Hedgehope Makarewa Catchment Group

Fresh water health and landscape influences in Hedgehope Makarewa Catchment

THRIVING SOUTHLAND
Tōnui ana te whenua. Tōnui ana te takata.
A thriving, prosperous land. A thriving, prosperous people.

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

Welcome to Hedgehope Makarewa Catchment brochure

This Hedgehope Makarewa 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 Hedgehope Makarewa Catchment.

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/environmentaotearoa-2019-glossary***.

We also recommend you check out the Catchment Group page on ***thrivingsouthland.co.nz/hedgehope-makarewa/*** to learn more about the catchment and what projects the Catchment Group has 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 Oreti Catchment

Oreti Catchment

Hedeghope Makarewa is part of the Oreti Catchment which outflows into the New River Estuary. The Oreti River and the New River Estuary are an important source of mahinga kai, particularly waterfowl, eels and inanga (whitebait).

Currently the New River Estuary is considered to be in poor condition as a result of rural, urban, industrial and historic practices.

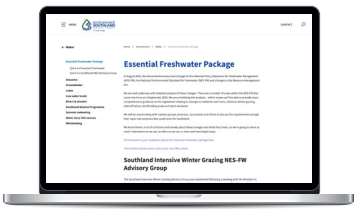
Summary of Hedgehope Makarewa Catchment

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 covers a mosaic of five different physiographic zones that differ greatly in nitrate levels from land use
- Most of this catchment overlies the Makarewa GMZ, which has generally low nitrate levels, but high phosphorus levels where reducing conditions exist in shallow groundwater.
- The outer areas of this catchment overlie:
  - Edendale GMZ, moderate to very high nitrate levels.
  - Waihopai GMZ, moderate to high nitrate levels.
  - Lower Oreti GMZ, variable nitrate levels, but some areas where it is very high.
- Water quality in this catchment is variable, with some areas showing signs of stress. In places it is degraded in terms of nitrogen (particularly groundwater), *E. coli* (faecal bacteria) (surface water), and the MCI.
- Neighbouring farms in 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
- More about Environment Southland's response to the Government's Essential Freshwater Package is here ***es.govt.nz/environment/water/essential-freshwater-package***



Environment Southland, in partnership with Te Ao Mārama Inc*, has indicated that a proposed limits and targets' plan change (LTPC) will be notified in 2023. This will establish nutrient limits and targets to improve the quality of groundwater and surface water. ***waterandland.es.govt.nz/about/values-and-objectives***

- Environment Southland and Te Ao Mārama Inc have established a community-based regional forum to consider and advise on limits, targets and methods
- 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.

Hedgehope Makarewa 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
Dunsdale Stream at Dunsdale Reserve	0.1925 mg/L			
Makarewa River at Wallacetown	1.08 mg/L			
Waikiwi Stream at North Road	2.8 mg/L			
Hedgehope Stream 20m u/s Makarewa Confluence	0.61 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

* 2014-2018 LAWA median per NPS-FM 2020 using TON as surrogate for NO^3-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
Dunsdale Stream at Dunsdale Reserve	0.005 mg/L	A			
Makarewa River at Wallacetown	0.046 mg/L	B			
Waikiwi Stream at North Road	0.02 mg/L	B			
Hedgehope Stream 20m u/s Makarewa Confluence	0.019 mg/L	B			

* 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
Dunsdale Stream at Dunsdale Reserve	0.01 mg/L	B			
Makarewa River at Wallacetown	0.015 mg/L	C			
Waikiwi Stream at North Road	0.008 mg/L	B			
Hedgehope Stream 20m u/s Makarewa Confluence	0.01 mg/L	B			

* 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
Dunsdale Stream at Dunsdale Reserve	0.02 mg/L			
Makarewa River at Wallacetown	0.046 mg/L			
Waikiwi Stream at North Road	0.033 mg/L			
Hedgehope Stream 20m u/s Makarewa Confluence	0.039 mg/L			

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

KEY (STATE)

A **Very good**

B **Good**

C **Fair**

D **Poor**

KEY (TREND)

 **Very likely improving**

 **Likely improving**

 **Indeterminate**

 **Very Likely degrading**

 **Likely Degrading**

 **Not Assessed**

E. coli

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Dunsdale Stream at Dunsdale Reserve	120 n/100ml	B			
Makarewa River at Wallacetown	360 n/100ml	E			
Waikiwi Stream at North Road	445 n/100ml	E			
Hedgehope Stream 20m u/s Makarewa Confluence	485 n/100ml	E			

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

Results from lawa.org.nz (October 2021)

KEY (STATE)

A **Very good** (infection risk is 1%)

B **Good** (infection risk is 2%)

C **Fair** (infection risk is 3%)

D **Poor** (infection risk is >3%)

E **Very Poor** (infection risk is >7%)

KEY (TREND)

 **Very likely improving**

 **Likely improving**

 **Indeterminate**

 **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).

Results for this catchment are below (LAWA October 2021).

