Awakino & Tasman Freshwater Monitoring Results

Merrin Whatley (PhD) – 25 July 2022

Overview

- Te mana o te wai
- Indicators of freshwater health
- Monitoring results
- On farm actions

Te Mana o te wai

RCs Must Give Effect to Te Mana o te Wai by applying the hierarchy of obligations that prioritise:

- the health and well-being of water bodies and freshwater ecosystems
- the health needs of people (such as drinking water)
- the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

Set Target Attribute States

- Must be set at or above the baseline state of that attribute (except the value human contact/E.coli).
- The target attribute state for E.coli must be set above the baseline state, unless the baseline state is already within the A band.
- The target state must be set at or above the national bottom line.
- Must specify a timeframe for achieving the target.

https://www.waikatoregion.govt.nz/council/policy-and-plans/freshwater-policy-review/


Photo: Susan Stoddard

Indicators of Freshwater Health

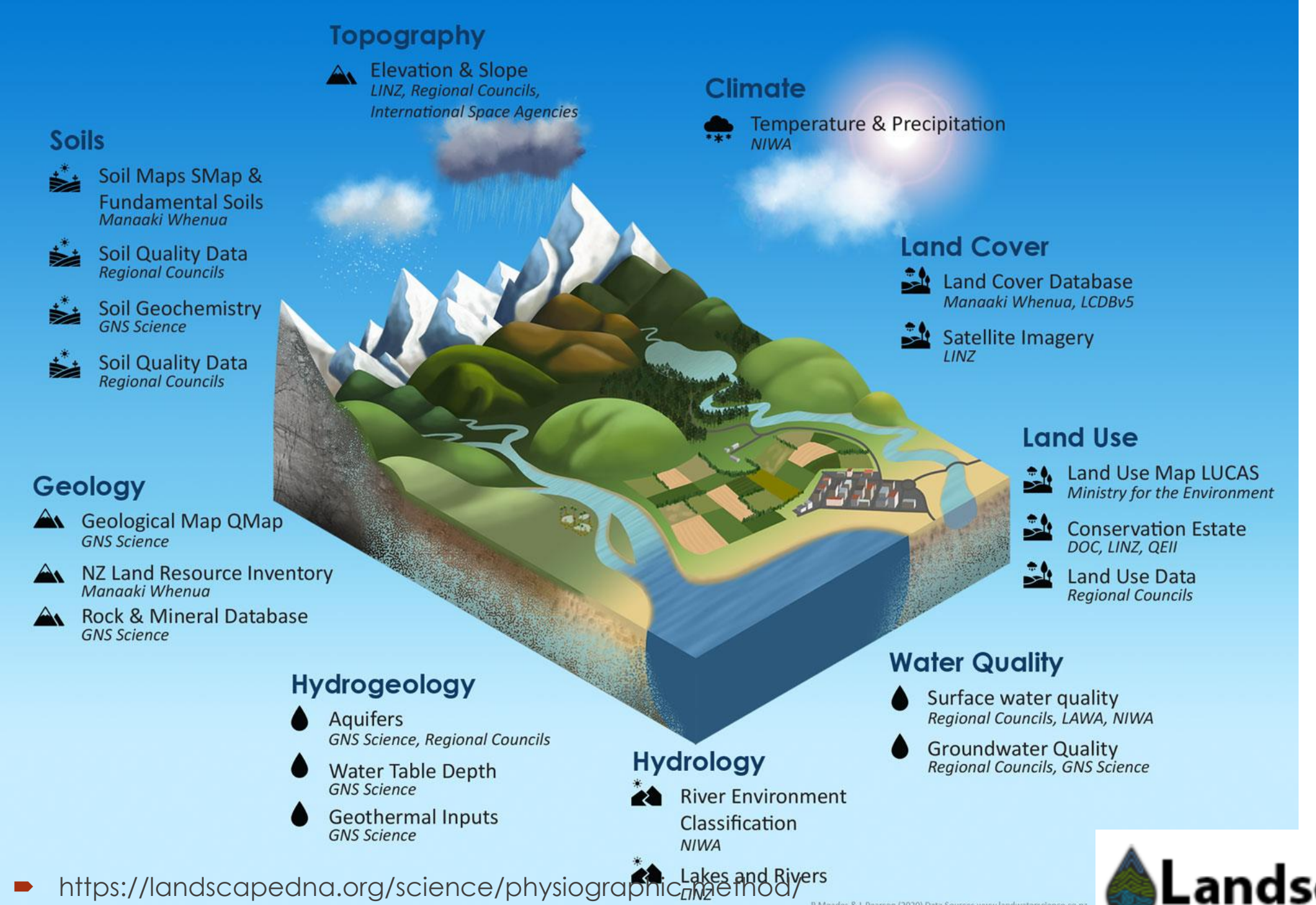
- Habitat
- Flow
- Wildlife
- Energy & Nutrient Dynamics
- Water Quality

