

Lower Waiau & Orauea River Catchment Groups

Fresh water health and landscape influences in the Lower Waiau and Orauea River Catchments



**THRIVING
SOUTHLAND**

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

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

Welcome to Lower Waiau and Orauea River Catchments brochure

This Lower Waiau and Orauea River Catchment Groups 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 Lower Waiau and Orauea River Catchments.

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 the 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/environmenttaotearoa-2019-glossary.

We also recommend you check out the catchment group pages on thrivingsouthland.co.nz/waiiau/ and thrivingsouthland.co.nz/orauea-river/ to learn more about the catchments 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 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 Waiau Catchment

Waiau Catchment

The Lower Waiau and Orauea River are part of the Waiau Catchment which lies on the eastern edge of Fiordland. The Waiau River drains Lake Te Anau into Lake Manapouri. The Waiau River then flows down to the sea, through Tuatapere, at Te Waewae Bay. Its major tributary is the Mararoa River.

The flow of the Waiau River has been significantly impacted by the diversion of water through the Manapouri Hydroelectric Power Scheme.

The Waiau River is an important source of mahinga kai, particularly tuna (eels), waterfowl, and kanakana (lamprey).

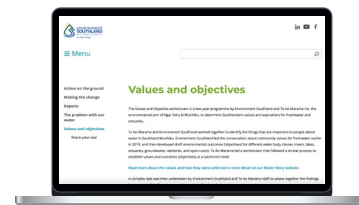
Summary of Lower Waiau and Orauea River Catchments

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.

- » Large areas of these catchments are undeveloped and fall into the alpine physiographic zone. Land below 800 metres above sea level falls into the bedrock/hill country physiographic zone. Flatter areas consist of a mosaic of oxidising, peat wetlands and lignite/marine terraces physiographic zone
- » Central parts of this catchment overlie:
 - » part of Te Anau GMZ, which generally has good water quality
 - » the Blackmount GMZ, which has elevated levels of nitrate where land use is intensive
 - » the Te Waewae GMZ, which generally has moderate nitrate levels where groundwater is oxidising.
- » Overall water quality in these catchments is generally good, although there are areas of high nitrate in groundwater, and surface water areas where E. coli and the MCI indicates poor water quality
- » 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



- » 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

*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.

Lower Waiau and Orauea River water quality

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

Total oxidised nitrogen

| Monitoring site | 5-year median | 5-year trend | 10-year trend | 15-year trend |
|---------------------------------------|---------------|--------------|---------------|---------------|
| Orauea River at Orawia Pukemaori Road | 0.51 mg/L | | | |
| Waiau River at Sunnyside | 0.18 mg/L | | | |
| Waiau River at Tuatapere | 0.27 mg/L | | | |
| Wairaki River at Blackmount Road | 0.13 mg/L | | | |
| Lill Burn at Lill Burn-Monowai Road | 0.059 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 |
|---------------------------------------|---------------|-------|--------------|---------------|---------------|
| Orauea River at Orawia Pukemaori Road | 0.005 mg/L | | | | |
| Waiau River at Sunnyside | 0.005 mg/L | | | | |
| Waiau River at Tuatapere | 0.005 mg/L | | | | |
| Wairaki River at Blackmount Road | 0.005 mg/L | | | | |
| Lill Burn at Lill Burn-Monowai 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 |
|---------------------------------------|---------------|-------|--------------|---------------|---------------|
| Orauea River at Orawia Pukemaori Road | 0.009 mg/L | | | | |
| Waiau River at Sunnyside | 0.002 mg/L | | | | |
| Waiau River at Tuatapere | 0.002 mg/L | | | | |
| Wairaki River at Blackmount Road | 0.002 mg/L | | | | |
| Lill Burn at Lill Burn-Monowai Road | 0.004 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 |
|---------------------------------------|---------------|---|---|---|
| Orauea River at Orawia Pukemaori Road | 0.031 mg/L |  |  |  |
| Waiau River at Sunnyside | 0.004 mg/L |  |  |  |
| Waiau River at Tuatapere | 0.007 mg/L |  |  |  |
| Wairaki River at Blackmount Road | 0.005 mg/L |  |  |  |
| Lill Burn at Lill Burn-Monowai Road | 0.018 mg/L |  |  |  |