MCI

Monitoring site	5-year median	State	10-year trend	15-year trend
Dunsdale Stream at Dunsdale Reserve	120.0	B		
Makarewa River at Wallacetown	83.0	D		
Waikiwi Stream at North Road	75.0	D		
Hedgehope Stream 20m u/s Makarewa Confluence	89.0	D		

KEY (STATE)

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

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

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

National bottom line: MCI score 90

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 New River Estuary is not in the Hedgehope Makarewa Catchment, it is an important factor in understanding the impacts of water quality in Hedgehope Makarewa. Decisions made in Hedgehope Makarewa that affect water quality upstream, flow downstream and impact on water quality in the estuary.

The New River Estuary has been significantly affected by urban and rural development over the past 150 years. This includes large areas of reclaimed land, urban discharges including treated sewage and untreated stormwater, past landfill leaching, and agricultural activities and run-off further up the catchment.

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.

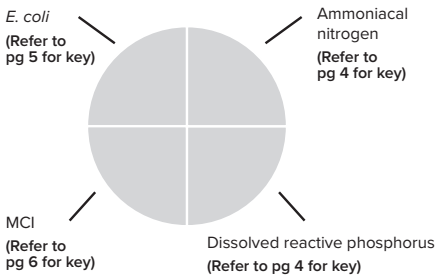
Estuary	Soft mud	Nutrients in sediment	Oxygen in sediment	Macroalgae cover	Seagrass loss	GEZ*
Waiau Lagoon/Te Wae		Poor	Fair			
Lake Brunton			Good			
Waituna Lagoon/Waiparera (not assessed)						
New River Estuary	Poor	Poor	Poor	Fair	Poor	Poor
Jacobs River Estuary	Poor	Fair	Poor	Poor	Poor	Poor
Waikawa Estuary	Poor	Fair	Poor	Good	Poor	Good
Haldane Estuary	Fair	Good	Very Good	Very Good		Very Good
Freshwater Estuary	Very Good	Good	Very Good	Good	Fair	Very Good
Waimatuku Estuary		Fair	Fair			
Toetoes Estuary	Fair	Good	Poor	Fair	Poor	Good

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.

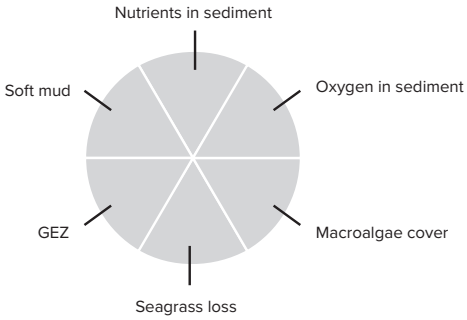
Oreti Catchment with Estuaries and Surface water quality monitoring sites*