Drivers of Health/Mauri of our Waterways

- Key contaminants, attributes/indicators?
- Where in the catchment are they coming from?
- Are there seasonal changes or changes over time?
- What are the underlying processes or practices contributing to contaminant loss?
- Tailor catchment-based interventions to target key contaminants over time and space.

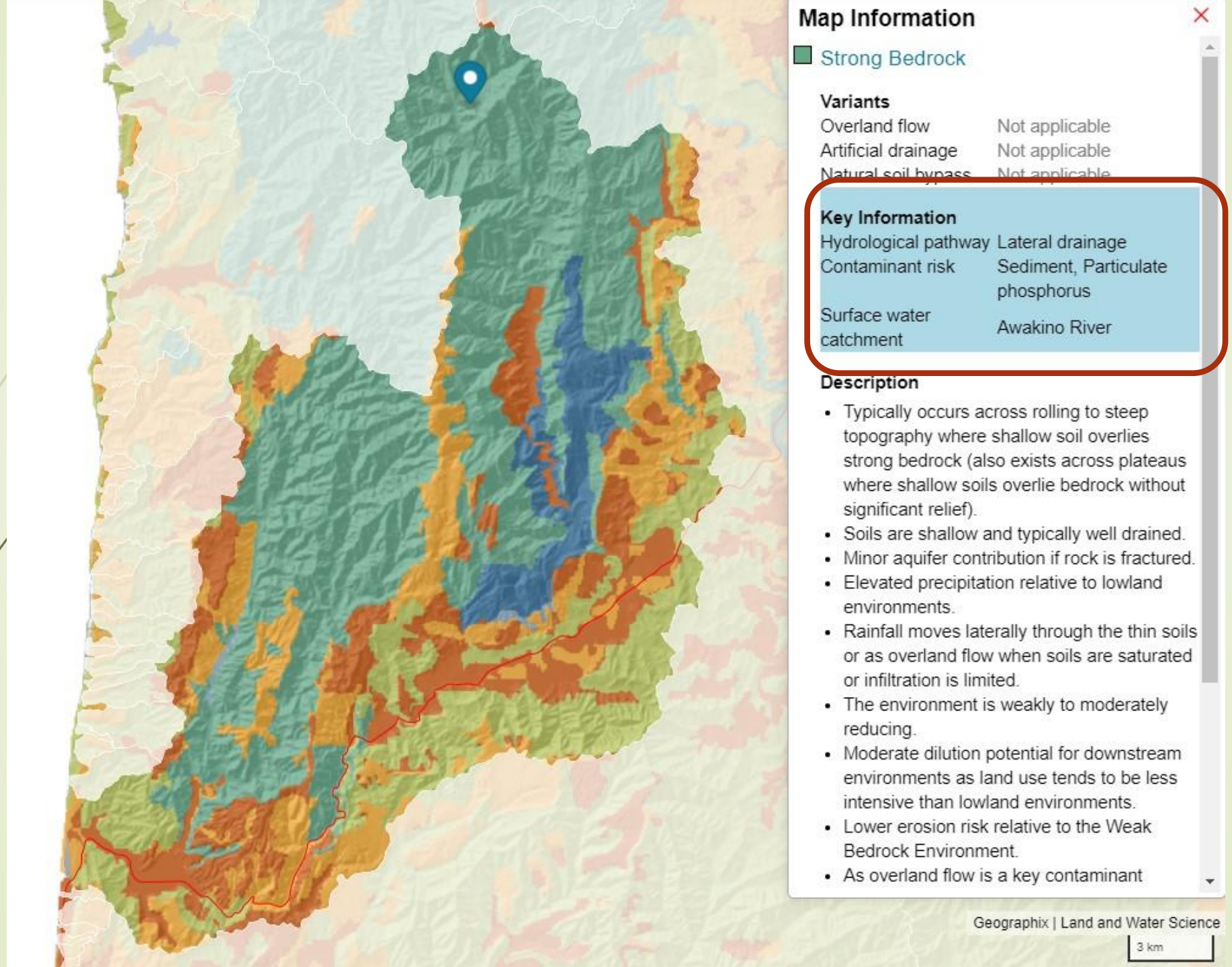
Natural Influences

- Climate
- Topography
- Geology
- Soils
- Hydrology
- Land cover

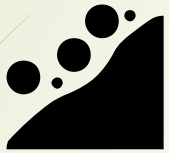


- https://landscapedna.org/science/physiographic_method/

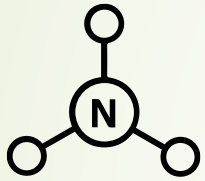
LandscapeDNA


Map Information
Strong Bedrock
Variants
Overland flow Not applicable
Artificial drainage Not applicable
Natural soil bypass Not applicable
Key Information
Hydrological pathway Lateral drainage
Contaminant risk Sediment, Particulate phosphorus
Surface water catchment Awakino River
Description
• Typically occurs across rolling to steep topography where shallow soil overlies strong bedrock (also exists across plateaus where shallow soils overlie bedrock without significant relief).
• Soils are shallow and typically well drained.
• Minor aquifer contribution if rock is fractured.
• Elevated precipitation relative to lowland environments.