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












| KEY (STATE) | | KEY (TREND) | | |
|---|---|---|--|---|
|  |  |  |  |  |
| Very good | Good | Very likely improving | Likely improving | Indeterminate |
|  |  |  |  |  |
| Fair | 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 |
|---------------------------------------|---------------|---|--|---|---|
| Orauea River at Orawia Pukemaori Road | 250 n/100 mL |  |  |  |  |
| Waiau River at Sunnyside | 40n /100 mL |  |  |  |  |
| Waiau River at Tuatapere | 75 n/100 mL |  |  |  |  |
| Wairaki River at Blackmount Road | 60 n/100 mL |  |  |  |  |
| Lill Burn at Lill Burn-Monowai Road | 170 n/100 mL |  |  |  |  |

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

Results from lawa.org.nz (October 2021)

| KEY (STATE) | | | KEY (TREND) | | |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| Very good (infection risk is 1%) | Good (infection risk is 2%) | Fair (infection risk is 3%) | Very likely improving | Likely improving | Indeterminate |
|  |  | |  |  |  |
| Poor (infection risk is >3%) | Very Poor (infection risk is >7%) | | Very Likely degrading | Likely Degrading | Not Assessed |



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 Lower Waiau and Orauea River Catchments are (LAWA October 2021):

MCI

| Monitoring site | 5-year median | State | 10-year trend | 15-year trend |
|---------------------------------------|---------------|-------|---------------|---------------|
| Orauea River at Orawia Pukemaori Road | 93.0 | C | | |
| Waiau River at Sunnyside | 103.0 | C | | |
| Waiau River at Tuatapere | 86.0 | D | | |
| Wairaki River at Blackmount Road | 114.0 | B | | |
| Lill Burn at Lill Burn-Monowai Road | 98.0 | 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).

As the Waiau Lagoon borders part of the Lower Waiau Catchment it is an important factor in understanding the impacts of water quality in the Waiau. Decisions made in the catchments that affect water quality flow downstream and impact on water quality in the lagoon.

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* |
|---|----------|-----------------------|--------------------|------------------|---------------|--------|
| Waiau 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 |

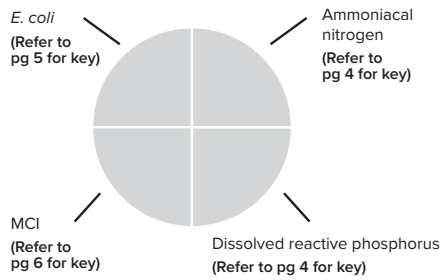
KEY Very Good Good Fair Poor

* 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.



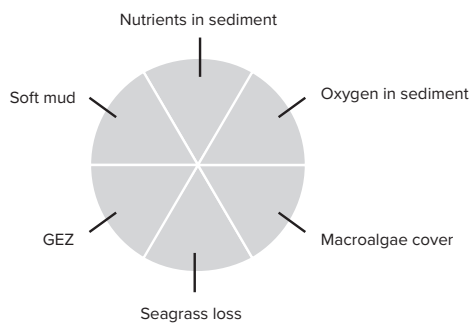
Waiau Catchment with estuaries and surface water quality monitoring sites*

