



For **now** &  
**our future**

# The Southland Environment

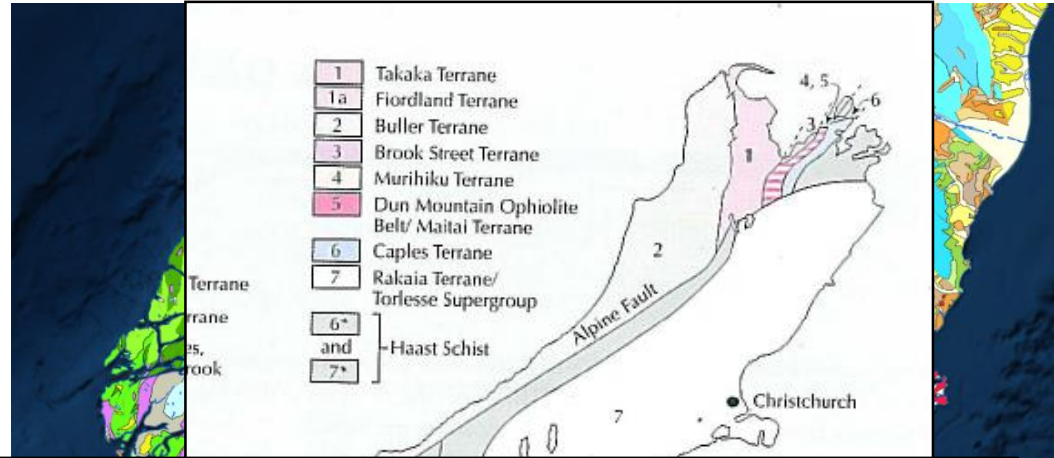
9<sup>th</sup> May 2019

# Outline

- Southland catchments
- Water body types
- Maitaura catchment

# Southland Geology

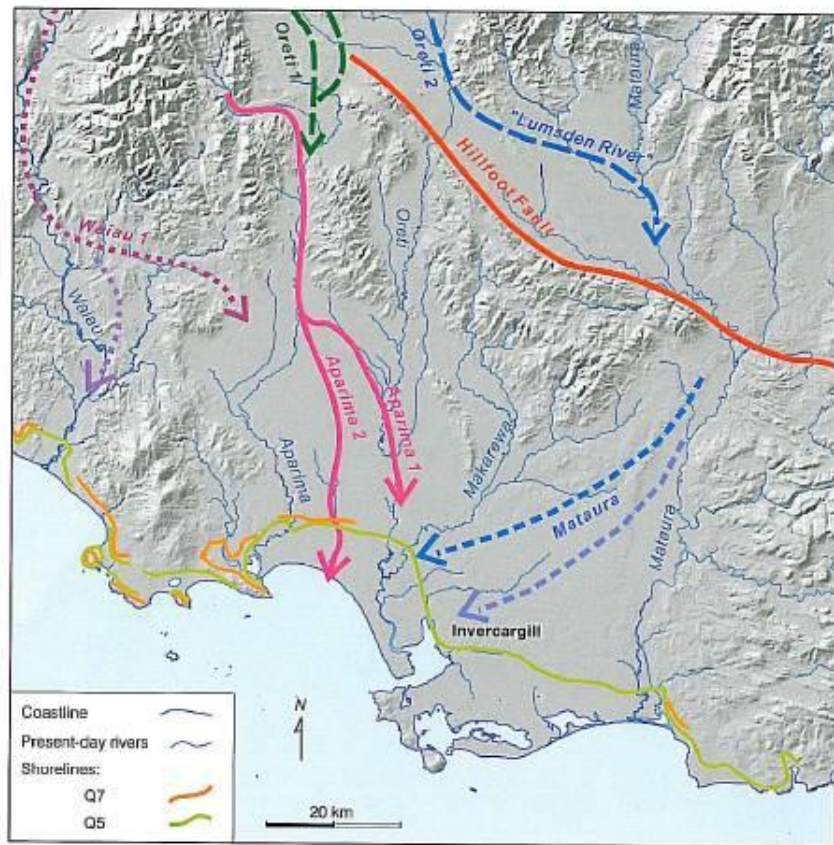
- Basement geology laid down under the sea ~300-145 mya
- Straddles two plates (Alpine Fault)
- Southland Syncline





# Historic river patterns

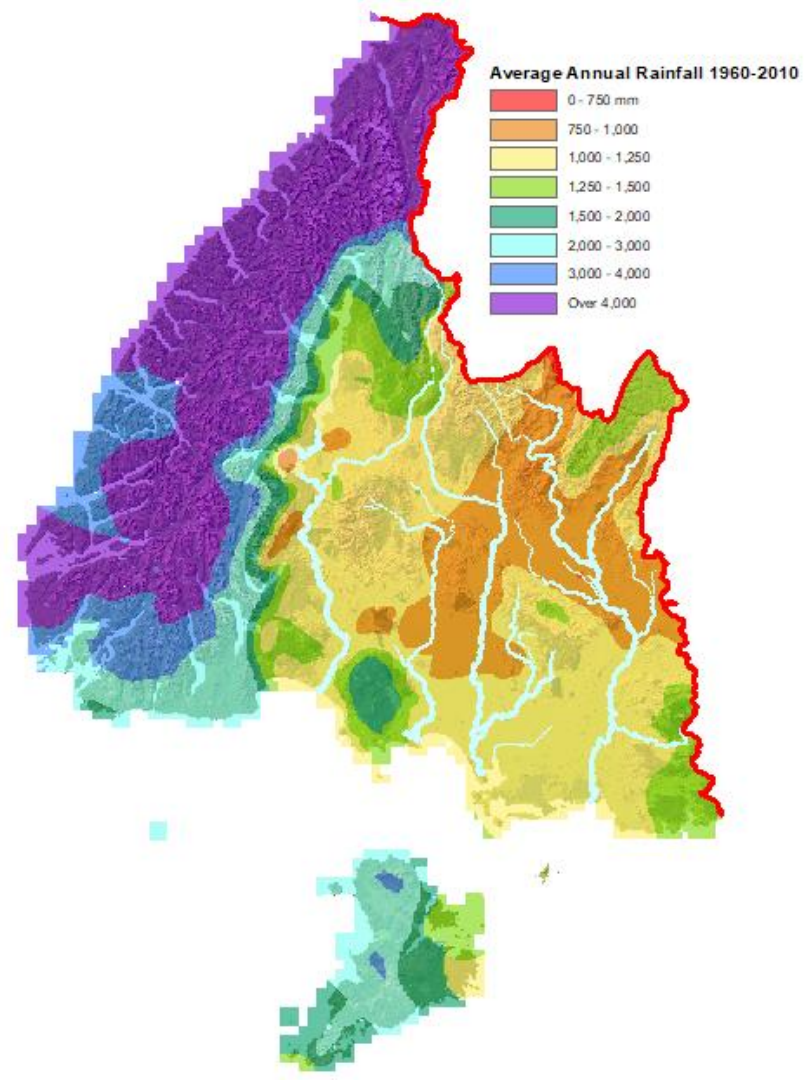
- Major changes over last million years
- Coastline extended by ~7km over 150,000 yrs
- Faulting, folding, glaciations dramatically affected regional hydrology and sculpted today's landscape