Water quality state and MCI

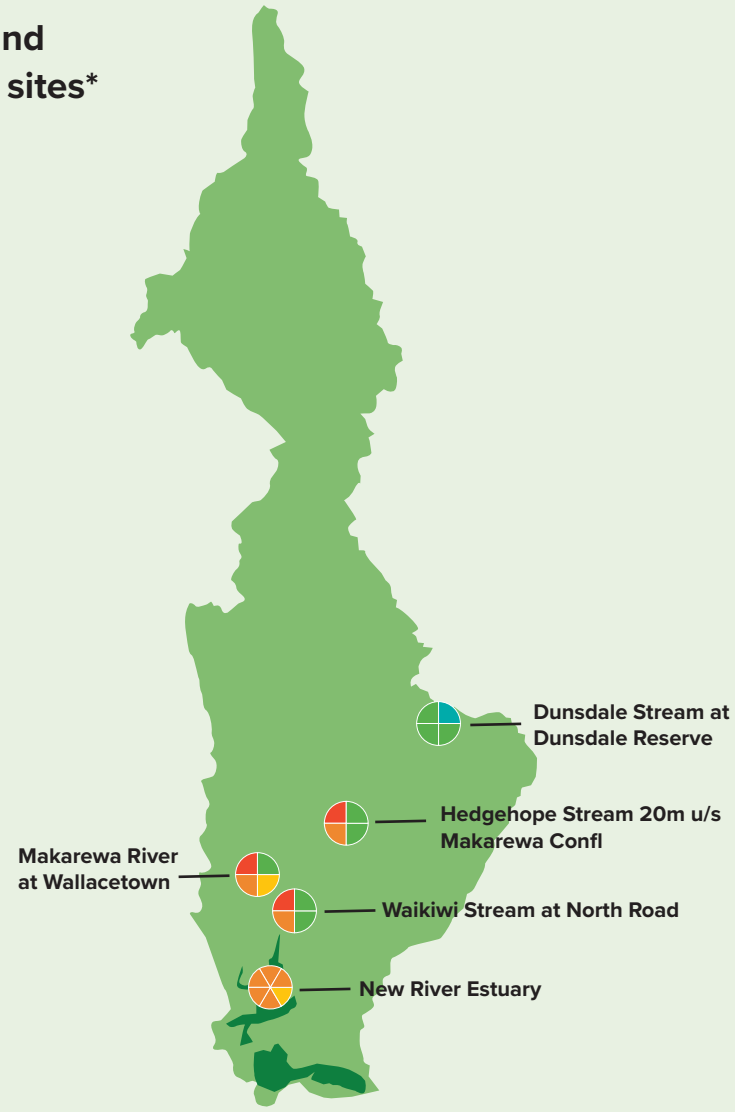


Estuary risk indicators

(Refer to pg 7 for key)



*sites in Hedeghope Makarewa 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.

The Hedgehope Makarewa Catchment area falls into a mosaic of physiographic zones that vary greatly in their influences on water quality. Extensive areas of this catchment fall into the bedrock/hill country and lignite/marine physiographic zones. Lower lying areas are mainly classified as oxidising, gleyed, or peat wetlands (see map below). These zones differ in the way contaminants are transported and attenuated within the catchment.

Hedgehope Makarewa Catchment showing physiographic zones

Lignite/marine terraces – artificial drainage

Located on gently undulating land that has slow subsoil permeability and may be seasonally wet.

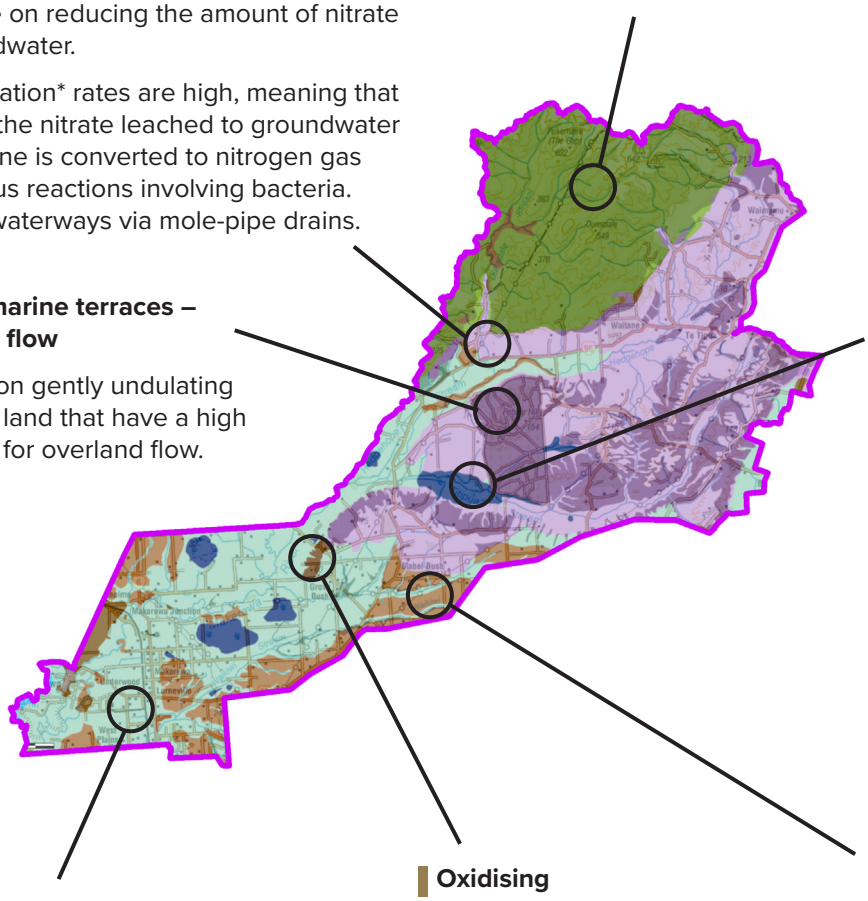
Organic-rich sediments like lignite, are found at depth within this zone. The presence of these sediments has a strong influence on reducing the amount of nitrate in groundwater.

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. surface waterways via mole-pipe drains.

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.



Lignite/marine terraces – overland flow

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

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.

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.