Water quality state and MCI

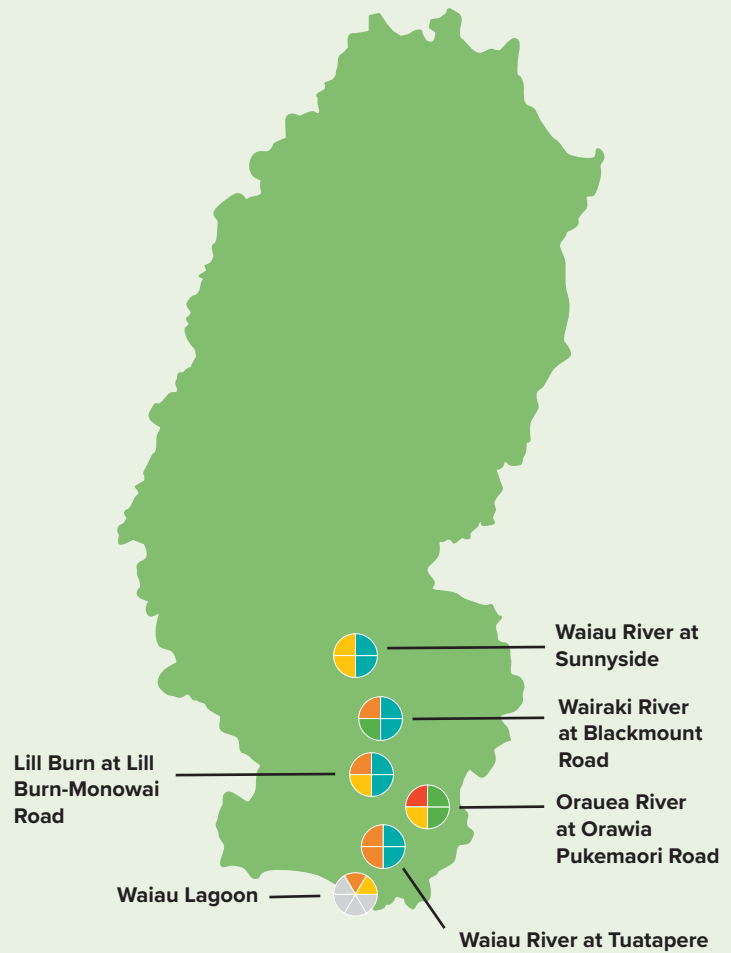


Estuary risk indicators

(Refer to pg 7 for key)



*sites in Lower Waiau and Orauea River Catchments 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.

Extensive areas of these catchments fall into the alpine and bedrock/hill country physiographic zones. Lower lying areas are mainly classified as oxidising, peat wetlands or riverine (see map below). These zones differ in the way contaminants are transported and attenuated within the catchments.



Lower Waiau and Orauea River Catchments showing physiographic zones

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.

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.

Alpine

This zone occupies land above 800 metres elevation. It is steeply sloping, with high rainfall and snow. There is limited loss of nutrients and faecal microbial contamination from this zone due to low land use intensity.