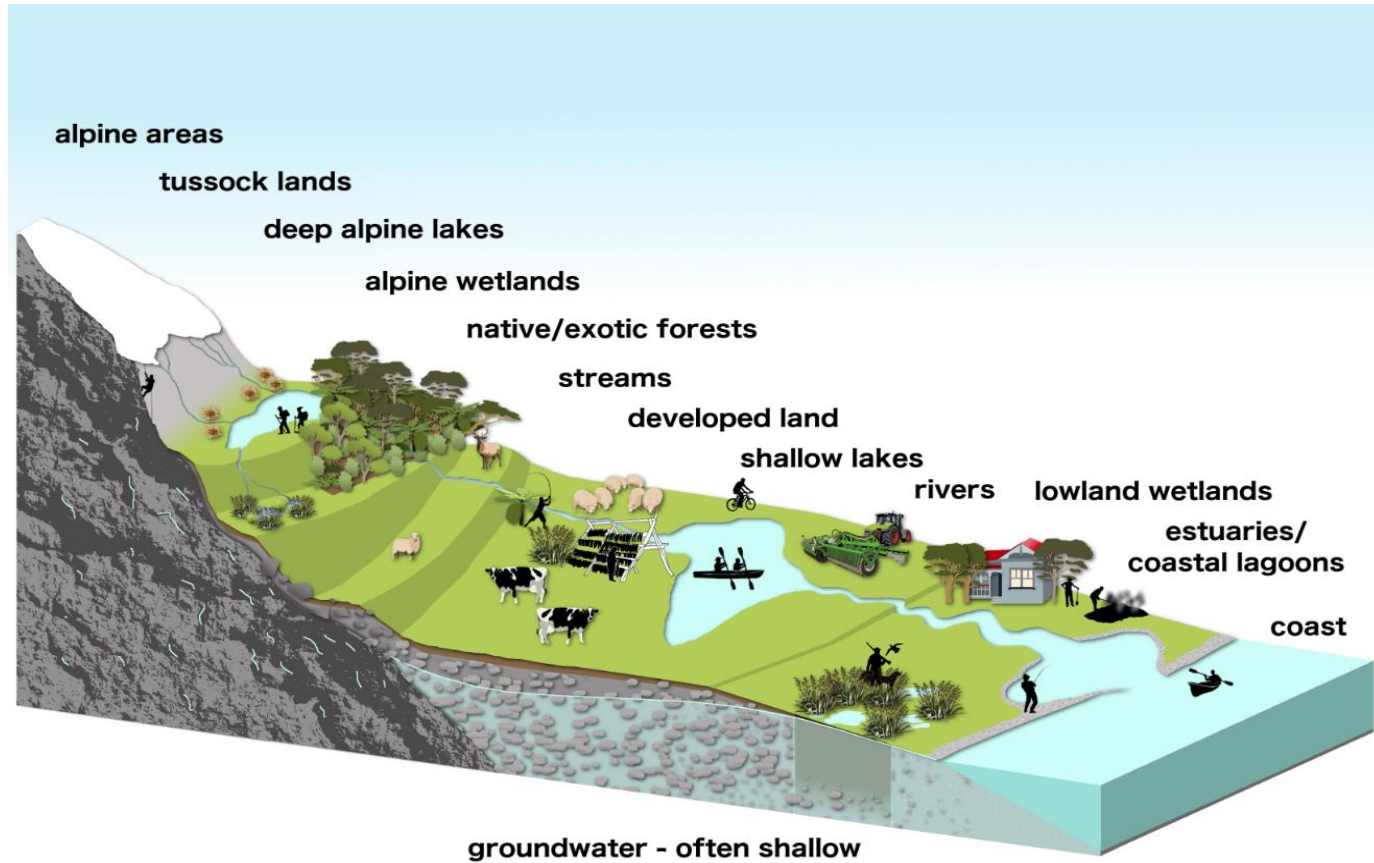
Source: GNS Science (2005), *Geology of the Murihiku Area*

# Southland climate

- W-E and N-S rainfall gradients
- Rainfall increases with elevation
- High regional variability