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.

Oxidising – overland flow

The overland flow variant is found on steeper areas where water preferentially flows over the land surface.

*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.

Map Source Environment Southland *maps.es.govt.nz/index.aspx?app=water-and-land*

GMZ – Hedgehope Makarewa

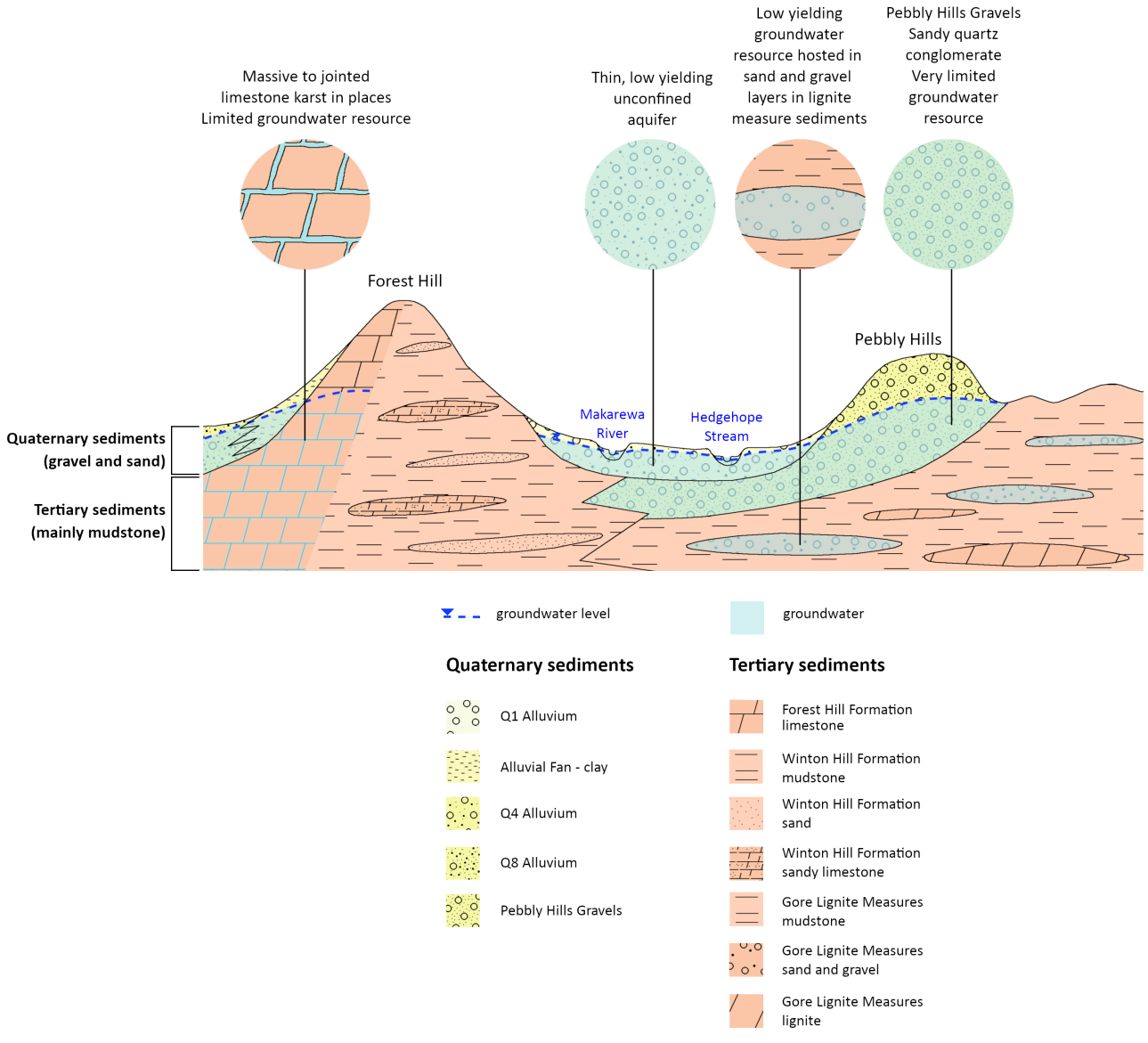
The majority of this catchment overlies the Makarewa GMZ. The outer parts of this area overlie edges of the Edendale, Waihopai and Lower Oreti GMZs (see map below). These zones differ in their geology and contaminant levels.

