

Three Rivers Catchment Group

Fresh water health and landscape influences in
Three Rivers Catchment, including sub catchments
Mimihau, Mokoreta and Glenham



**THRIVING
SOUTHLAND**

*Tōmū ana te whenua. Tōmū ana te takata.
A thriving, prosperous land. A thriving, prosperous people.*

AS AT OCTOBER 2022
Further updates will be included as new
information becomes available.

Welcome to Three Rivers Catchment brochure

This Three Rivers Catchment Group brochure is one of a series of brochures on catchments in Southland.

Catchment Groups have been asking for more detailed insights into their individual catchments. This brochure provides insights based on available information, bringing together published science, research, data and information on the state of water, soil and land in the Three Rivers Catchment, including the sub catchments of Mimihau, Mokoreta and Glenham.

It provides details on what affects water quality and how these impact the rest of the catchment, including out-of-catchment areas that may be impacted by what goes on in the catchment, such as the estuary.

Although this brochure collates all the available information that has been brought together in a literature review commissioned by Thriving Southland – called the Science Report, thrivingsouthland.co.nz/science-report/ - it may not have all the details you know about in your catchment, or the research you may have done on your farm or in your Catchment Group.

How to use this brochure

This brochure sets out (publicly available) details on:

- » Water quality
- » Landscape influences
- » Physiographic zones
- » Groundwater management zones (GMZs)
- » Measuring what lives in streams and rivers
- » Macroinvertebrate community index (MCI)
- » Estuary health
- » Where to get more information.

If you are not familiar with the terms and language used, read the brochure in conjunction with this glossary environment.govt.nz/publications/environment-aotearoa-2019-glossary.

We also recommend you check out the catchment group pages on

thrivingsouthland.co.nz/three-rivers/,

thrivingsouthland.co.nz/mimihau/,

thrivingsouthland.co.nz/mokoreta/,

thrivingsouthland.co.nz/glenham/

to learn more about the catchment and what projects the Catchment Groups have underway or planned.

Interpreting what the data in the brochure means

Because this brochure brings together the data available, we have deliberately not interpreted that data or explained what the trends may mean for your catchment.

We recommend you contact an environmental consultant, your Thriving Southland Catchment Group coordinator or Environment Southland to speak to experts who can explain what these trends and data may mean for your catchment, or for your farm specifically.

You can also check out a range of information on the Thriving Southland Information Resource Hub thrivingsouthland.co.nz/info-hub which will connect you with tools and resources from many different organisations to help you with understanding limit setting, environmental contributing factors, mitigations and options available to you.

A little bit about Thriving Southland

Thriving Southland supports Southland's Catchment Groups to understand challenges and opportunities in their catchments and create innovative and exciting solutions.

We have a vision to create a prosperous Southland, healthy people, and a healthy environment, and believe that by working together, Thriving Southland's communities will create a better future for all by protecting the region's prosperity, heritage, environment and health.

Thanks

Thank you to the farmers who supported the development of this brochure, and to the Ministry of Primary Industry for its Sustainable Land Use Programme which supports the work Thriving Southland is delivering for farmers and communities in Southland. Thank you also to Environment Southland who reviewed the content of this brochure.



Water quality in Maitaura Catchment

Maitaura Catchment

Three Rivers and its sub catchments are part of the Maitaura Catchment which outflows via the Maitaura River into the Toetoes (Fortrose) Estuary. The Maitaura River and Toetoes Estuary are an important source of mahinga kai, particularly kanakana (lamprey), inanga (whitebait) and tuna (eels).

Various industrial and municipal water discharges, and increasing agricultural intensification are key contributors to the degradation of water quality in the Maitaura Catchment. Currently the Toetoes Estuary is considered to be in poor condition.

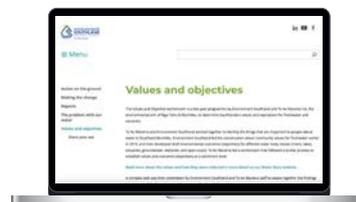
Summary of Three Rivers Catchment

The hydrology, health and functions of a stream/river or area of groundwater is directly linked to the characteristics of its catchment, including the landscape, soils and human activities.

- » This catchment is large, with most of the area falling into the bedrock/hill country – overland flow physiographic zone. The next largest zone is oxidising, covering areas around Edendale and Mokoreta. Areas of the gleyed physiographic zone and lignite/marine terraces are also important in this catchment
- » The western part of this catchment overlies parts of two GMZs - Edendale and the Lower Maitaura. The Edendale GMZ experiences higher nitrate levels than the Lower Maitaura GMZ
- » Water quality in this catchment is highly variable. In places it is degraded in terms of nitrogen (groundwater) and *E. coli* (faecal bacteria) (ground- and surface water)
- » Neighbouring farms on different zones may have very different water quality outcomes with similar farm practices due to different contamination movement and attenuation pathways (reducing the effects of contaminants).

What does this mean?

- » In August 2020, the Government announced changes to the National Policy Statement for Freshwater Management (NPS-FM), the National Environmental Standard for Freshwater (NES) and changes to the Resource Management Act. These outline changes in regulations relating to wetlands and rivers, intensive winter grazing, intensification, stockholding areas and stock exclusion
- » Environment Southland, in partnership with Te Ao Marama Incorporated (as the environmental arm of Ngāi Tahu Ki Murihiku), is working towards updating the Water and Land Plan in line with the 2020 NPS-FM. This update is known as Plan Change Tuatahi (first plan change), and will set limits, targets and methods (for discharges to and abstractions from waterways) that will help achieve hauora, a state of healthy resilience, for waterbodies. There will be an opportunity for public submissions to this plan in 2023 before it is finalised in 2025. [waterandland.es.govt.nz/about/values-and-objectives](https://www.waterandland.es.govt.nz/about/values-and-objectives)



- » Plan changes will result in additional controls and rules in Southland that will be focused on reducing the loss of nutrients, specifically nitrogen and phosphorus, and reducing discharges of sediment and faecal microorganisms, from land to groundwater and surface water
- » In the Environment Southland Proposed Water and Land Plan there is a focus on good management practices (GMPs) and farm environmental management plans (FEPs). You can view GMP factsheets for each physiographic zone on The Environment Southland website [es.govt.nz](https://www.es.govt.nz)

* Te Ao Mārama Incorporated looks after mana whenua interests in resource management and other aspects related to local government in Southland. It is authorised to represent three Ngāi Tahu papatipu runanga in Murihiku/Southland. It is involved in the protection of the spiritual and cultural values of the region, including wahi tapu (sacred places), mahinga kai (gathering of food and resources) and other natural resources.