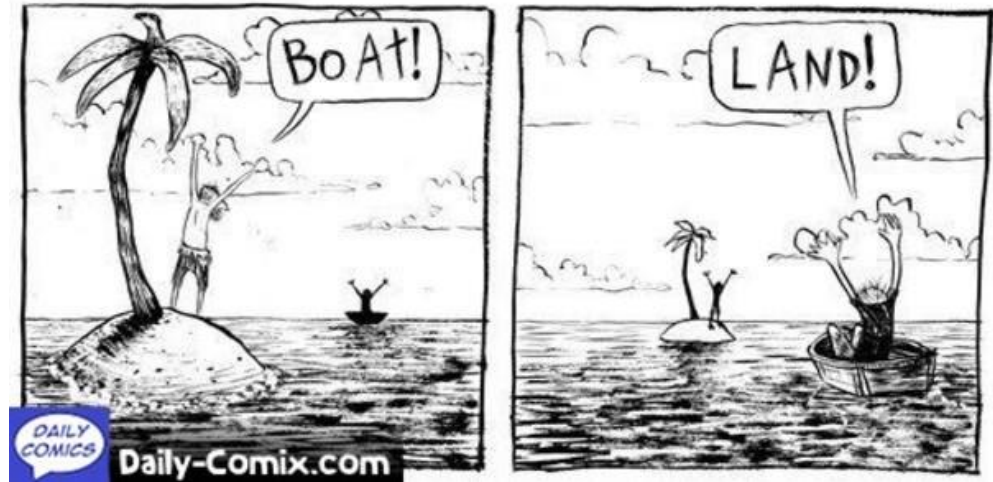


# Complex setting



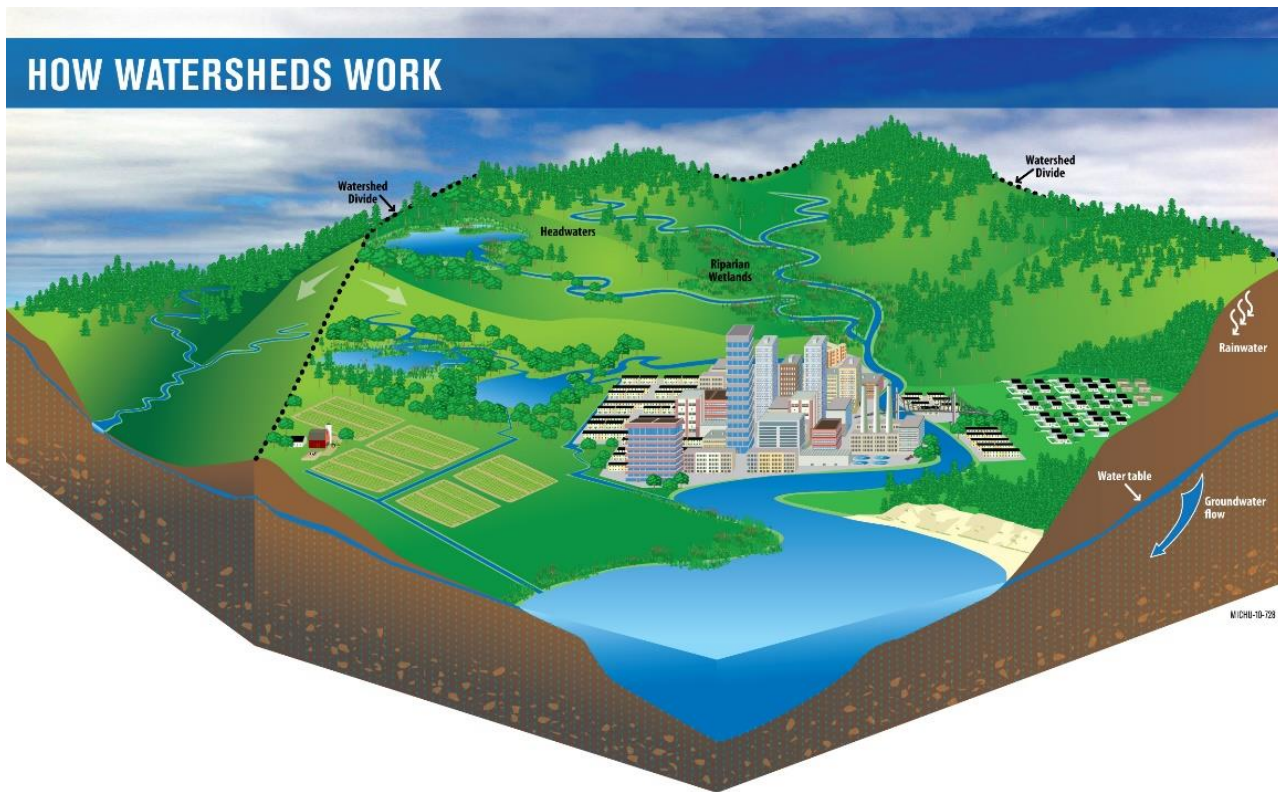
# Environmental perspectives

- Spatial
- Ecological
- Cultural
- Economic
- Civic
- Historical





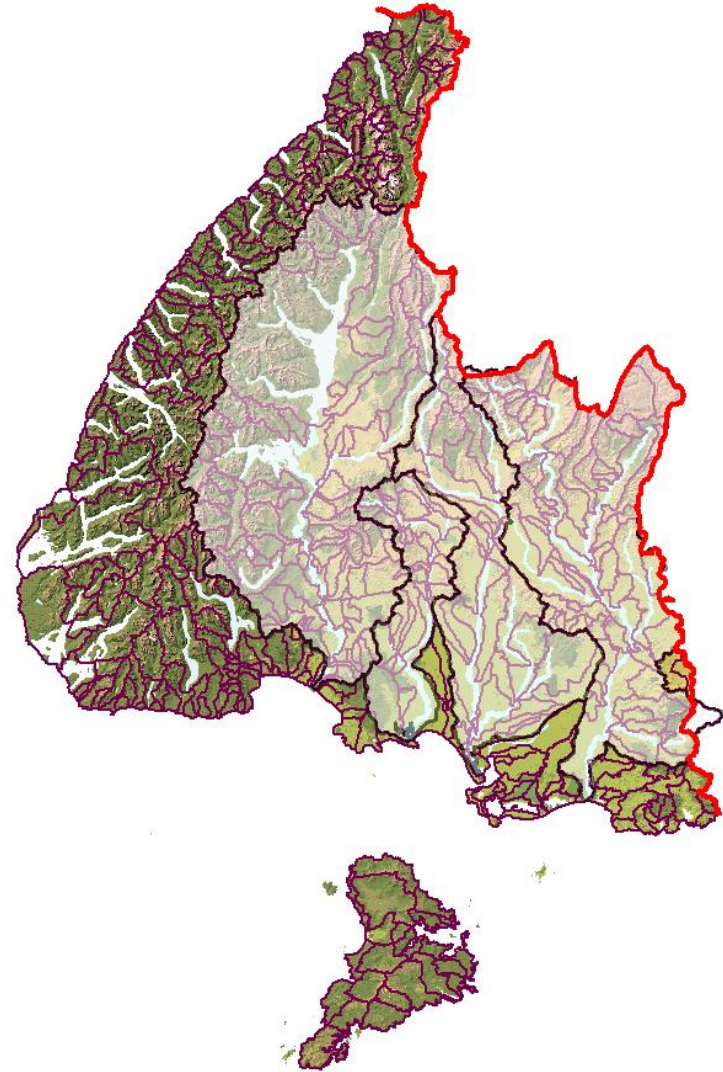
# Watershed or Catchments





# Southland Catchments

- Lots of catchments
- 4 large, long catchments
- Numerous smaller coastal catchments
- Majority N-S alignment
- Small overlaps with Otago Region



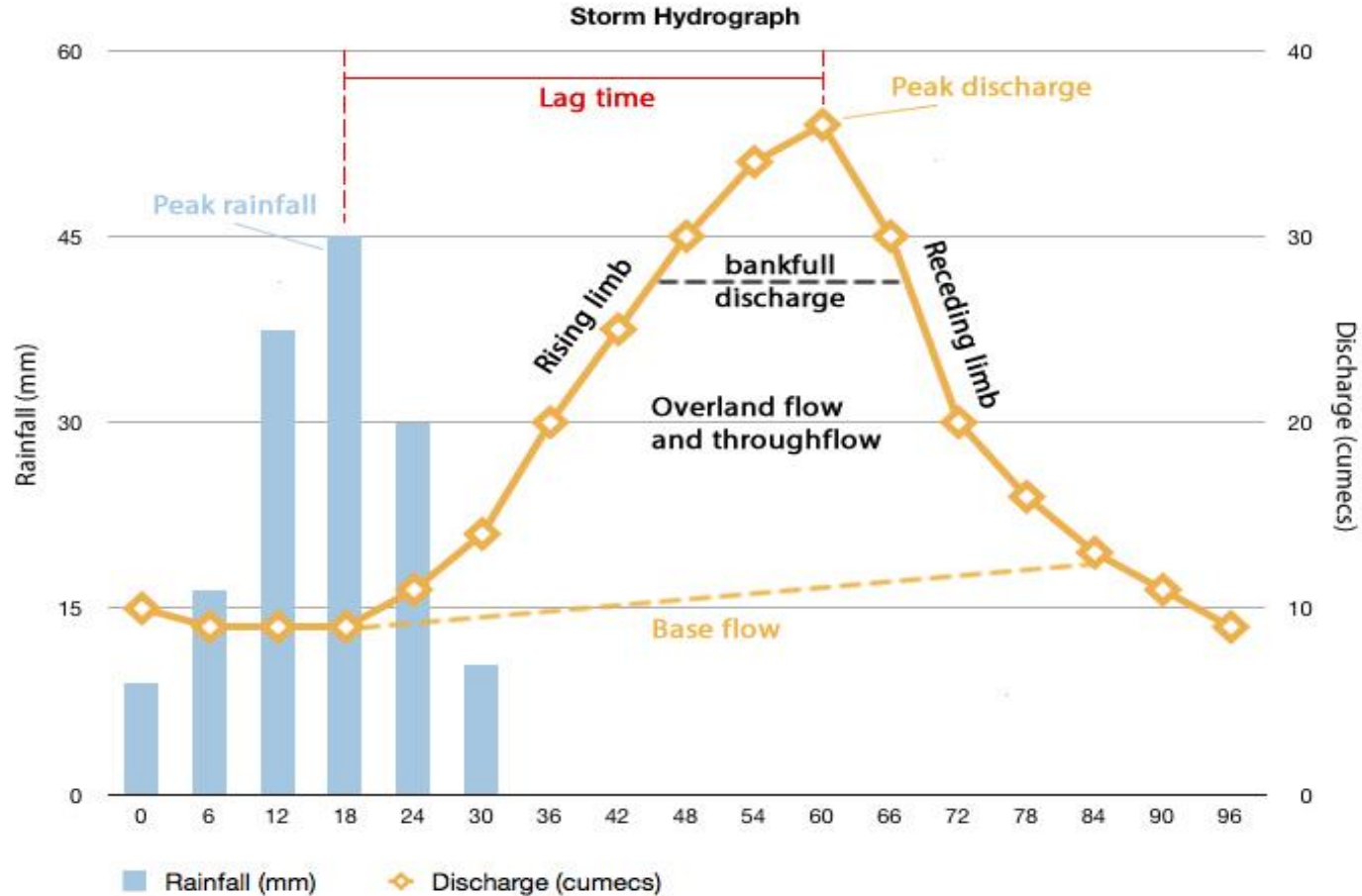
# Large catchments

River Catchment	Length (km)	Area (km <sup>2</sup> )	Rainfall (mm/y)	Mean Flow (m <sup>3</sup> /s)	Flood travel time (hours)	Major Tributaries
Waiau	217	8,202	809 – 9,605 (2,617)	136.6 (558.2)	-	Orauea River, Lill Burn, Wairaki River, Monowai River, Mararoa River, Upukerora River, Whitestone River
Aparima	113	1,575	838 – 1,944 (1,136)	24.7	22	Hamilton Burn, Otautau Stream, Wairio Stream, Opio Stream, Taringatura Creek, Hillpoint Stream
Ōreti	203	3,512	851 – 1,336 (1,049)	62.3	36	Makarewa River, Irthing Stream, Waikiwi Stream, Winton Stream, Bog Burn, Otapiri Stream, Dipton Stream
Mataura	240	5,392	600 – 1,488 (1,136)	98.0	42	Waikaka Stream, Mokoreta River, Waimea Stream, Mimiha Stream, Otamita Stream, Waikaia River, Brightwater Spring