Map Source Environment Southland *maps.es.govt.nz/index.aspx?app=water-and-land*

Makarewa GMZ

The Makarewa GMZ covers an area of approximately 66,000 ha in the Makarewa River Catchment:

- Depth to groundwater is close to the ground surface near streams and rivers, increasing to up to 10 metres on higher ridges.
- Groundwater level varies seasonally, with levels highest in winter and lowest in early autumn. Groundwater levels usually fluctuate by one-two metres.
- A diagrammatic cross-section of this GMZ showing areas of groundwater is provided below (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/makarewa***).
- Groundwater recharge in this zone is derived from local rainfall that soaks through the soil. Discharge mostly occurs as baseflow to a network of small streams. Extensive areas of artificial drainage also divert water from the land surface to waterways.



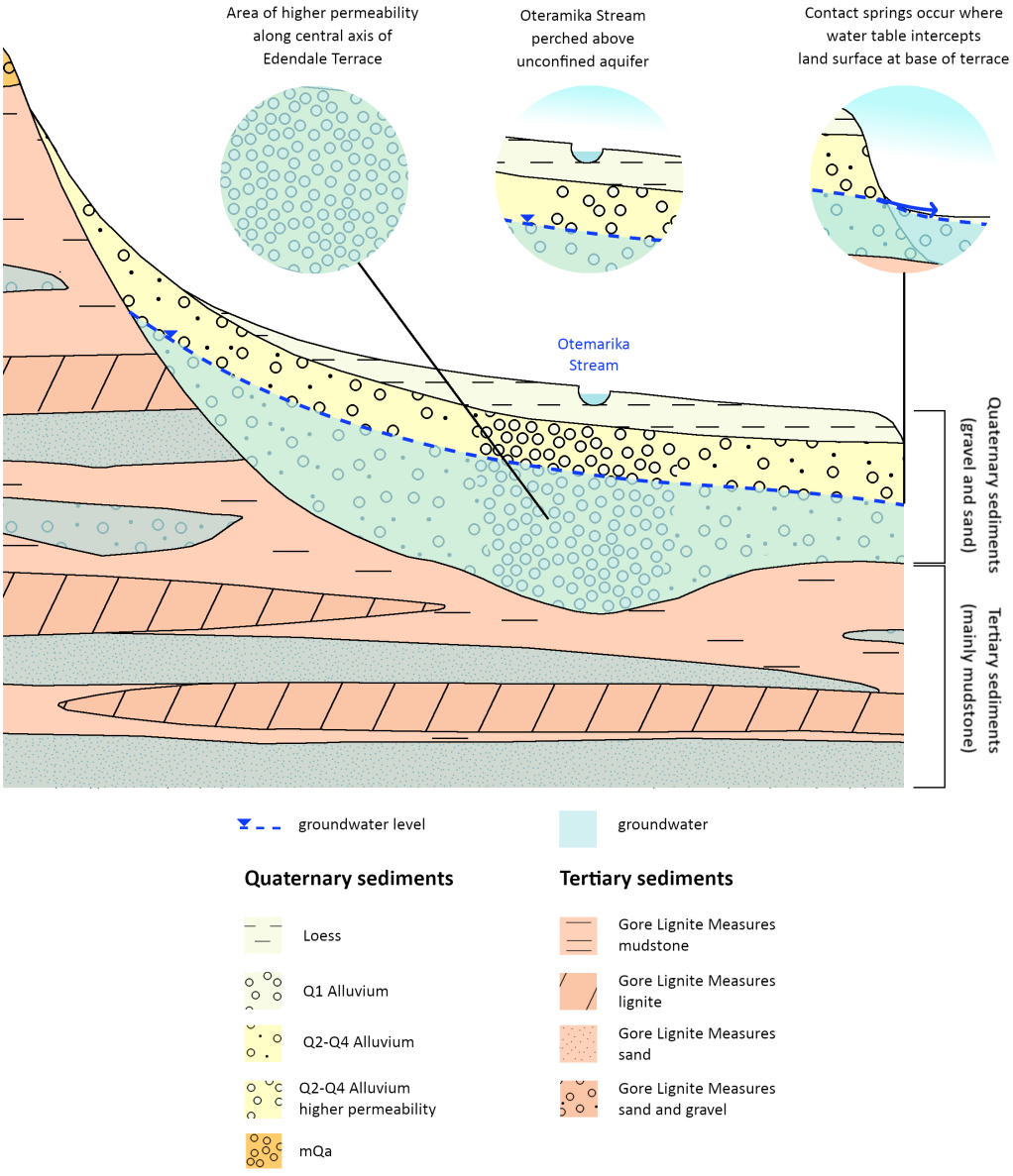
Groundwater quality Makarewa GMZ

- Nitrate = generally low, but can be elevated due to intensive land use where groundwater is more oxic (has more oxygen)
- Phosphorus = low, but can be elevated where reducing conditions exist in shallow groundwater
- *E. coli* = low, but risk may be elevated close to source.