Three Rivers water quality

Surface water quality is assessed by testing how much nitrogen, phosphorus and *E. coli* is present. LAWA summary results for this catchment are shown below (lawa.org.nz):

Total oxidised nitrogen

Monitoring site	5-year median	5-year trend	10-year trend	15-year trend
Mimihau Stream at Wyndham	0.91 mg/L			
Mimihau Stream Tributary at Venlaw Forest	0.155 mg/L			
Mokoreta River at Wyndham River Road	1.1 mg/L			

^ Total Oxidized Nitrogen (TON) is the sum of nitrate and nitrite. Nitrite is generally a very small fraction of the TON concentration in rivers, TON is taken to be equivalent to the nitrate concentration

* 2016-2020 LAWA median per NPS-FM 2020 using TON as surrogate for NO₃-N

Too much TON can contribute to excessive algal growth in waterways.

Ammoniacal nitrogen

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Mimihau Stream at Wyndham	0.005 mg/L				
Mimihau Stream Tributary at Venlaw Forest	0.005 mg/L				
Mokoreta River at Wyndham River Road	0.005 mg/L				

If ammoniacal nitrogen reaches very high concentrations it can become toxic under certain temperature and pH conditions.

Dissolved reactive phosphorus

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Mimihau Stream at Wyndham	0.01 mg/L				
Mimihau Stream Tributary at Venlaw Forest	0.0115 mg/L				
Mokoreta River at Wyndham River Road	0.007 mg/L				

Dissolved reactive phosphorus concentrations are an indication of a waterbody's ability to support nuisance algal or plant growths (algal blooms).

Total phosphorus

Monitoring site	5-year median	5-year trend	10-year trend	15-year trend
Mimihau Stream at Wyndham	0.036 mg/L			
Mimihau Stream Tributary at Venlaw Forest	0.0195 mg/L			
Mokoreta River at Wyndham River Road	0.026 mg/L			

Too much phosphorus can encourage the growth of nuisance plants such as algal blooms.

KEY (STATE)		KEY (TREND)		
A Very good	B Good	Very likely improving	Likely improving	Indeterminate
C Fair	D Poor	Very Likely degrading	Likely Degrading	Not Assessed

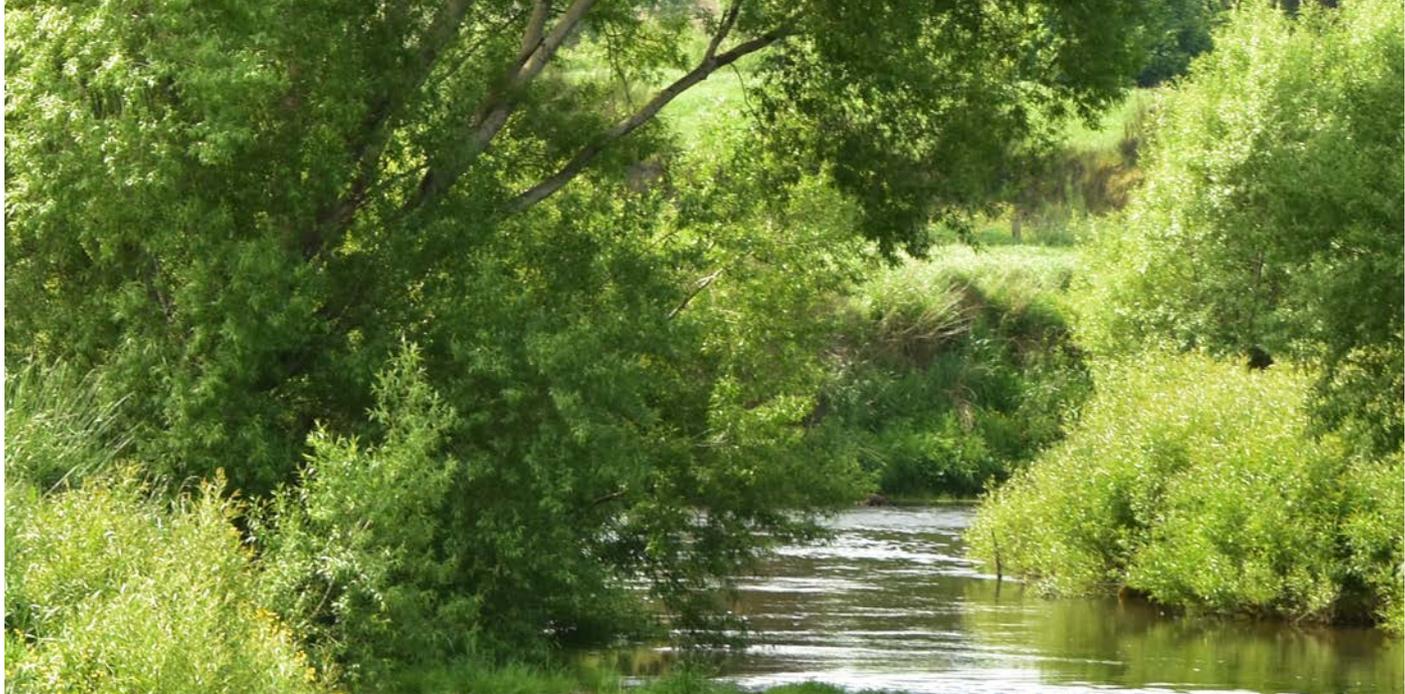
E. coli

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Mimihau Stream at Wyndham	265 n/100ml	E			
Mimihau Stream Tributary at Venlaw Forest	45 n/100ml	B			
Mokoreta River at Wyndham River Road	225 n/100ml	D			