# Coastal catchments

River Catchment	Length (km)	Area (km <sup>2</sup> )	Rainfall (mm/y)	Mean Flow (m <sup>3</sup> /s)	Flood travel time (hours)	Major Tributaries
Waihopai	36	192	1,054 – 1,149 (1,082)	3.32	12	Spurhead Creek
Waikawa	30	242	1,207 – 1,474 (1,339)	5.43	11	Marirui Stream, Bogle Creek
Waimatuku	43	190	853 – 1,157 (1,020)	2.43	18	Middle Creek

# Hydrology

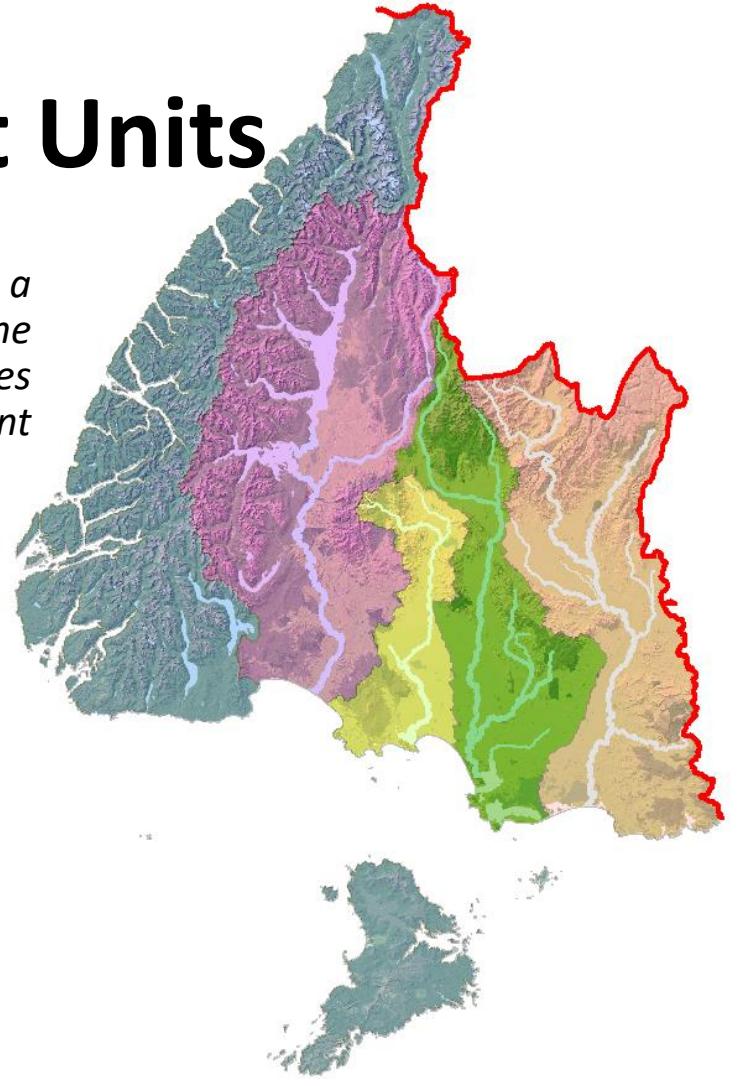




# Freshwater Management Units

*“The water body, multiple water bodies or any part of a water body determined by the regional council as the appropriate spatial scale for setting freshwater objectives and limits and for freshwater accounting and management purposes”*

- Southland FMUs:
  - Fiordland and the islands
  - Waiaua
  - Aparima
  - Ōreti
  - Maitai

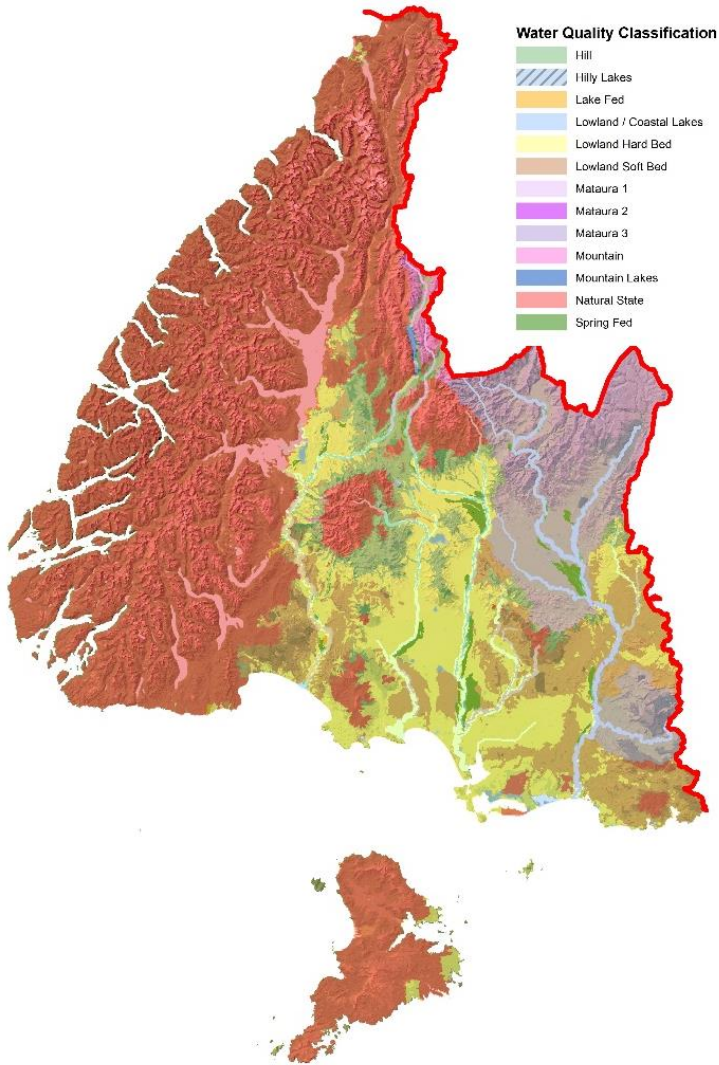


# Water body types









# Rivers/streams

- Classification system largely based on source of flow from REC
- Water quality standards based on river/stream classification



# Rivers/streams

Classification	Characteristics	Examples
<b>Mountain</b>	- Frequent flushing; 50% rainfall from above 1000m altitude; more than 1.5% from ice melt.	Upper Waikaia
<b>Hill</b>	- 50% rainfall from 400 - 1000m altitude	Mimihau
<b>Lake-fed</b>	- Lake water origins, more stable flows	Mararoa
<b>Spring fed</b>	-Water from groundwater springs	Brightwater Spring
<b>Lowland hard bed</b>	-Mainly boulder, cobble or gravel.	Mid Aparima/Oreti/Mataura
<b>Lowland soft bed</b>	-Mainly sand, silt or clay bottom.	Lower Mataura