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.
- A diagrammatic cross-section of this GMZ showing areas of groundwater is provided below (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, which 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.



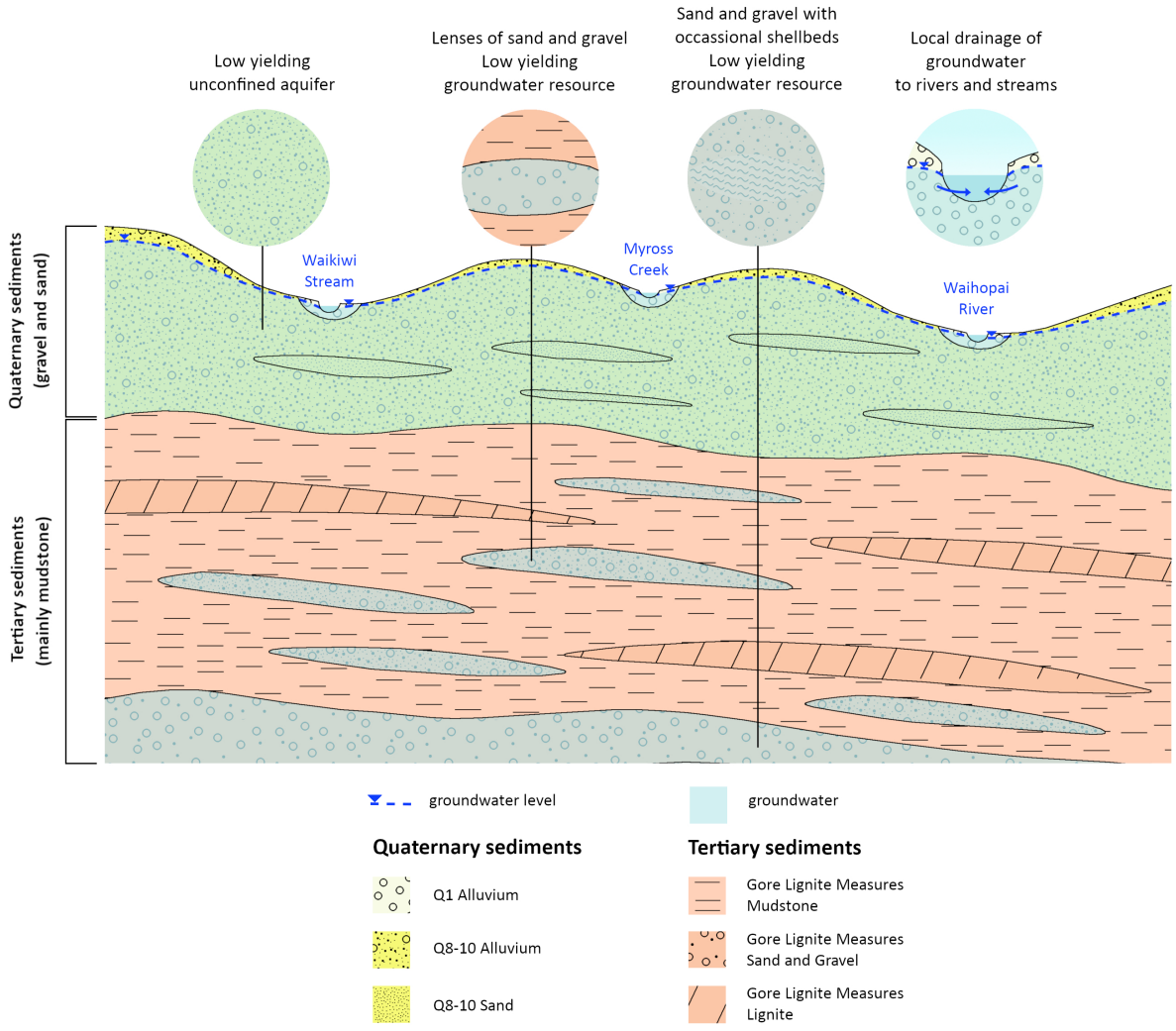
Groundwater quality Edendale GMZ

- 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).