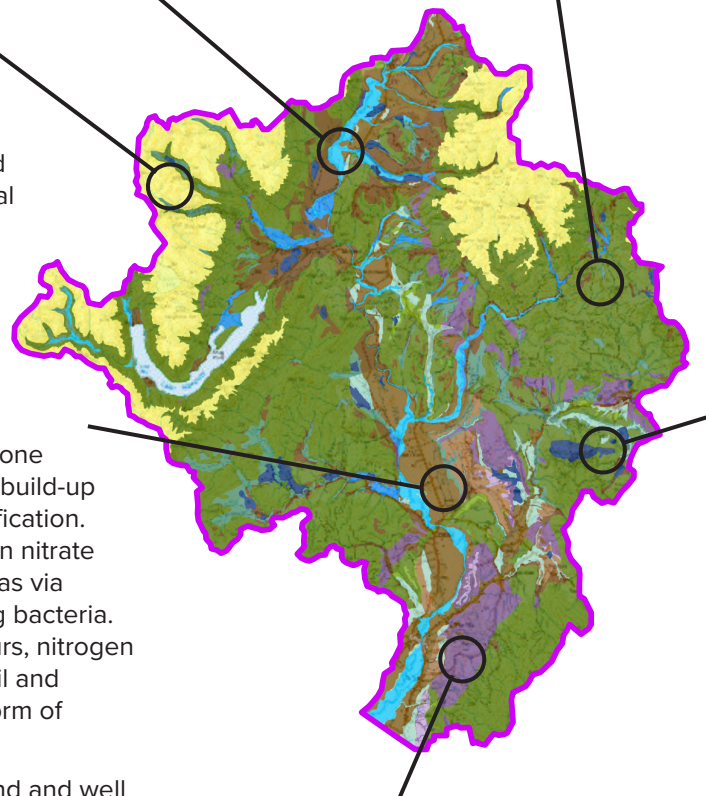
Oxidising

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

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

Peat wetlands

This zone features poorly drained, peaty soils that are extremely acidic. The water table in these areas is high. Developed areas require extensive artificial