* 2016-2020 LAWA median graded as per NPS-FM 2020

KEY (STATE)			KEY (TREND)		
A Very good (infection risk is 1%)	B Good (infection risk is 2%)	C Fair (infection risk is 3%)	Very likely improving	Likely improving	Indeterminate
D Poor (infection risk is >3%)	E Very Poor (infection risk is >7%)		Very Likely degrading	Likely Degrading	Not Assessed

Results from lawa.org.nz (September 2022)



MCI

Macroinvertebrates include the caddisflies, mayflies, stoneflies, worms and snails that live in rivers. They are an important food source for fish and birds and sensitive to the combination of nutrients, sediment and habitat. Due to this sensitivity they are considered to be a good representation of overall water quality and ecosystem health. The different macroinvertebrates present can be identified and then converted to a score called the MCI.

A higher MCI score generally indicates a healthier stream. Generally, MCI scores range from >150 (very good water quality) to as low as 20 (very poor water quality).

The MCI scores for the Three Rivers Catchment are (LAWA September 2022):

MCI

Monitoring site	5-year median	State	10-year trend	15-year trend
Mimihau Stream at Wyndham	96.0	C		
Mimihau Stream Tributary at Venlaw Forest	119.0	B		
Mokoreta River at Wyndham River Road	94.3	C		

KEY (STATE)

A
Macroinvertebrate community indicative of pristine conditions with almost no organic pollution or nutrient enrichment.

C
Macroinvertebrate community indicative of moderate organic pollution or nutrient enrichment. There is a mix of taxa sensitive and insensitive to organic pollution/nutrient enrichment.

National bottom line: MCI score 90

B
Macroinvertebrate community indicative of mild organic pollution or nutrient enrichment. Largely composed of taxa sensitive to organic pollution/nutrient enrichment.

D
Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. Communities are largely composed of taxa insensitive to inorganic pollution/nutrient enrichment.

KEY (TREND)

Very likely improving
 Likely improving
 Indeterminate

Very Likely degrading
 Likely Degrading
 Not Assessed

Estuary Health

Table: Estuary state information (provided by Environment Southland July 2021 es.govt.nz state and outcome map).

Although the estuary is not in the Three Rivers Catchment, it is an important factor in understanding the impacts of water quality in Three Rivers. Decisions made in the catchment that affect water quality, flow downstream and impact on water quality in the estuary.

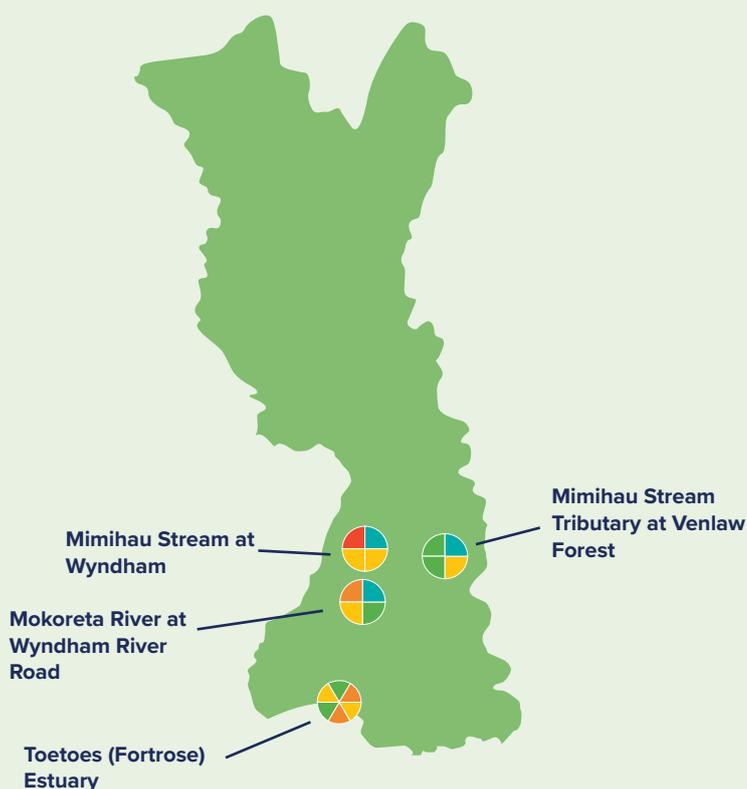
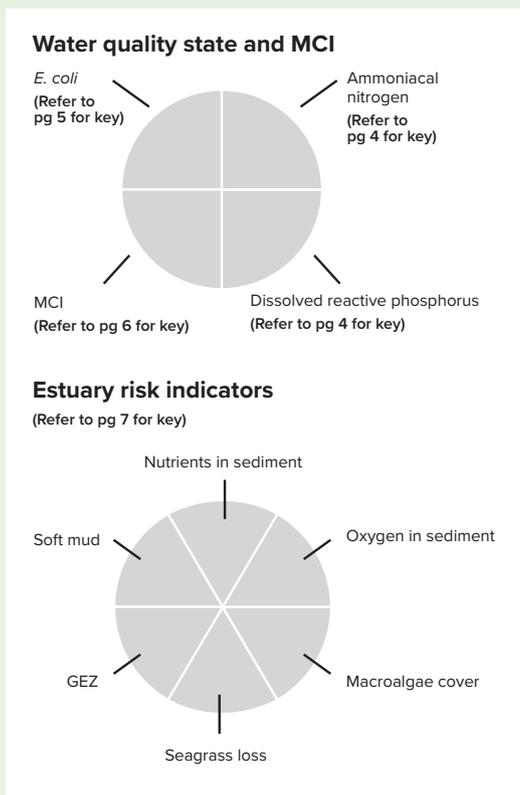
The below assessment of estuary health based on the sediment quality gives a good indication of what is happening upstream across all catchments that feed into waterways supplying the estuary and therefore impact on the ecosystems and the cultural values of the area.