Waihopai GMZ

The Waihopai GMZ covers an area of approximately 42,000 ha, encompassing the Waihopai River and Waikiwi Stream catchments on the Southland Plains:

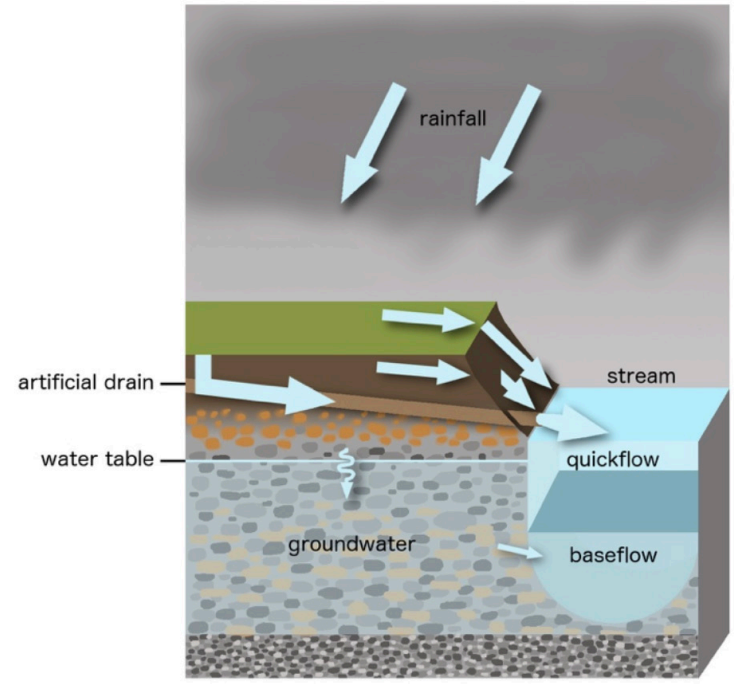
- This zone has a large unconfined aquifer situated in a thick layer of gravel and sand that is between 20 to 40 metres deep.
- The water table generally sits at about two-three metres below the ground surface near streams and the Waihopai River and is up to about 10 metres deep on higher land. There are also areas of groundwater in the deeper mudstone deposits, however these are disconnected from the unconfined aquifer sitting above.
- A diagrammatic cross-section of this GMZ showing areas of groundwater is provided below (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/waihopai***).
- Groundwater and surface water in this zone are highly connected and water flows freely between them, especially when the water table is high. Groundwater levels generally vary between two-three metres, depending on seasonal rainfall patterns and dry spells.

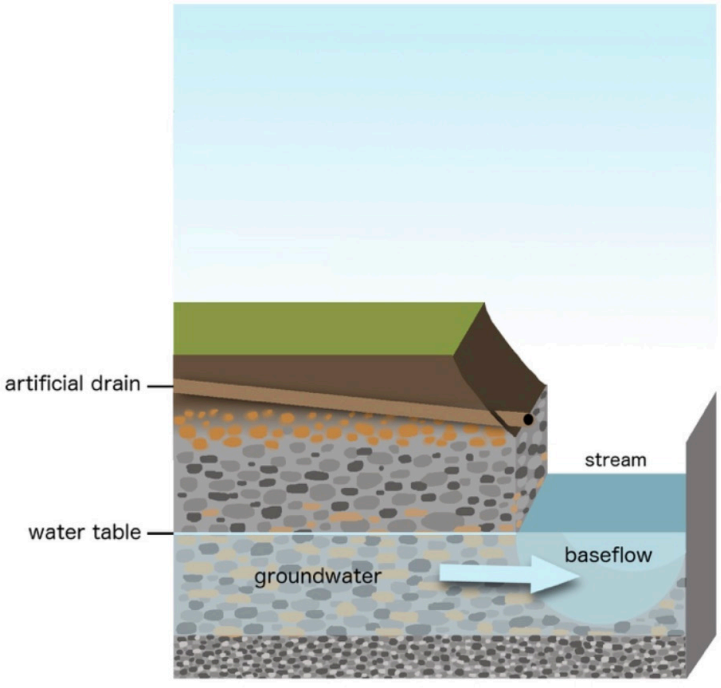


Groundwater quality Waihopai GMZ

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

» Groundwater recharge in this zone is derived from local rainfall that soaks through the soil, therefore, there is a high risk of groundwater contamination from leaching. Groundwater provides baseflow to surface streams and rivers, and artificial drainage networks in lower-lying areas (see diagram below, source Environment Southland). If nitrate is high in the groundwater, this can flow into connected streams increasing stream nitrate levels. The reverse can also occur. The connection between groundwater and the baseflow of streams and rivers is illustrated below (source Environment Southland).