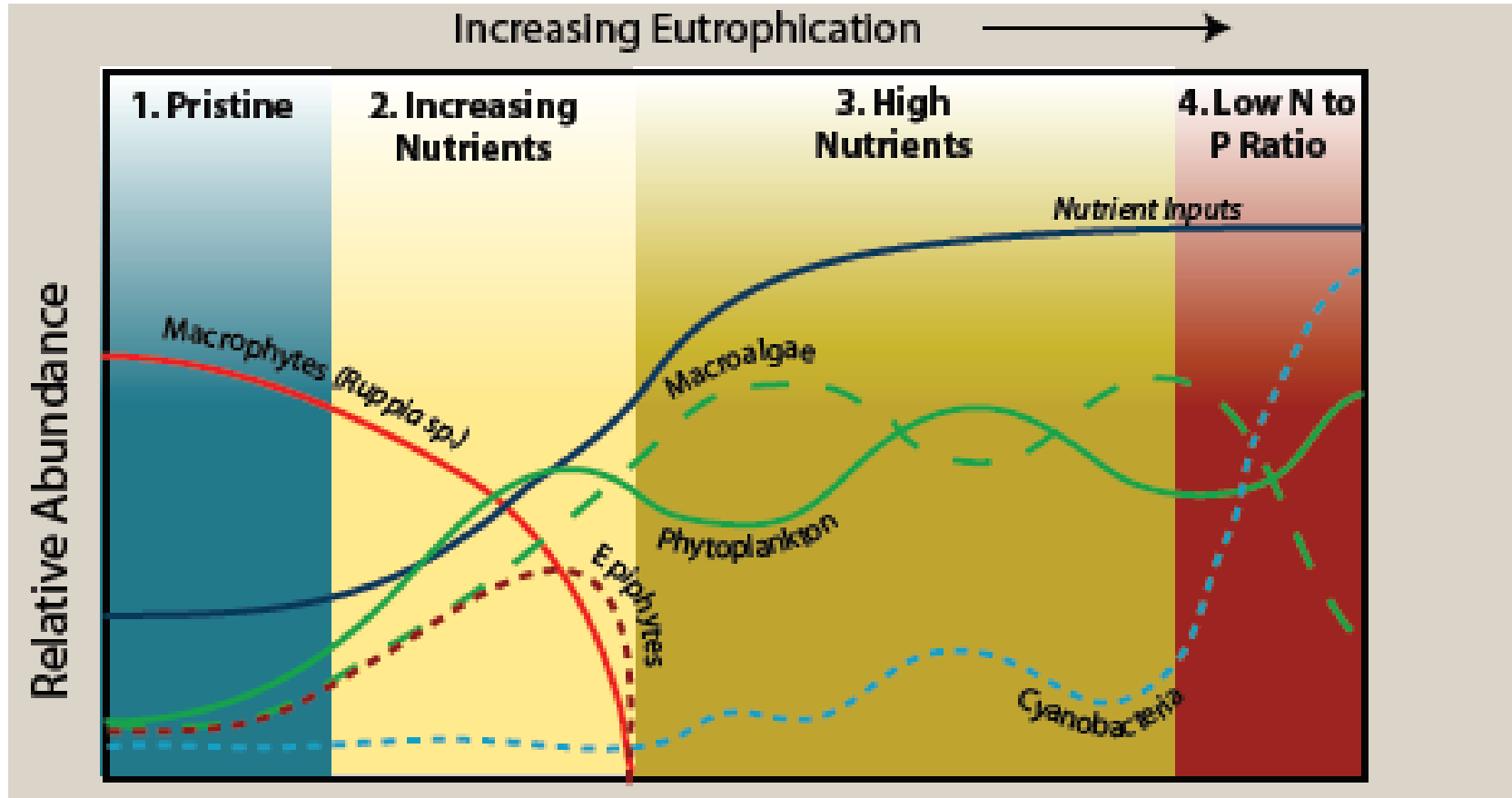
# Lakes

## Characteristics

- Depth/open or closed – determines mixing
- Sediment and nutrient input are key to health



# Lakes

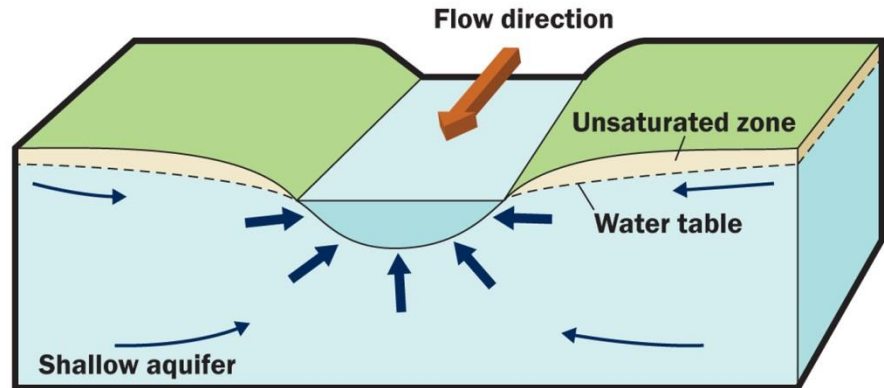


# Lakes

Classification	Typical characteristics	Examples
Lowland/coastal lakes	Average depth <2 metres) Well mixed, often from wind.	Lakes Vincent, George, The Reservoir, Murihiku, Lake sheila, Lake Calder.
Intermittently Open and Closed Lakes and Lagoons ( <b>ICOLLs</b> )	Open at times, generally behaves as Lake when closed with good mixing. When closed behaves more like a Lake. This category is also used for classifying estuaries.	Waituna, Lake Brunton
Mountain Lakes	Deep glacial lakes. Ten Anau more than 400m deep. Water often layers with warmer water on top, when layered it is not well mixed.	Lakes Te Anau, Manapouri; and hundreds more in Fiordland