Estuary	Soft mud	Nutrients in sediment	Oxygen in sediment	Macroalgae cover	Seagrass loss	GEZ*
Waiiau Lagoon/Te Wae		Orange	Yellow			
Lake Brunton			Green			
Waituna Lagoon/Waiparera (not assessed)						
New River Estuary	Orange	Orange	Orange	Yellow	Orange	Orange
Jacobs River Estuary	Orange	Yellow	Orange	Orange	Orange	Orange
Waikawa Estuary	Orange	Yellow	Orange	Green	Orange	Green
Haldane Estuary	Yellow	Green	Teal	Teal		Teal
Freshwater Estuary	Teal	Green	Teal	Green	Yellow	Teal
Waimatuku Estuary		Yellow	Yellow			
Toetoes Estuary	Yellow	Green	Orange	Yellow	Orange	Green

KEY Very Good Good Fair Poor

* Gross Eutrophic Zone (GEZ) is defined as an area that has low sediment oxygenation (<1cm aRPD), soft mud (>25% mud content) and the presence of high macroalgal cover (>50% cover). These areas are in poor condition and can no longer support most estuarine animals and shellfish.

Mataura Catchment with estuaries and surface water quality monitoring sites



*sites in Three Rivers Catchment only shown

Landscape influences

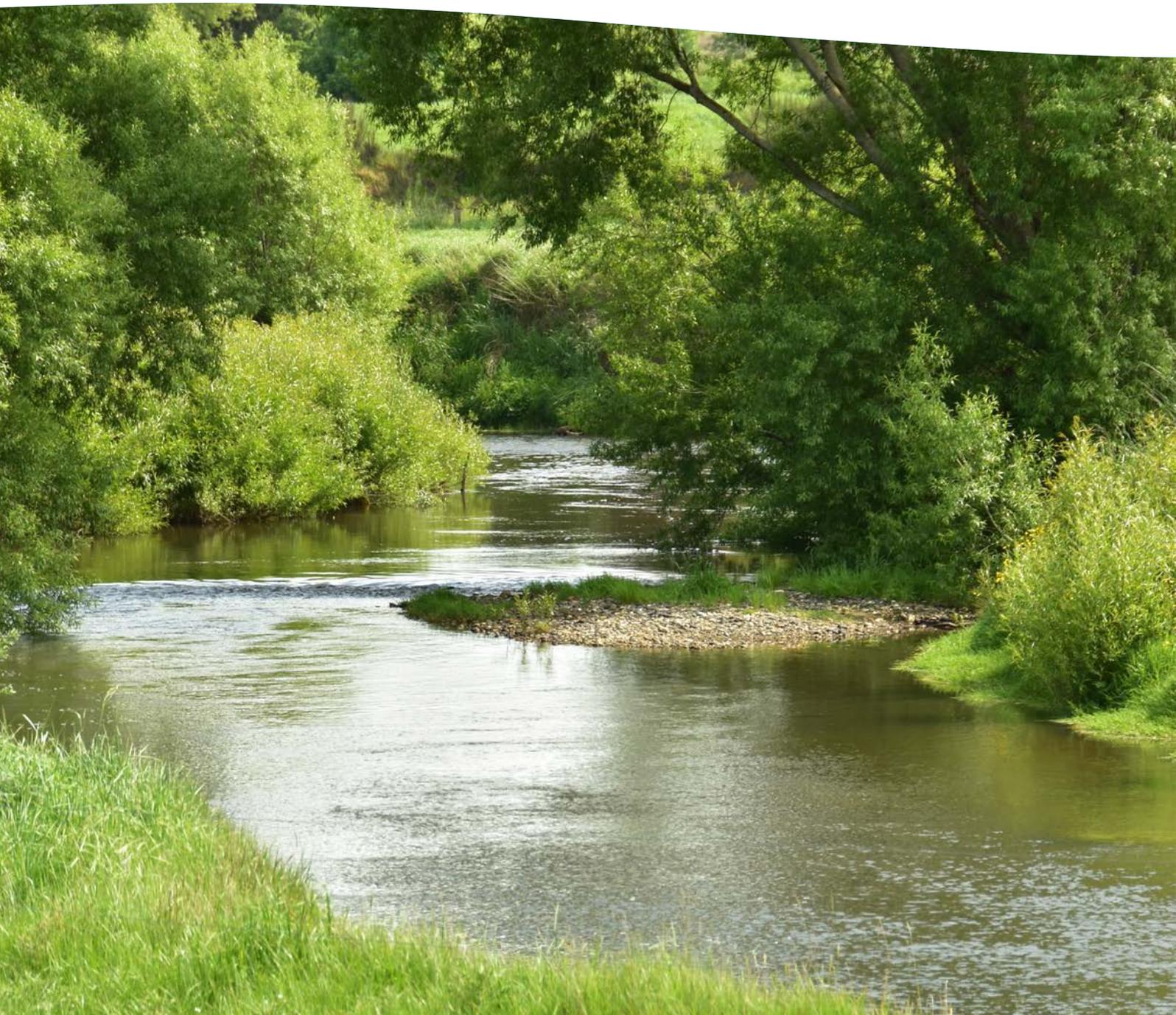
What we do on the land can affect our water, but how it affects our water depends on a range of factors, including how our landscape works. It is useful to look at:

- » Physiographic zones which help to explain how nitrogen, phosphorus, sediment and faecal microorganisms (such as *E. coli*) move and are attenuated (reduced, e.g. by biological or chemical processes)
- » GMZs which highlight the connectivity between land, surface water and groundwater.