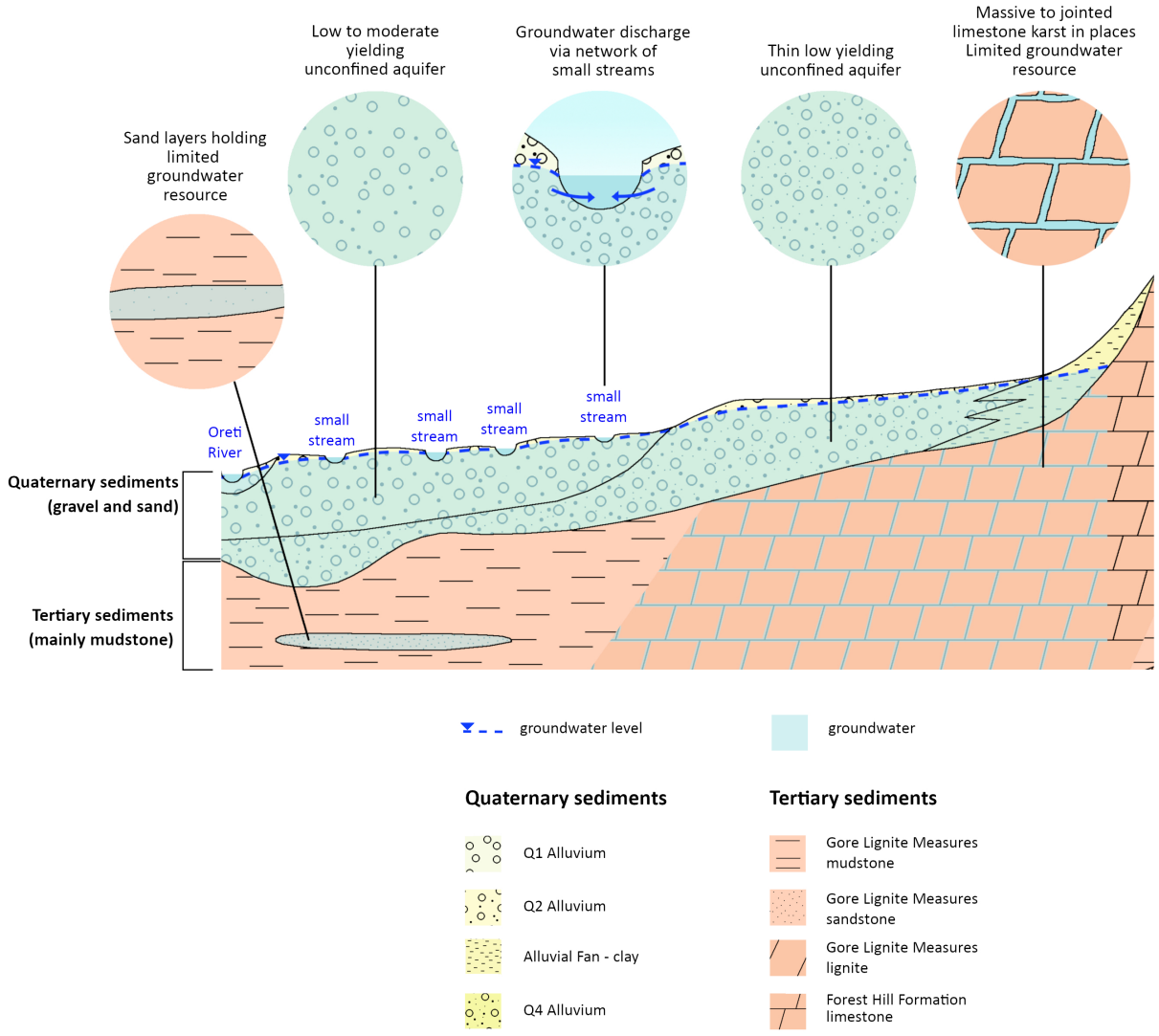




Lower Oreti GMZ

The Lower Oreti GMZ covers an area of approximately 22,500 ha in the lower reaches of the Oreti River catchment, downstream of the Hokonui Hills:

- Depth to groundwater ranges from 1 to 4 metres, becoming shallower closer to the Oreti River.
- Groundwater levels vary seasonally, being highest in winter and lowest in early autumn.
- A diagrammatic cross-section of this Groundwater Management Zone showing areas of groundwater is provided below (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/lower-oreti)***
- Groundwater recharge in this zone is derived from local rainfall that soaks through the soil, therefore, there is a high risk of groundwater contamination from leaching. Groundwater discharge occurs to the Oreti River north of Lochiel and many small streams that crisscross the terrace. Some discharge is also likely to occur to New River Estuary.



Groundwater quality Lower Oreti GMZ

- Nitrate = variable, with high levels in some areas
- Phosphorus = low
- *E. coli* = low, but risk can be elevated close to source in coarse-grained aquifers.

Notes

Notes

Find out more

Find out more about physiographic zones
bit.ly/2Ol7z7F

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

Tōnui ana te whenua. Tōnui ana te takata.
A thriving, prosperous land. A thriving, prosperous people.