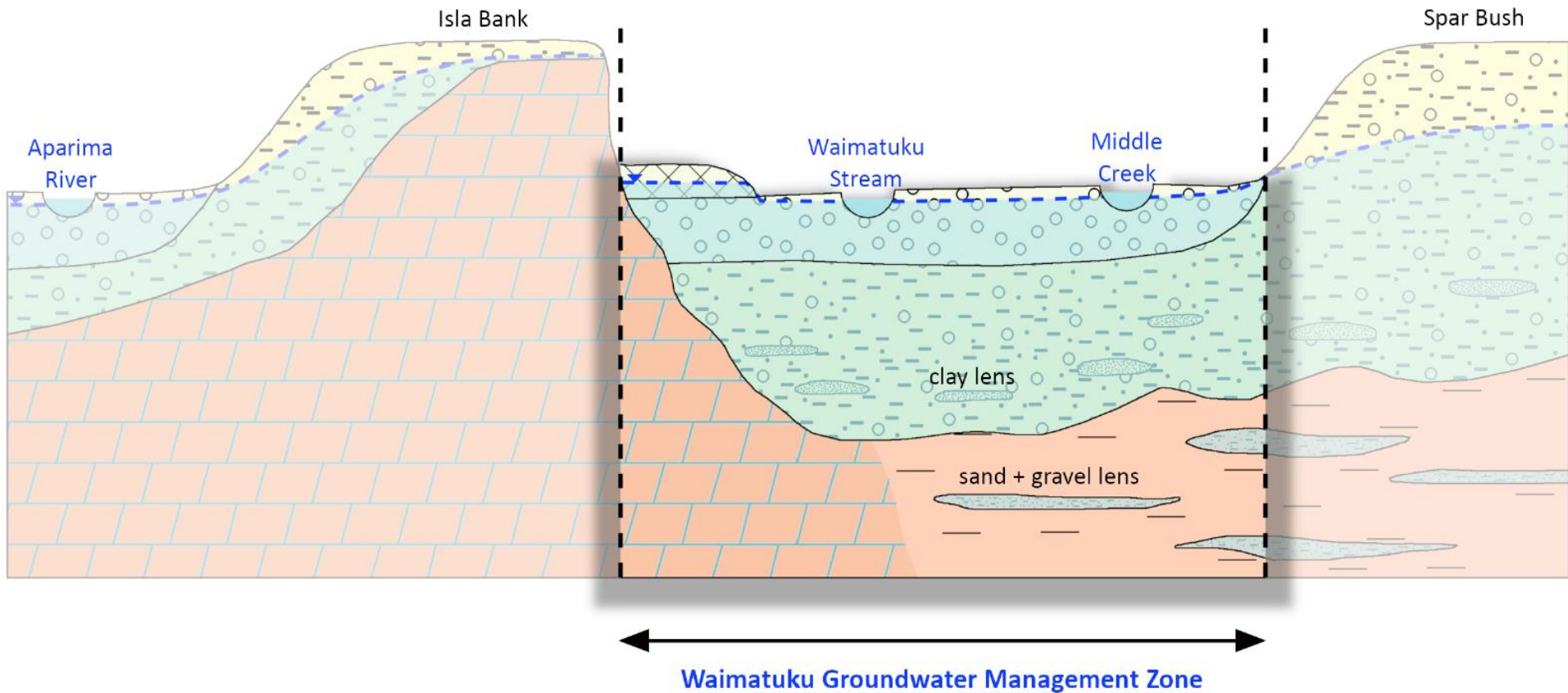
# Groundwater



# Aquifer Types

Types	Characteristics	Examples
Confined	Under pressure due to overlying and underlying impermeable layers. Very low interaction with surface water.	Lumsden and North Range Aquifers
Fractured rock	Water is held within the joints and fractures of consolidated rock. Usually a limited aquifer resource.	Hokonui Hills and Catlins areas
Lowland	Hosted in the sediments underlying the low lying plains. Moderate interaction with surface water.	Awarua, Central Plains, and Waimatuku
Terrace	Hosted in gravels and sediments under elevated alluvial terraces. Primarily rainfall recharged and have limited interaction with surface water.	Edendale and Castlerock
Riparian	Highly permeable, unconfined aquifers along the margins/floodplains of major river systems. High degree of interaction with surface water.	Riversdale, Waipounamu, and Five Rivers

# Groundwater

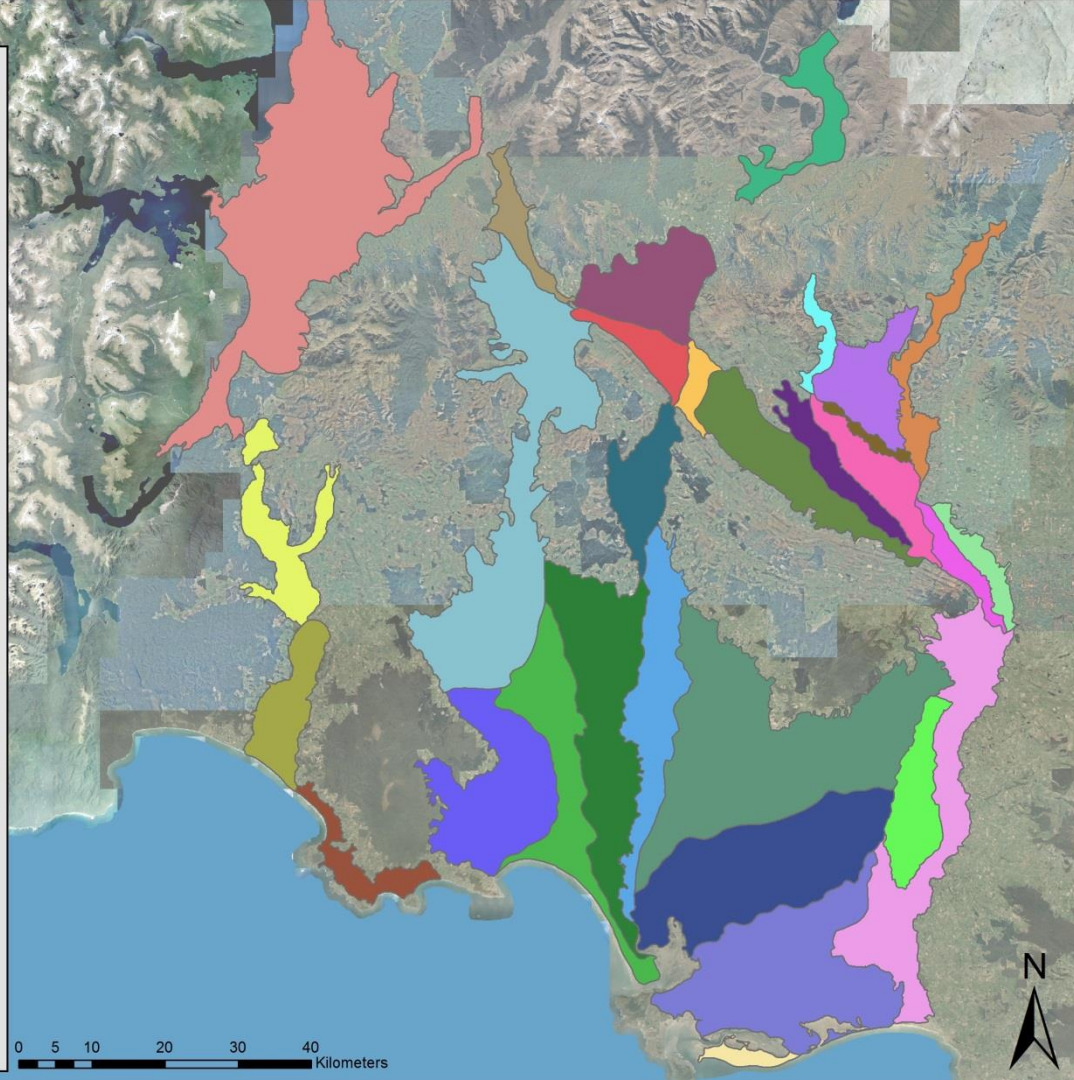




## Legend

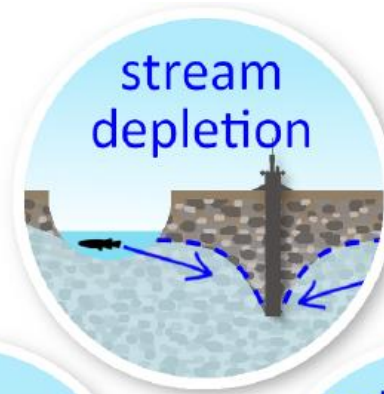
### Groundwater Management Zones (pSWLP)

- Awarua
- Blackmount
- Castlerock
- Cattle Flat
- Central Plains
- Centre Hill
- Croydon
- Dipton
- Edendale
- Five Rivers
- Knapdale
- Longridge
- Lower Aparima
- Lower Maitaura
- Lower Oreti
- Makarewa
- Orepuki
- Oreti
- Riversdale
- Te Anau
- Te Waewae
- Tiwai
- Upper Aparima
- Upper Maitaura
- Waihopai
- Waimatuku
- Waimea Plains
- Waipounamu
- Wendon
- Wendonside