Physiographic zones

Southland has been divided into nine physiographic zones to help understand how water moves across the landscape and why water quality is better in some places than others. Each physiographic zone represents an area that has similar factors influencing water quality, such as climate, topography, geology and soil type.

Over two-thirds of the Three Rivers Catchment is characterised by the bedrock/hill country overland flow physiographic zone. The next largest zone is oxidising, covering areas around Edendale and Mokoreta. Areas of the gleyed physiographic zone and lignite/marine terraces are also important in this catchment (see map below). These zones differ in the way contaminants are transported and attenuated within the catchment.



Three Rivers Catchment showing physiographic zones

Lignite/marine terraces

Organic-rich sediments like lignite, are found at depth within this zone. The presence of these sediments has a strong influence on reducing the amount of nitrate in groundwater.

Denitrification rates are high, meaning that much of the nitrate leached to groundwater in this zone is converted to nitrogen gas via various reactions involving bacteria.

Riverine

Located along the margins of major rivers, this zone is characterized by shallow, stony soils that drain quickly to underlying shallow aquifers. This zone transports contaminants, particularly nitrogen, to coastal estuaries and lagoons.

Oxidising

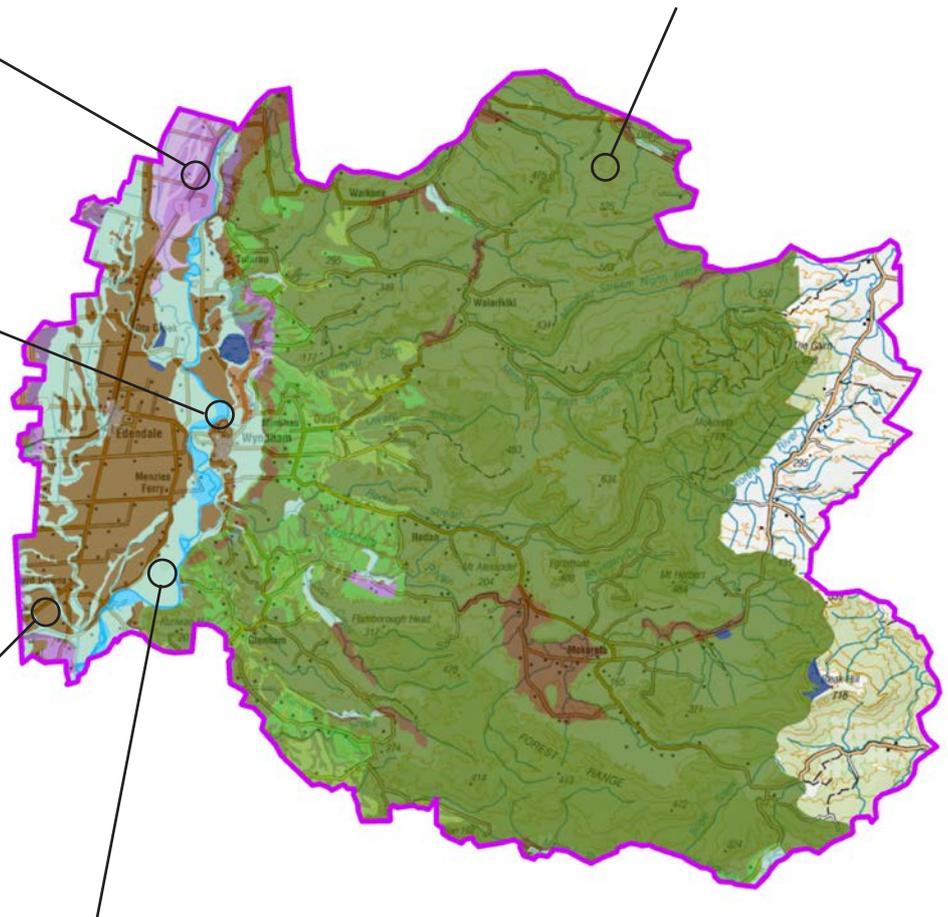
Soils and aquifers in this zone have high risk of nitrogen build-up due to low rates of denitrification*.

The combination of flat land and well drained soils results in high rates of nitrogen leaching (deep drainage) to underlying aquifers.

Bedrock/Hill country – overland flow

This zone is found on rolling to steep land below 800 metres. This zone is characterized by high rainfall and a dense network of branching streams.

Water quickly flows down-slope to nearby streams following high or prolonged rainfall. Nitrogen, phosphorus, sediment and faecal microorganisms are all carried with water, particularly during late autumn and winter.



