETER	EXPLANATION
Water Clarity	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.
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).

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 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 small section of a stream (a reach). Higher MCI scores indicate better stream conditions 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 6: FRESHWATER ECOSYSTEM HEALTH

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Mōtū at Conservation Area (SS)	Mōtū at Kotare Station (VA)	Mōtū above Falls (SS)	Matawai Stream (SS)
Macroinvertebrates QMCI (abundance) (Mean 2016 -2018)	A >6.5 B 6.5-5.5 C 5.5-4.5 D <4.5	7.2 A Band	6 B Band	5.4 BELOW NATIONAL BOTTOM LINE	4.3 BELOW NATIONAL BOTTOM LINE
What does this mean?	At the Mōtū Above Falls and the Matawai Stream sites there are insufficient numbers and types of freshwater insects to support good ecosystem health. These insects are the main food source for fish, including trout. These results mean an Action Plan for Macroinvertebrates is required.				
Macroinvertebrates MCI (presence)	A >130 B 129-110 C 109-90 D <90	129	118	98	112
What does this mean?	There are a good range of different types of native insects present at 3 of the sites, but the number of different types of species is poor at the site above the Falls				
Macroinvertebrates ASPM	A >0.6 B 0.6-0.4 C 0.4-0.3 D <0.3	0.6	0.5	0.3	0.5
What does this mean?	The ecosystems in the B ban have mild to moderate loss of integrity. At the site above the Falls the loss is moderate to severe.				
Fish	A >34 B 34 -28 C 28 -18 D <18	No data			
Ecosystem Metabolism	No bottomlines set These data indicate health is satisfactory (Matawai Stream) to healthy (Kotare site)	Not calculated	-4.00	-4.92	-9.22
Periphyton mg chl-a/m2	A < 50 B 50 -120 C 120 - 200 D 200	Average 45% periphyton cover during summer sampling	Average 41% periphyton cover during summer sampling	Average 76% periphyton cover during summer sampling	No data
What does this mean?	Periphyton is the slimy green algae that grows in rivers. A lot of periphyton means that there is too much light and too many nutrients in the water. The things that drive periphyton growth are Phosphate (DRP) and Nitrogen (DIN). If we want to reduce periphyton we need to reduce those nutrients in the water. Shading through riverbank planting on the rivers/streams also helps.				

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Koranga River at Koranga Road (VA)	Koranga Trib at Rakauroa Road (VA)	Upper Mōtū Trib at Mangatu (HS)	Whakarau Trib at Whakarau Road (SS)	Marumoko Stream at Marumoko Road (HS)
Macroinvertebrates QMCI (abundance) (Mean 2016 -2018)	A >6.5 B 6.5-5.5 C 5.5-4.5 D <4.5	6.1	6.7	5.9	5.6	6.4
Macroinvertebrates MCI (presence)	A >130 B 129-110 C 109-90 D <90	119	124	121	110	120
Macroinvertebrates ASPM	A >0.6 B 0.6-0.4 C 0.4-0.3 D <0.3	0.6	0.6	0.6	0.4	0.6
Periphyton	A < 50 B 50 -120 C 120 - 200 D 200	Average 63% cover during summer sampling	Average 45.5% cover during summer sampling	Average 18% cover during summer sampling.	Average 84% cover during summer sampling	Average 75% cover during summer sampling
Deposited Fine Sediment	A <10 <13 B 10-19 13-19 C 19-29 19-27 D >29 >27	10%	21.5%	39% BELOW NATIONAL BOTTOM LINE	15%	0%

The Mōtū Catchment Project sites have only been monitored for two years, and provides some useful "infill" data for the Mōtū River.