# Potential Groundwater Issues



# Estuaries

- Different types & characteristics
- Dilution potential
- Flushing potential

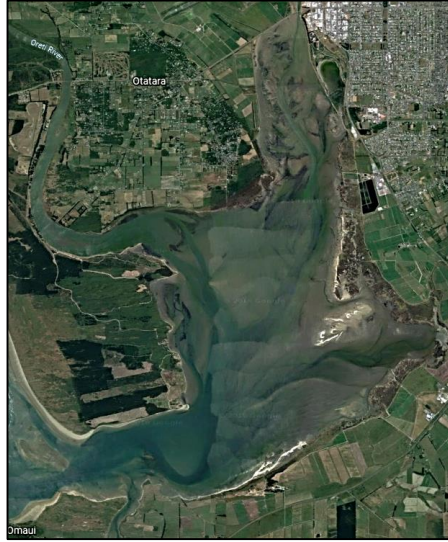


**Intermittently  
Closed/ Open Lake  
and Lagoon  
(ICOLL)**



Waituna Lagoon

**Shallow, Intertidal  
Dominated Estuary  
(SIDE)**



New River Estuary

**Shallow, short  
residence, tidal river  
estuary (SSRTRE)**



Fortrose (Toetoes) Estuary

# Estuaries

Types	Eutrophication Risk	Key features	Examples
ICOLLS <sup>1</sup>	Very High	Shallow, Lagoon or tidal river shape, mouth opens and closes, variable residence time.	Waituna Lagoon, Lake Brunton
SIDE <sup>2</sup>	Moderate to High	Shallow, Lagoon shape, more than 40% intertidal, generally short residence time (<3 days)	New River, Jacobs River, Waikawa, Haldane and Freshwater Estuaries
SSRTRE <sup>3</sup>	Low to Very Low	Shallow, tidal river shape, high flushing potential, generally short residence time (<3 days)	Toetoes and Waimatuku estuaries
DSDE <sup>4</sup>	Moderate to Low	Deep, generally long residence time	Embayments and Fiords

<sup>1</sup>Intermittently Closed and Open Lakes and Lagoons

<sup>2</sup>Shallow, Intertidal Dominated Estuary

<sup>3</sup>Shallow, short residence, tidal river estuary

<sup>4</sup>Deeper, Subtidal dominated Estuaries

# Mataura FMU

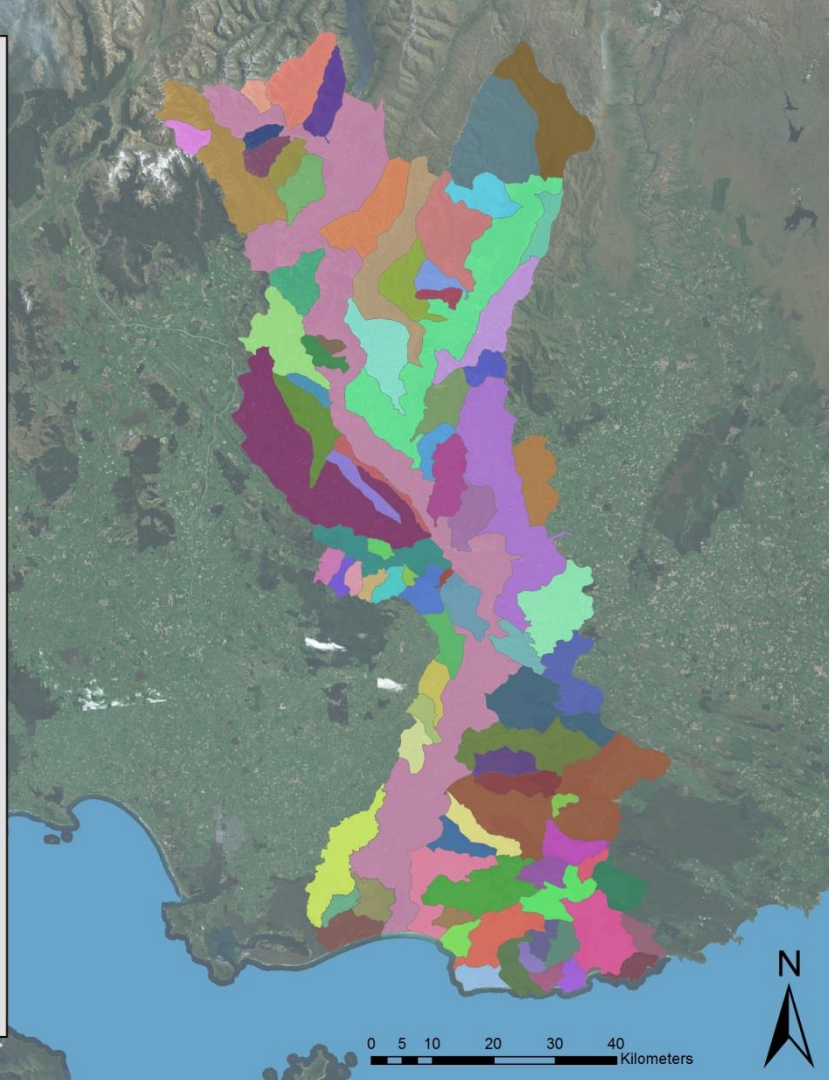
- The FMU can be considered at various different scales
- From the whole FMU, to minor catchments and sub-catchments



## Legend

### Catchments

Allen Creek	Marinui Stream	Toi Toi Stream
Argyle Burn	Mataura River	Tokanui River
Boggy Creek	McKellar Stream	Tomogalak Stream
Bogle Creek	Mimihau Stream	Tower Creek
Boundary Creek	Moffats Creek	Waiaikiki Stream
Bowels of the Earth	Mokoreta River	Waikaia River
Brothers Point	Moss Burn	Waikaia River East Branch
Caddon Burn	Nokomai River	Waikaia River West Branch
Carrans Creek	Okapua Stream	Waikaka Stream
Charlton Stream	Ota Creek	Waikaka Stream East Branch
Cone Burn	Otakaramu Stream	Waikawa River
Cook's Creek	Otama Creek	Waikawa River East Branch
Dome Burn	Otamita Stream	Waikawa River West Branch
Dome Creek	Oteramika Creek	Waikopikopiko Stream
Dornoch Burn	Oware Stream	Waimahaka Stream
Eyre Creek	Peel Stream	Waimea Stream
Futtah Gully	Pig Creek	Waimumu Stream
Garvie Burn	Pukerau Stream	Waionepu Stream
Gordon Stream	Pyramid Creek	Waipapa Point
Gow Burn	Quoich Creek	Waipapa Stream
Haldane Estuary	Redan Stream	Waipohatu Stream
Hapukinini Creek	Robert Creek	Waituna Creek
Kaiwera Stream	Ruhtra Stream	Waituna Lagoon
Kelvin Stream	Sandstone Stream	Welshman's Creek
Kuriwai Creek	Sheepwash Creek	Wendon Stream
Lake Vincent	Station Burn	Whiskey Creek
Longbeach Creek	Stepple Burn	Whitcombe Creek
Longridge Stream	Steven Burn	Winding Creek
Low Burn	Thomson Creek	Windley Creek
	Titiroa Stream	