Gleyed

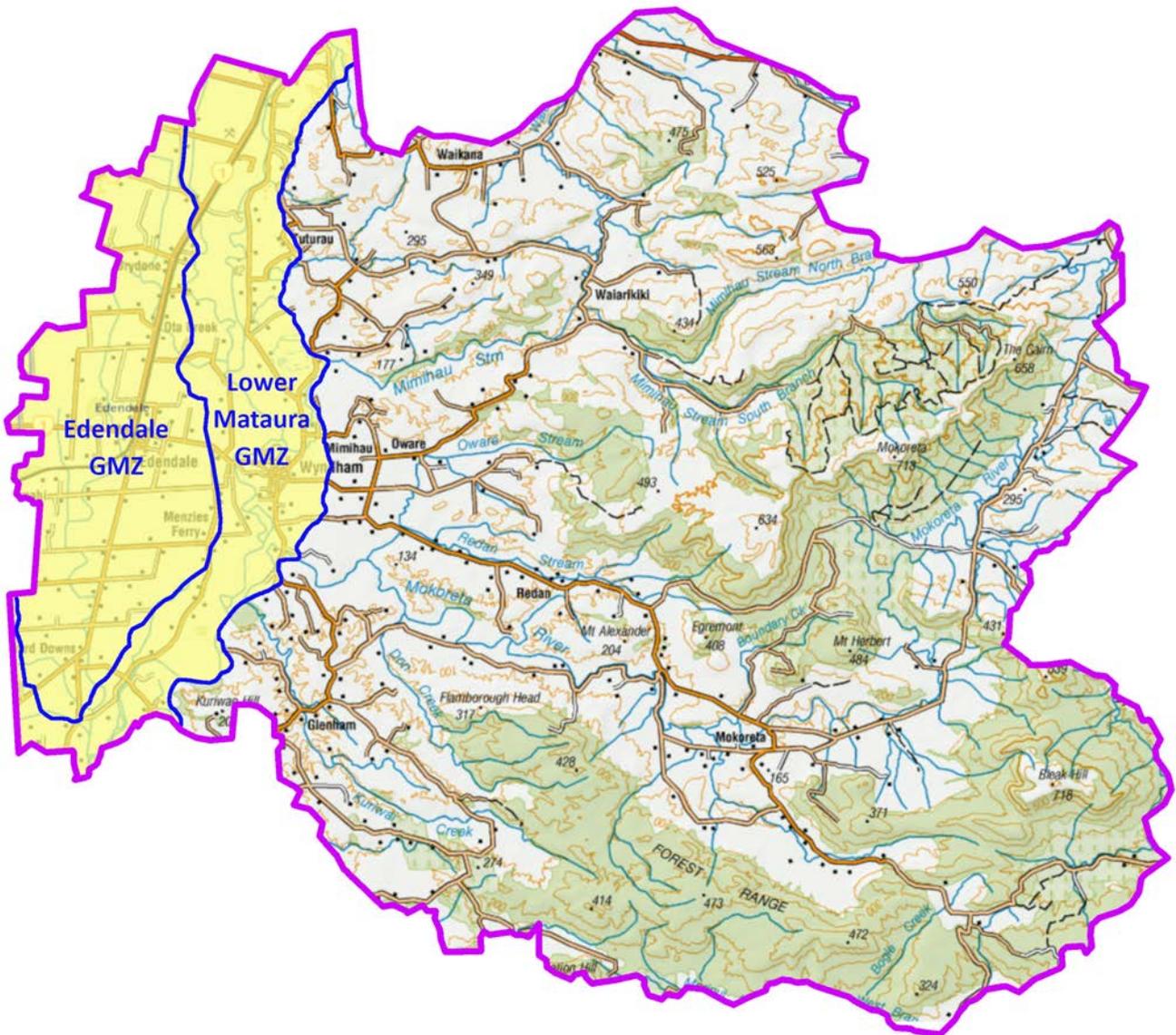
This zone is generally found in areas that were once wetlands. It is characterized by a dense network of streams and a high water table during winter.

Soils are prone to waterlogging and have some denitrification ability, which reduces build-up of soil nitrogen. However, an extensive network of artificial drainage rapidly transports nitrogen, phosphorus, sediment and faecal microbes to surface water, particularly during heavy rain.

*Denitrification occurs when nitrate is converted to nitrogen gas via various reactions involving bacteria. Where denitrification occurs, nitrogen is effectively 'lost' from soil and water as a gas. This is a form of 'attenuation'.

GMZ – Three Rivers

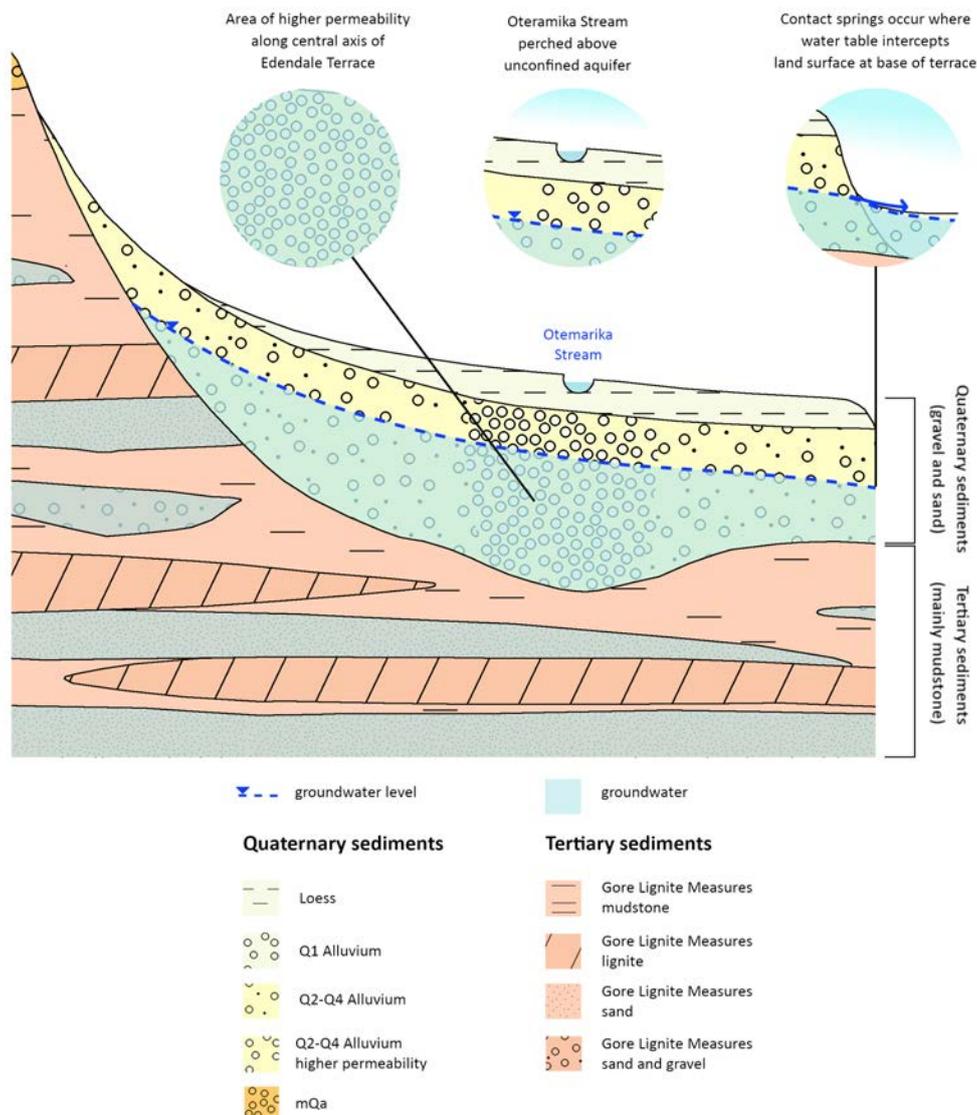
The western side of the Three Rivers Catchment overlies two GMZs - Edendale and Lower Mataura.