Attribute (REC Class Cool Wet Hill)	NPSFM Limit	Site 1 at Te Wera Road	Site 2 – Mōtū River at Mōtū Road	Site 3 –Mōtū River by Whakarau Road	Site 4 – Mōtū River beneath Mōtū Village	Site 5 –Mōtū River by Fraser Hill Road
MCI	A >130 B 129-110 C 109-90 D <90	126 B Band	122 B Band	117 B Band	122 B Band	110 B Band
QMCI	A >6.5 B 6.5-5.5 C 5.5-4.5 D <4.5	7.1 A Band	6.7 A Band	7.1 A Band	5.9 A Band	4.2 Below National Bottom Line

APPENDIX 7: BIBLIOGRAPHY

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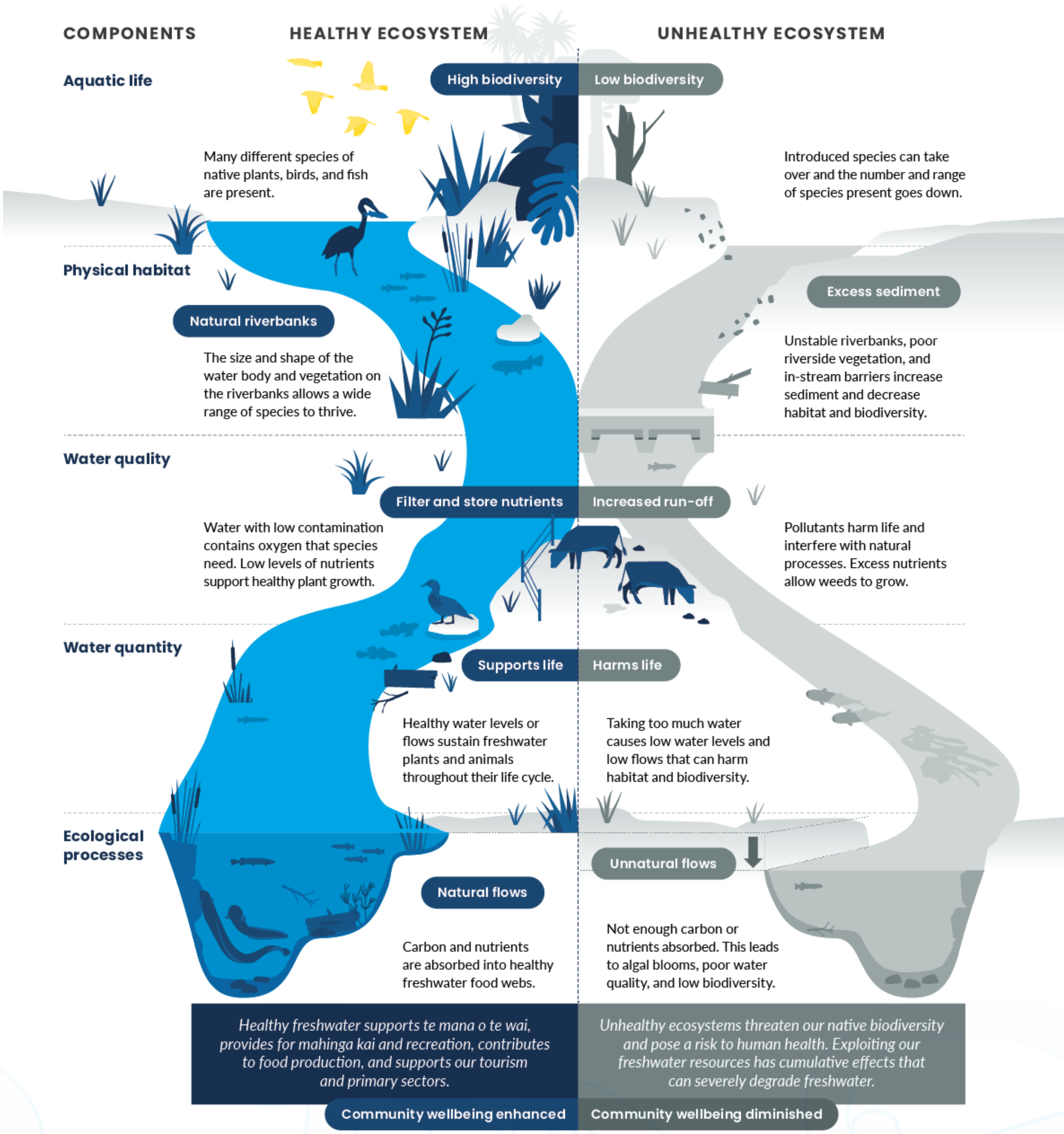
APPENDIX 8: FRESHWATER ECOSYSTEM HEALTH EXPLANATION

Healthier ecosystems have been less affected by our activities and contain more of the native species that would be present in natural conditions.



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