drainage. Soluble phosphorus concentrations are high in acidic, oxygen depleted ground- and surface waters; conversely nitrate concentrations are low.



Lignite/marine terraces – overland flow

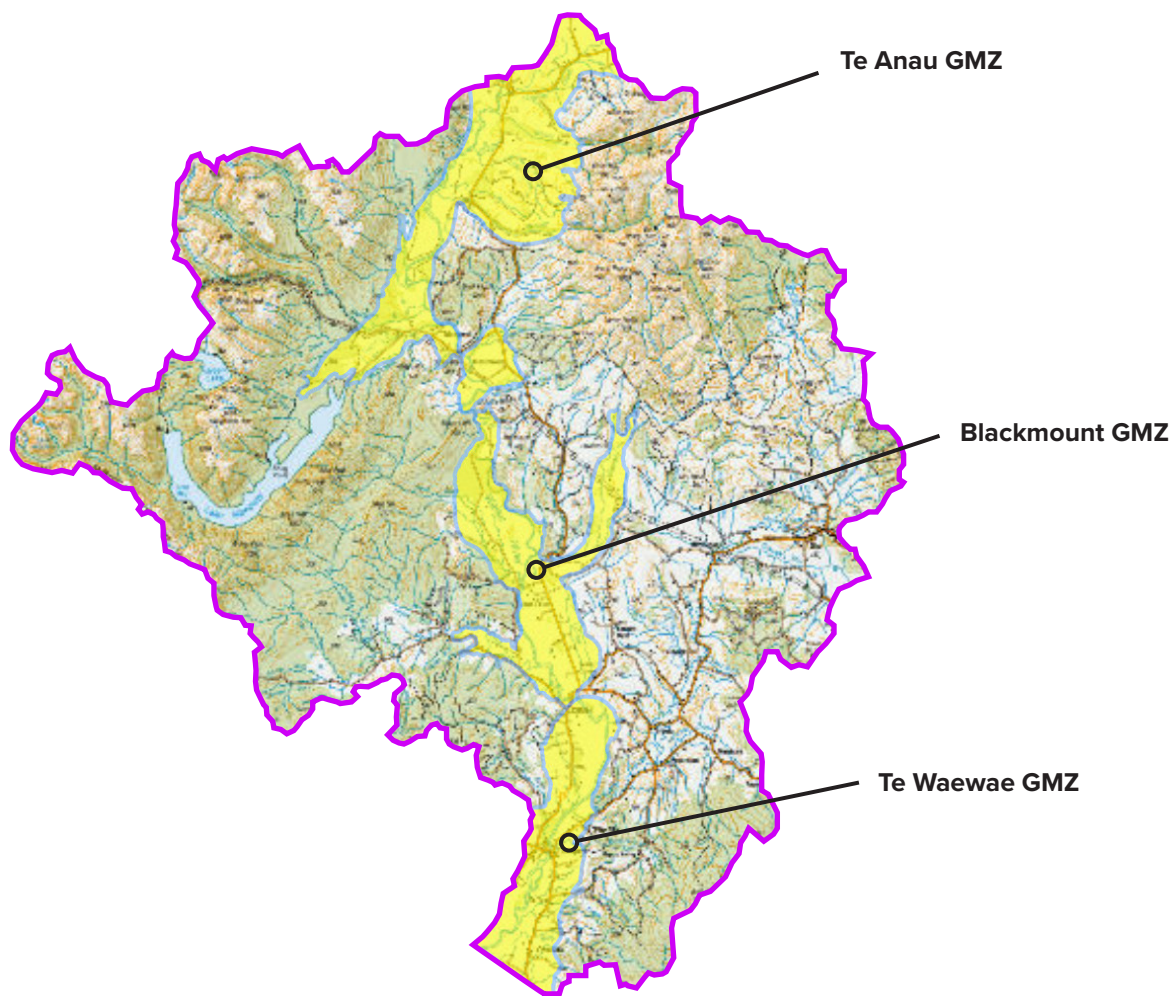
Located on gently undulating to rolling land that have a high potential for overland flow.