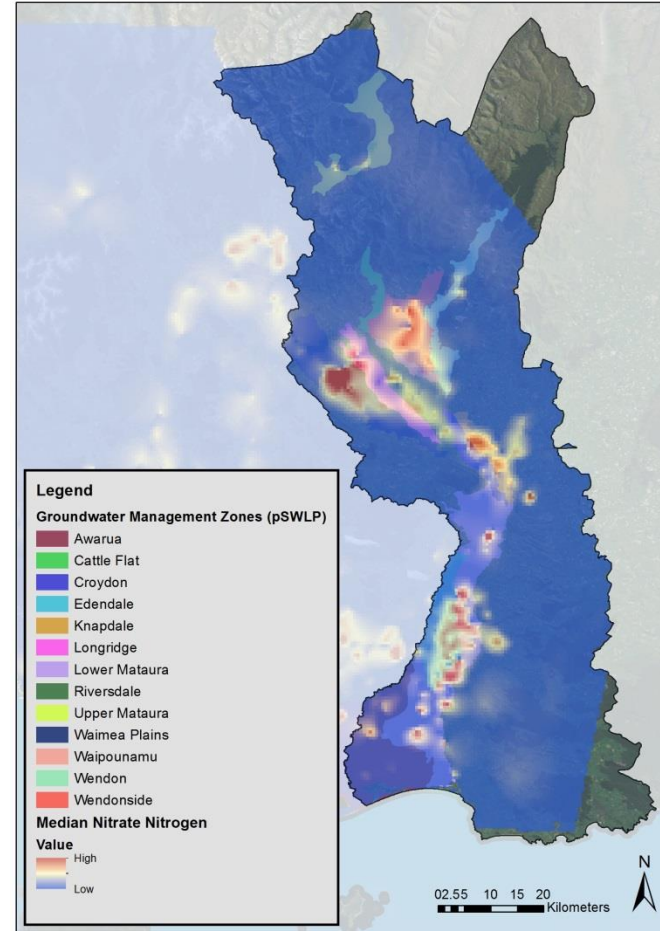
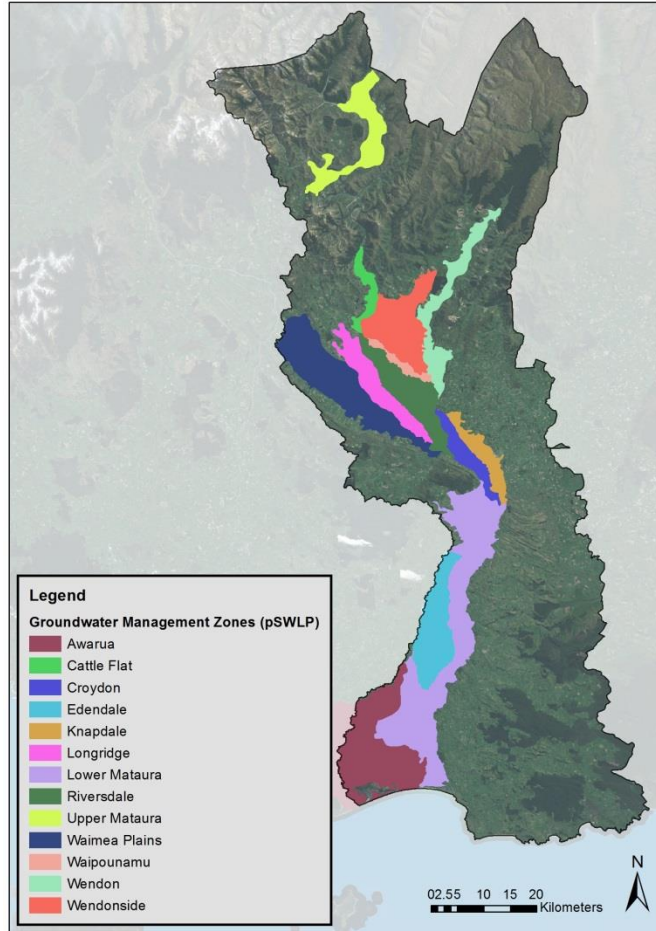




# Mataura FMU rivers/streams



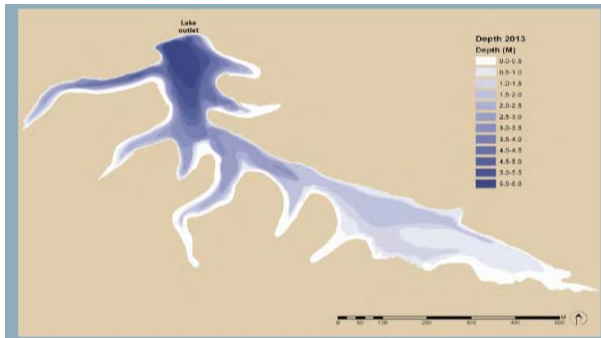
# Mataura FMU aquifers





# Mataura FMU lakes and Estuaries

- Sensitivities/vulnerabilities to human impacts
- Those monitored
  - Coastal Shallow Lakes = Lake Vincent, the Reservoir
  - ICOLLs = Waituna
  - SIDEs = Waikawa, Haldane
  - SSTREs = Totetoes



# Summary

- Southland's environment is complex
- There are many different ways of looking at the environment
- Time (history) and space (catchments, water body types) are very important components to consider

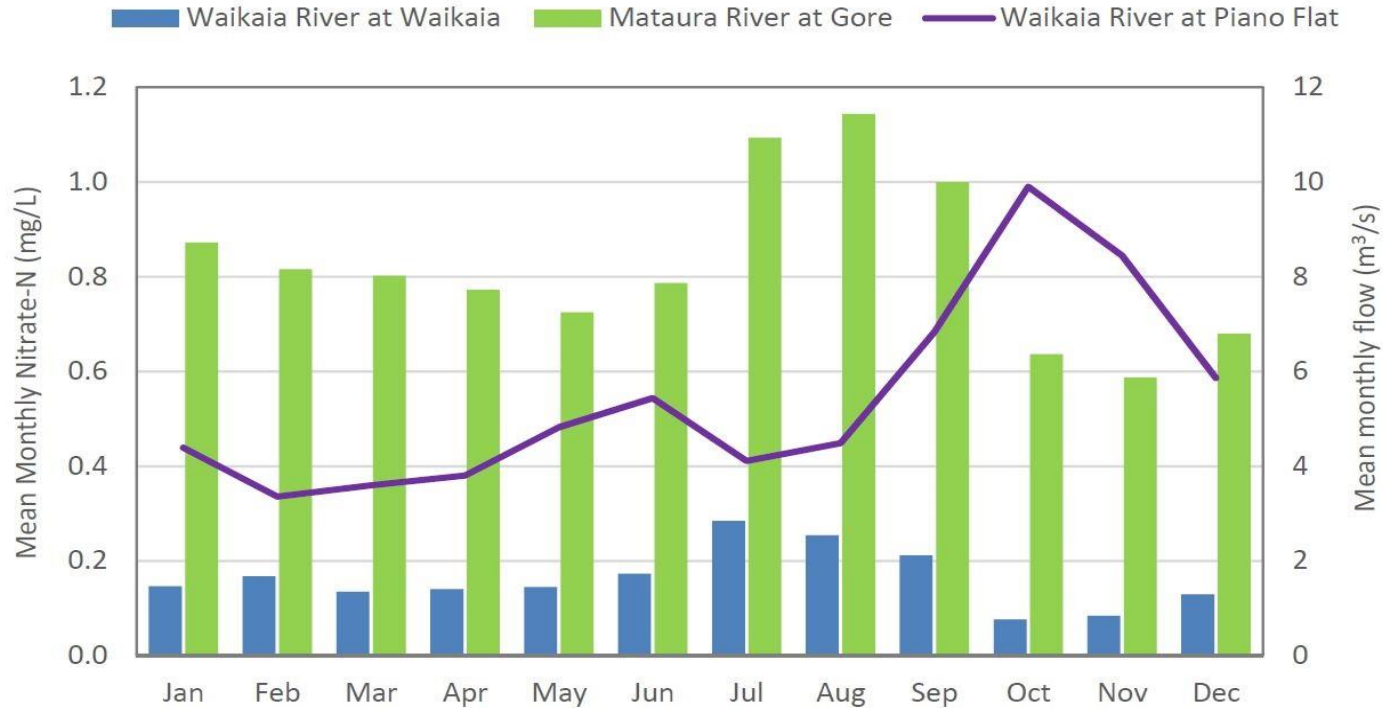


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[www.es.govt.nz](http://www.es.govt.nz)



# Hydrology



***Mean monthly nitrate (bars) in the Waikaia River at Waikaia and Mataura River at Gore and mean monthly flow (line) in the Waikaia River at Piano Flat.***