• Rainfall moves laterally through the thin soils or as overland flow when soils are saturated or infiltration is limited.
• The environment is weakly to moderately reducing.
• Moderate dilution potential for downstream environments as land use tends to be less intensive than lowland environments.
• Lower erosion risk relative to the Weak Bedrock Environment.
• As overland flow is a key contaminant
Geographix | Land and Water Science
3 km

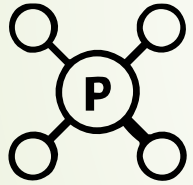
Attribute Descriptions



Water Clarity – Suspended Particles Including Sediment

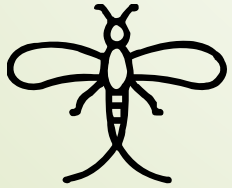


Nitrate



Dissolved Reactive Phosphorus (DRP)

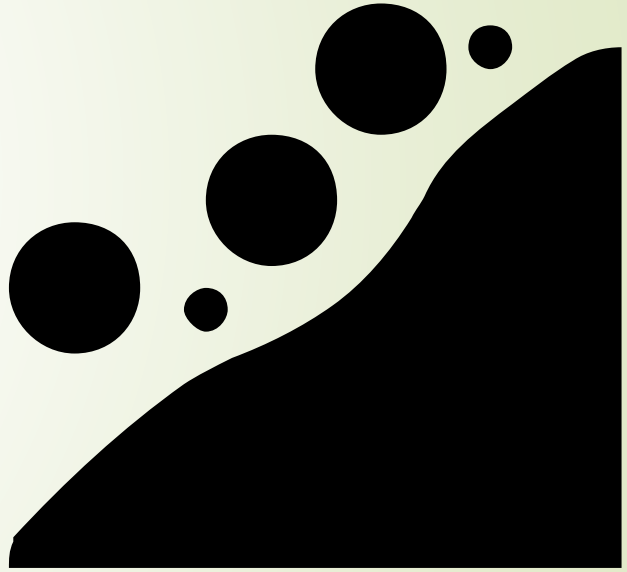
Pathogens/E. coli (short for Escherichia coli)



Freshwater Macroinvertebrate Community Index (MCI)

Water Clarity / Suspended Sediment

- The estimated national average annual erosion rate in NZ is 720 tonnes per square kilometer.
- As of 2015, soil erosion processes were attributed to cost $250 to $300 million annually.
- Erosion releases tiny particles of clay, silt or small organic particles which are washed into waterways.
- Sediment can harm aquatic life by clogging their gills which reduces their ability to take up oxygen.
- As fine particles settle, the spaces between rocks and gravel are filled making the habitat unsuitable for aquatic species.