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.

GMZ – Lower Waiau and Orauea River

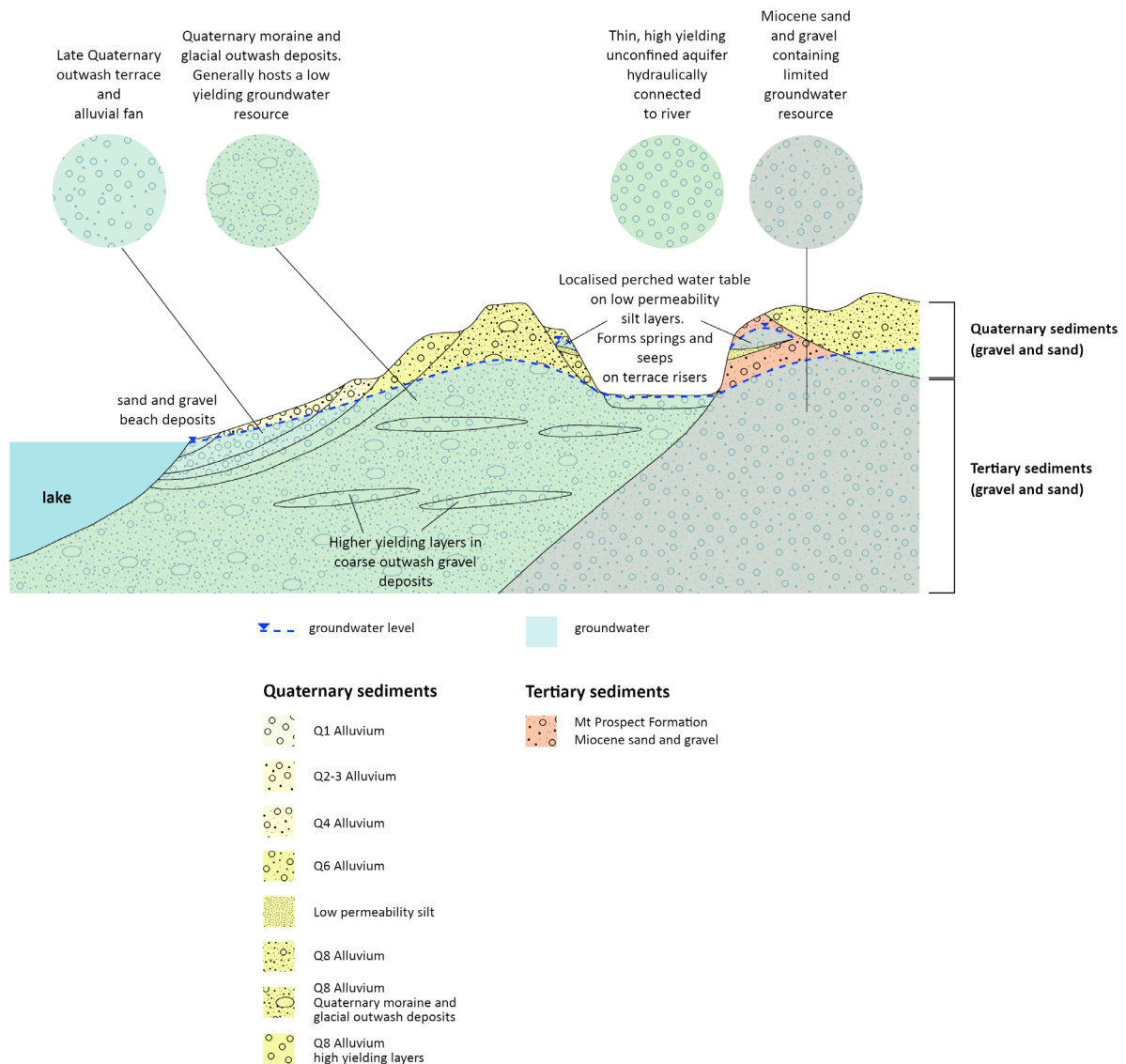
Parts of the Lower Waiau Catchment area overlie the southern part of the Te Anau GMZ, and the entire Blackmount and Te Waewae GMZs (see map below). The Orauea River Catchment does not overlie any GMZ.