Edendale GMZ

The Edendale GMZ covers the entire Edendale Terrace:

- » Depth to groundwater ranges from over 10 metres below ground level north of Edendale, to around five metres at Seaward Downs
- » Streams such as Ota Creek and Oteramika Stream sit above the water table and are not connected to the aquifer below
- » See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source es.govt.nz/environment/water/groundwater/groundwater-management-zones/edendale)
- » Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills, that soaks through the soil. Therefore, there is a high risk of groundwater contamination from leaching
- » Most discharge occurs to spring-fed streams such as Clear Creek and Ives Creek, that originate along the base of the terrace in the Seaward Downs area. Surface waterways such as Ota Creek and Oteramika Stream, also gain baseflow along the base of the Edendale Terrace.



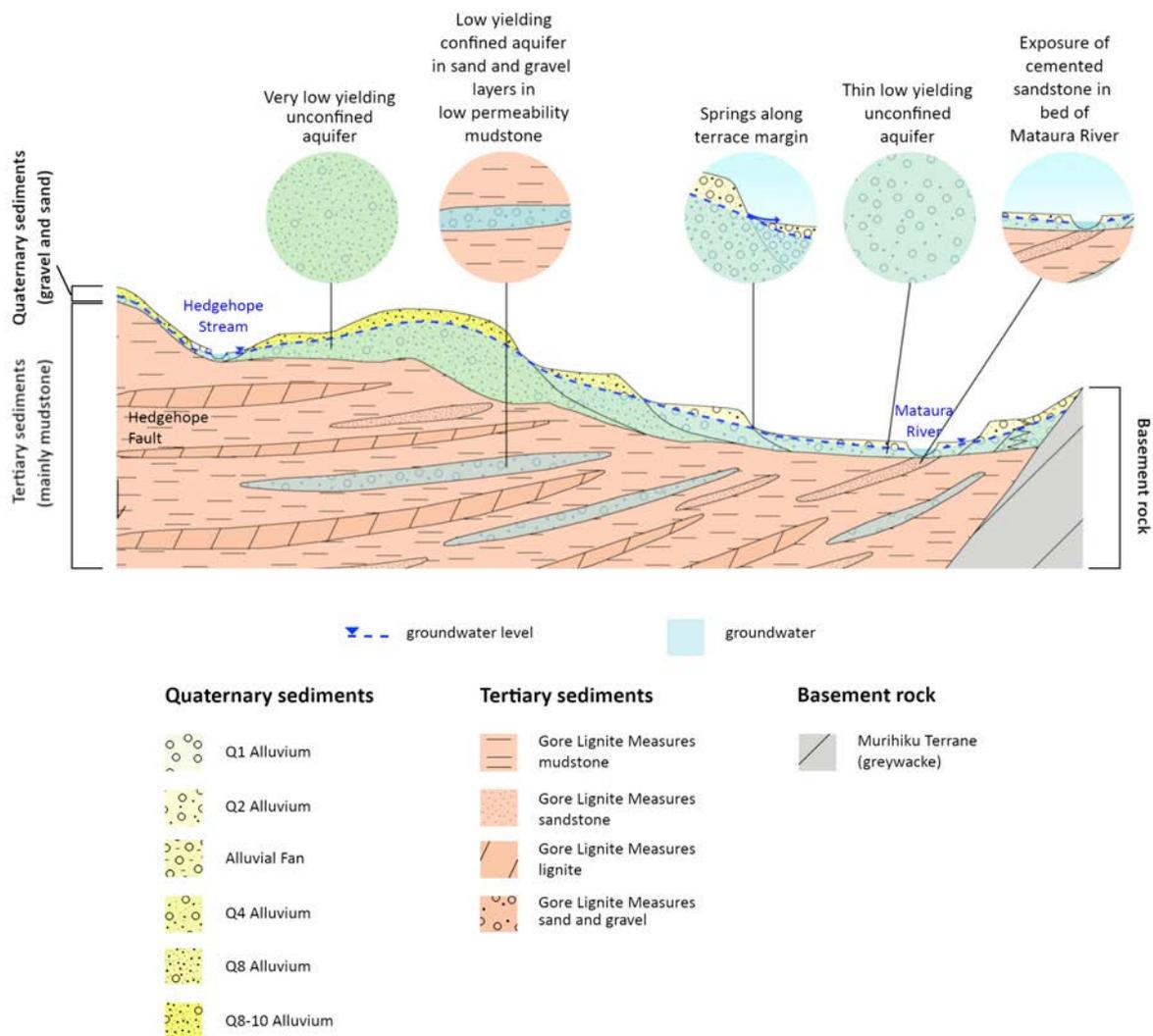
Groundwater quality Edendale GMZ

- » Nitrate = moderate to very high (from leaching)
- » Phosphorus = low
- » *E. coli* = low, but risk can be elevated close to source (e.g. septic tanks, effluent spreading, surface ponding).