https://ourenvironment.ac.nz/2020/04/25/soil-erosion-in-new-zealand/

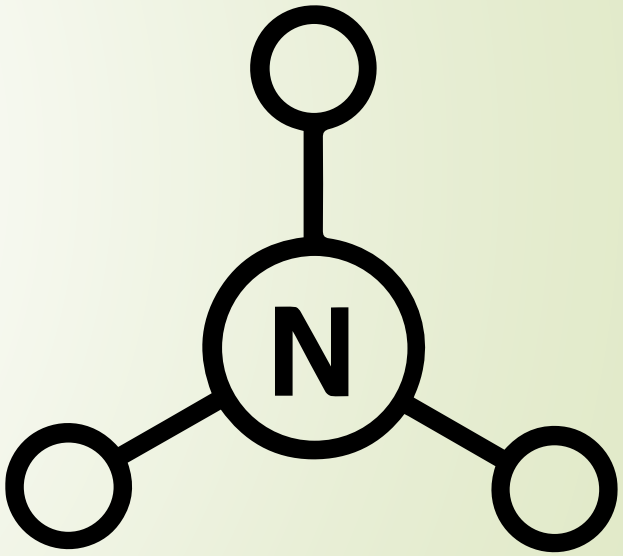
Nitrate

- Nitrate is a highly soluble form of nitrogen that is both a nutrient and, in excess quantities, a toxic substance.

Between 1990 and 2017:

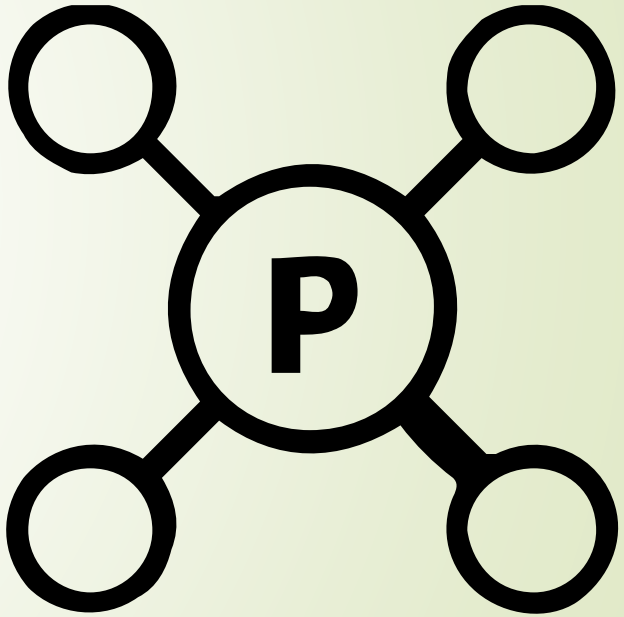
- The total amount of nitrate leached from NZ livestock increased from 189,000 tonnes to 199,000 tonnes pa.
- Sheep contribution to national nitrate leaching decreased from 34% to15%.
- Beef cattle contribution decreased from 26% to 19%.
- Dairy cattle contribution increased from 39% to 65%.
- Last month Ballance notified farmers that some fertiliser products would increase in price between 7% and 25%.

https://www.stats.govt.nz/indicators/nitrate-leaching-from-livestock



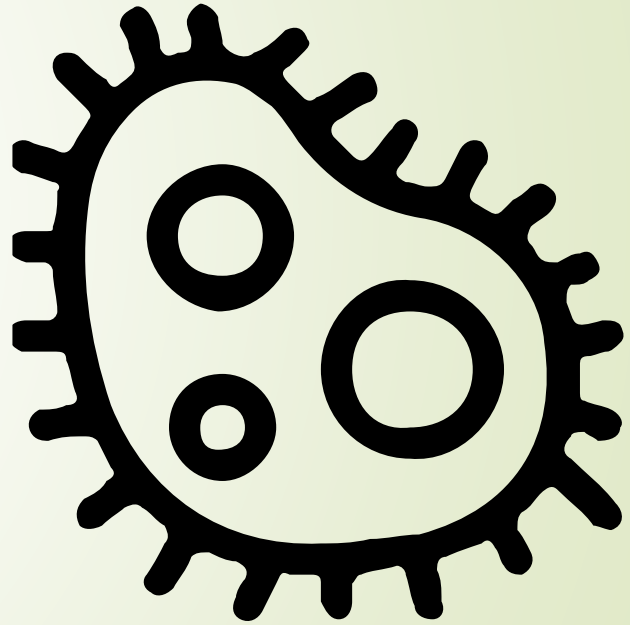
DRP

- Phosphorus occurs naturally in rocks and minerals and can be a common component in soils and sediments.
- Weathering of rocks and minerals also releases phosphorus in bio-available forms as DRP, suitable for uptake by plants.
- Phosphorus binds strongly to soil particles, but once the storage capacity of the soil is exceeded, it will leach into groundwater.
- Very high phosphorus concentrations in waterways are likely to cause rapid weed growth or algal blooms which can choke aquatic life and cause long-term damage to the health of a waterbody.