Te Anau GMZ

The Te Anau GMZ covers an area of approximately 79,000 ha. It encompasses Te Anau Basin and the Waiau River valley upstream of Sunnyside:

- » The soils in this zone are often shallow and well drained, allowing water to easily flow through them to underlying groundwater
- » Depth to groundwater ranges from two-four metres below ground level under the lower terraces, up to 40 metres below ground level on the higher ridges
- » Seasonal variation in groundwater levels is generally between one-two metres
- » See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source es.govt.nz/environment/water/groundwater/groundwater-management-zones/te-anau)
- » Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills, which soaks through the soil. Some recharge is sourced from riverine recharge in riparian aquifers along the margins of the major rivers.



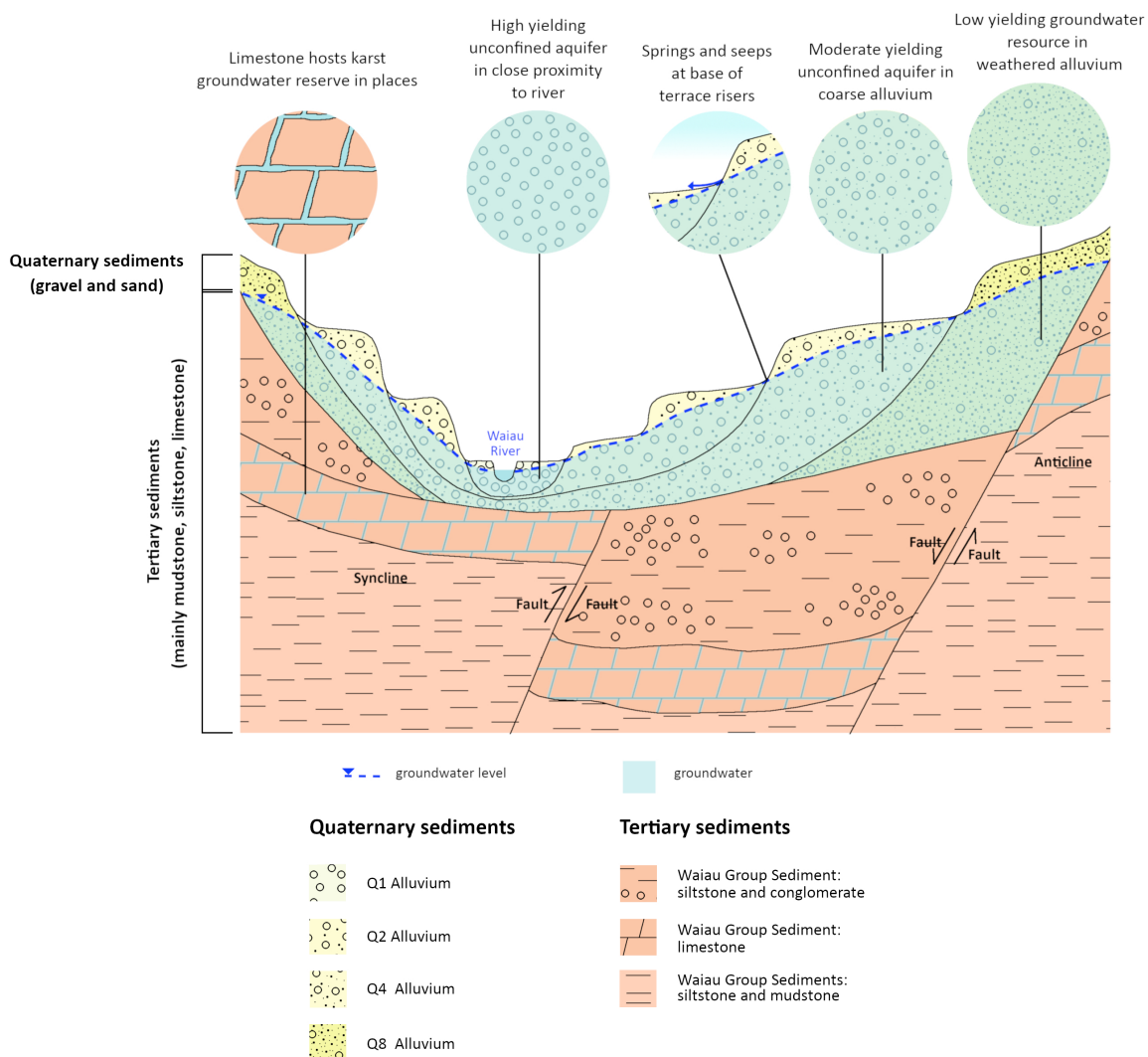
Groundwater quality Te Anau GMZ

- » Nitrate = generally low
- » Phosphorus = low
- » *E. coli* = low, but risk may be elevated where soils are well-drained and the water table is shallow.

Blackmount GMZ

The Blackmount GMZ covers approximately 14,000 ha and encompasses a series of terraces that flank the middle reaches of the Waiau River, the Wairaki River and lower Lill Burn:

- » Soils on the intermediate to lower terraces are generally well-drained, enabling water to readily drain from the land surface into underlying aquifers. Imperfectly to poorly drained soils occur on higher terraces where surface run-off may increase
- » Depth to groundwater is less than two metres below ground level on lower terraces and five and 10 metres below ground level on higher terraces
- » Seasonal groundwater variation is generally two-three metres, but less close to main rivers
- » See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source es.govt.nz/environment/water/groundwater/groundwater-management-zones/blackmount)
- » Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills, which soaks through the soil. Some recharge is sourced from riverine recharge in riparian aquifers along the margins of the major rivers. Groundwater discharge mostly occurs as baseflow to the Waiau River.