Lower Mataura GMZ

The Lower Mataura GMZ covers an area of approximately 35,000 ha in the lower reaches of the Mataura River Catchment downstream from Gore. Soils in this zone are predominantly deep, fine-grained and poorly drained. This increases the potential for runoff in sloping areas, and the use of artificial drainage on flatter-lying areas:

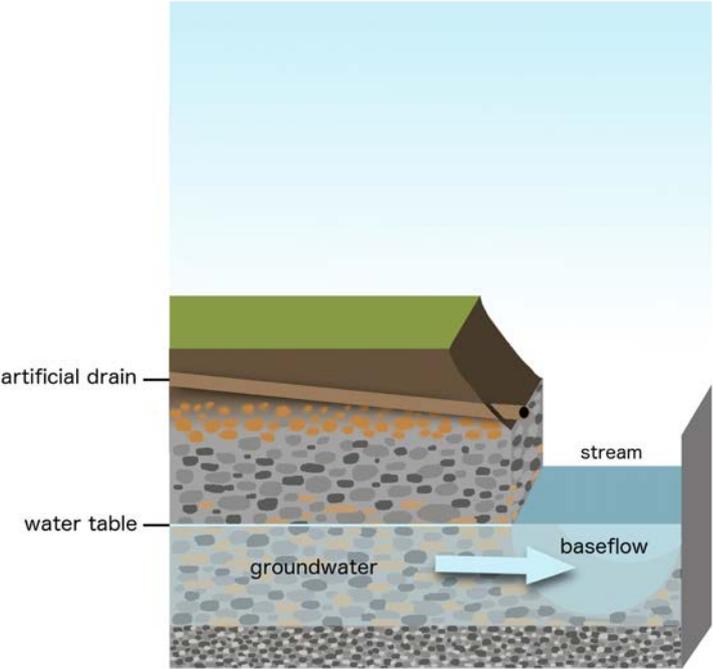
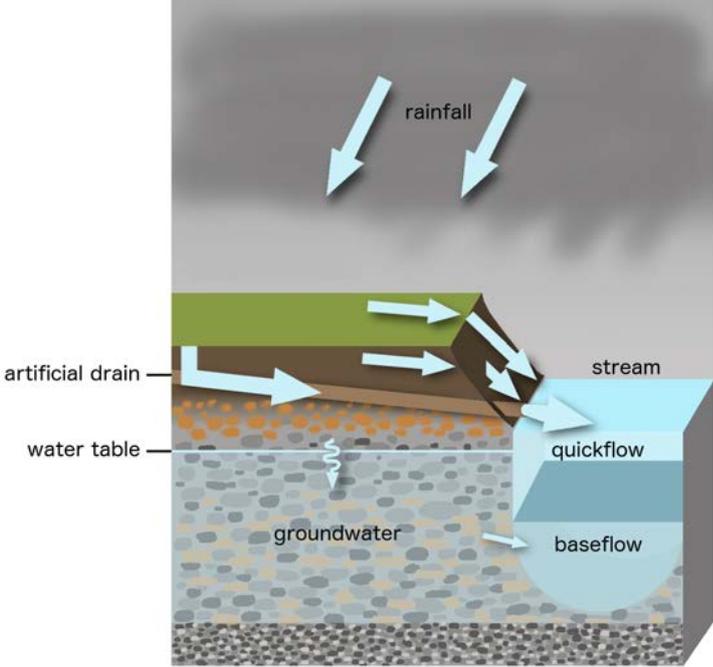
- » Depth to groundwater generally ranges from two-three metres below ground level. On the higher terraces groundwater depth increases to between five and 10 metres below ground level
- » Groundwater level varies seasonally, usually fluctuating by one-two metres, depending on rainfall
- » See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source es.govt.nz/environment/water/groundwater/groundwater-management-zones/lower-mataura)
- » Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills that soaks through the soil therefore, there is a high risk of groundwater contamination from leaching
- » Groundwater discharge occurs to the Mataura River downstream of Mataura township. Groundwater discharge also provides baseflow to the lower reaches of many of the large tributary streams (e.g. Charleton Stream, Titipua Stream).



Groundwater quality Lower Mataura GMZ

- » Nitrate = variable, reflecting the mixed oxidizing and reducing aquifer conditions
- » Phosphorus = low but can be elevated where reducing conditions exist in shallow groundwater
- » *E. coli* = low, but risk can be elevated close to source (e.g. septic tanks, effluent spreading, surface ponding).

The connection between groundwater and the baseflow of streams and rivers is illustrated below (source: Environment Southland).





Find out more

Find out more about physiographic zones

bit.ly/2OI7z7F

Find out more about Southland's groundwater

bit.ly/30Db5g1

Find out more about stream health

Environment Southland

es.govt.nz/environment/water/rivers-and-streams

Land Air Water Aotearoa (LAWA)

lawa.org.nz

Ministry for the Environment

environment.govt.nz/facts-and-science/freshwater

Link to iwi freshwater objectives

bit.ly/2P4HsBV

Get in contact

For more information about your catchment and to contact your local catchment coordinator

021 466 700 | office@thrivingsouthland.co.nz

thrivingsouthland.co.nz/catchment-groups



THRIVING SOUTHLAND

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