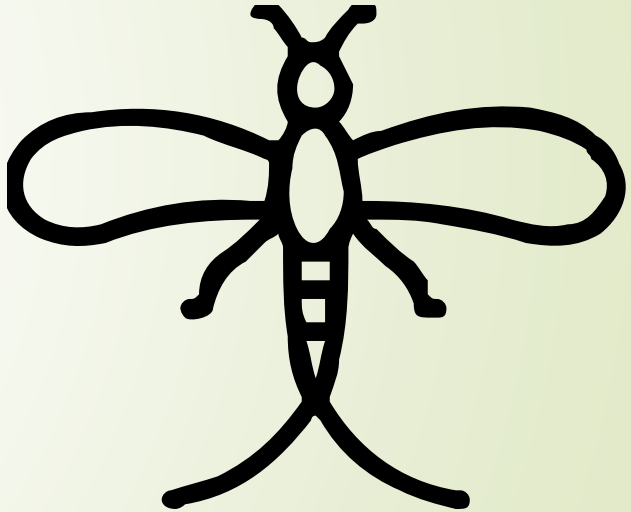
E. coli/Pathogens

- E. coli (short for Escherichia coli) is a type of bacteria commonly found in the guts of warm-blooded mammals (including people) and birds.
- E. coli can survive for up to four to six weeks outside the body in fresh water, making it a useful indicator of faecal contamination and the presence of disease-causing organisms.
- Common sources of E. coli bacteria are human wastewater discharges, animal waste, bird droppings and stormwater run-off.
- In response to public pressure in 2017 the then National Govt. set a target for 90% of NZ rivers & lakes to be swimmable by 2040.

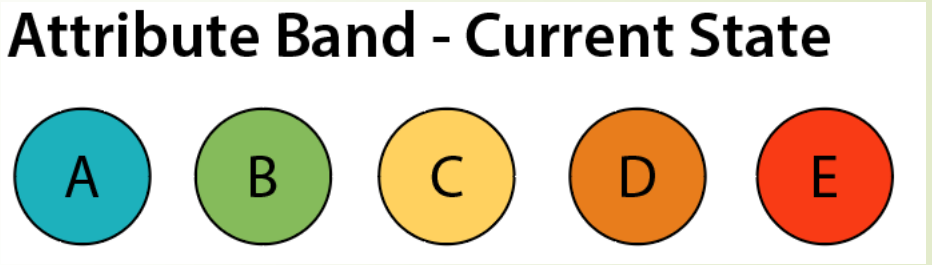


Benthic Freshwater Invertebrates (MCI)

- Benthic macroinvertebrates are small animals without backbones that live on or just below the stream-bed.
- Macro-invertebrates, means they can be seen with the naked eye.
- They play a central role in stream ecosystems by feeding on periphyton, macrophytes, dead leaves and wood, or on each other.
- MCI stands for Macroinvertebrate Community Index which is used as an indicator of stream ecological health.
- Higher MCI scores indicate better stream conditions.



https://www.lawa.org.nz/learn/factsheets/benthic-macroinvertebrates/



Attribute Dials

Monitoring in Awakino & Tasman

Waikato Regional Council Sites

- Awakino River – 10 sites in total
  - 3 River Water Quality Sites
  - 6 Ecological Monitoring Sites
  - 1 River flow Site
- Tasman - 4 Ecology sites

Frequency of Measurements

- WQ collected by monthly grab sample
- Ecology site visited every 3 years
- Continuous river flow recorded every 15 minutes