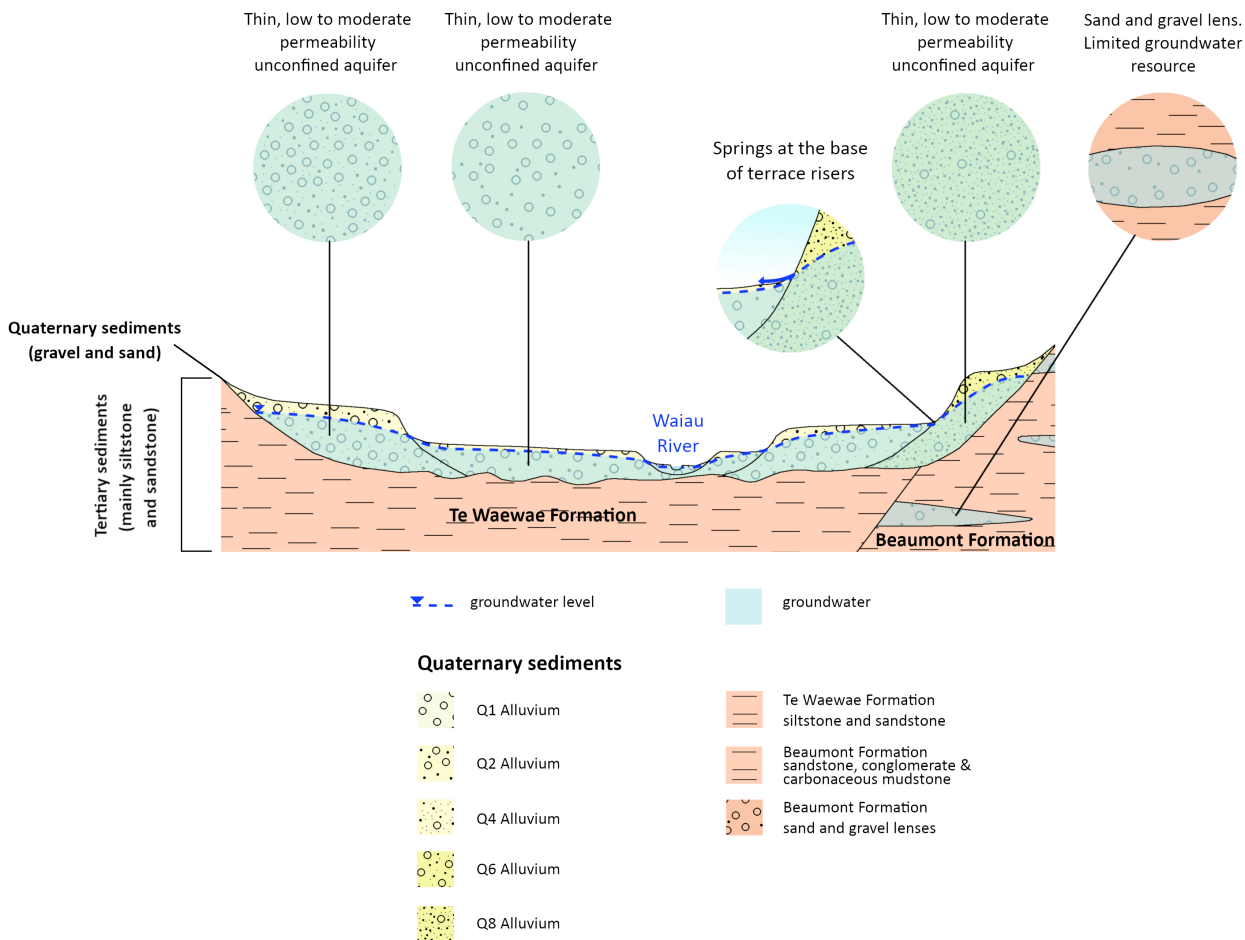
Groundwater quality Blackmount GMZ

- » Nitrate = elevated in areas of intensive land use
- » Phosphorus = low
- » *E. coli* = low, but risk may be elevated close to source in coarse-grained aquifers.

Te Waewae GMZ

The Te Waewae GMZ covers an area of approximately 12,000 ha in the lower reaches of the Waiau River Catchment downstream of Clifden:

- » Soil types in this zone range from shallow, stony well-drained soils along the margins of the Waiau River to moderately well to imperfectly drained soils on higher terraces along the valley margins
- » Groundwater and surface streams and rivers are closely linked in this zone, feeding into each other. Groundwater levels are typically shallow in low lying area, being less than two metres below ground level. Groundwater levels increase up to about 10 metres below ground level along the higher terraces along valley margins
- » Seasonal groundwater levels can vary up to two-three metres
- » See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source es.govt.nz/environment/water/groundwater/groundwater-management-zones/te-waewae/)
- » Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills, which soaks through the soil. Discharge predominantly occurs to springs, spring-fed streams (such as Kowhai Creek) and wetlands.



Groundwater quality Te Waewae GMZ

- » Nitrate = moderate
- » Phosphorus = low
- » *E. coli* = low, but risk may be elevated close to source, particularly on well drained soils where the water table is shallow.



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



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