Monitoring in Awakino & Tasman

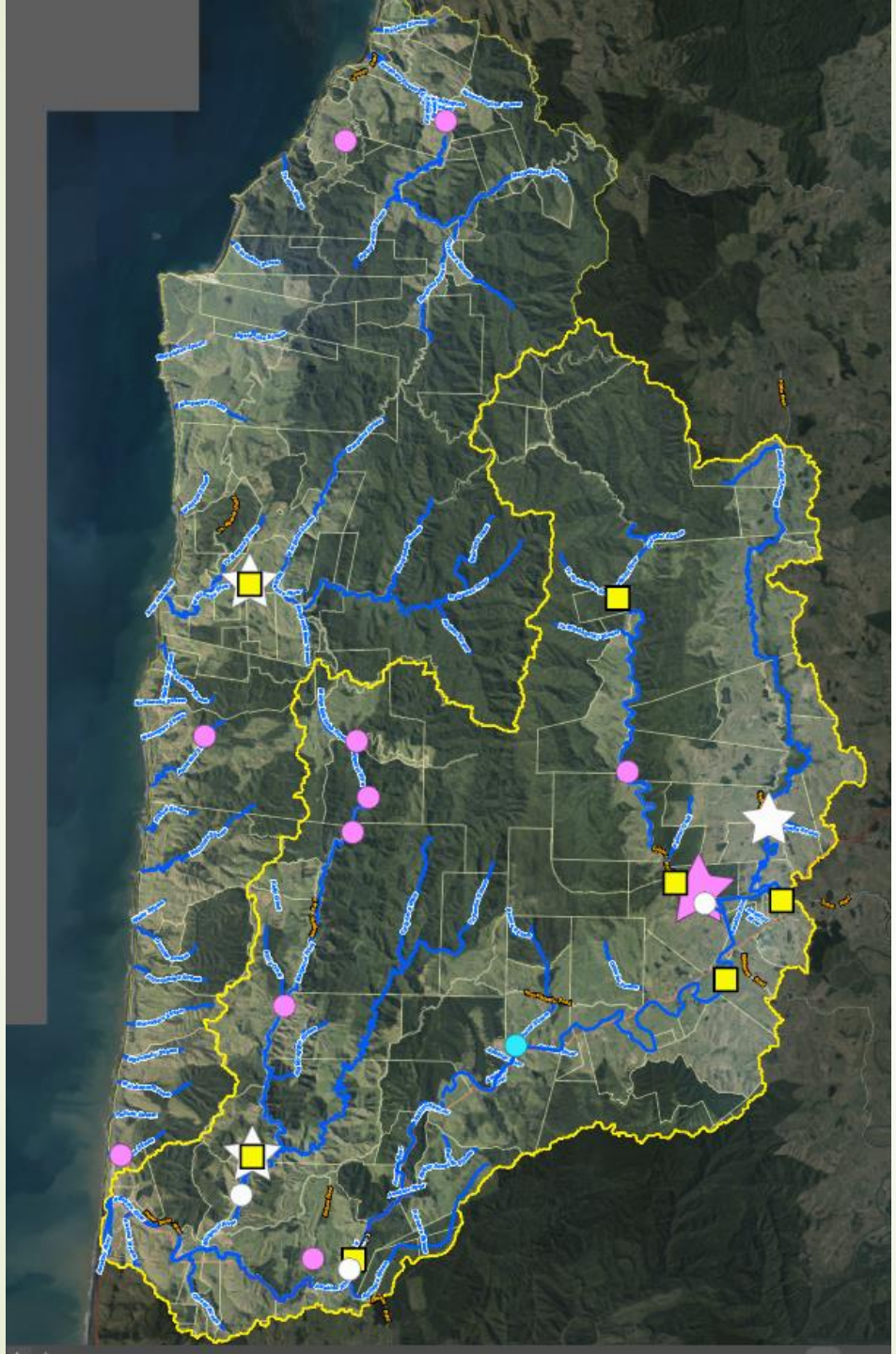
KCRC Sites

- Awakino River – 7 sites in total
- 2 Water Quality sites
- 1 eDNA sites
- 7 SHMAK sites

- Tasman – 1 site Water Quality + Ecology/SHMAK

Frequency of Measurements

- Water quality collected by grab sample 4 times a year
- eDNA collected twice, 22 Feb & 29 Nov 2021



Monitoring Sites

- Aquatic Life - WRC
- Water Quality - WRC
- River Flow - WRC
- Water Quality - KCRC
- eDNA - KCRC
- Aquatic Life /SHMAK

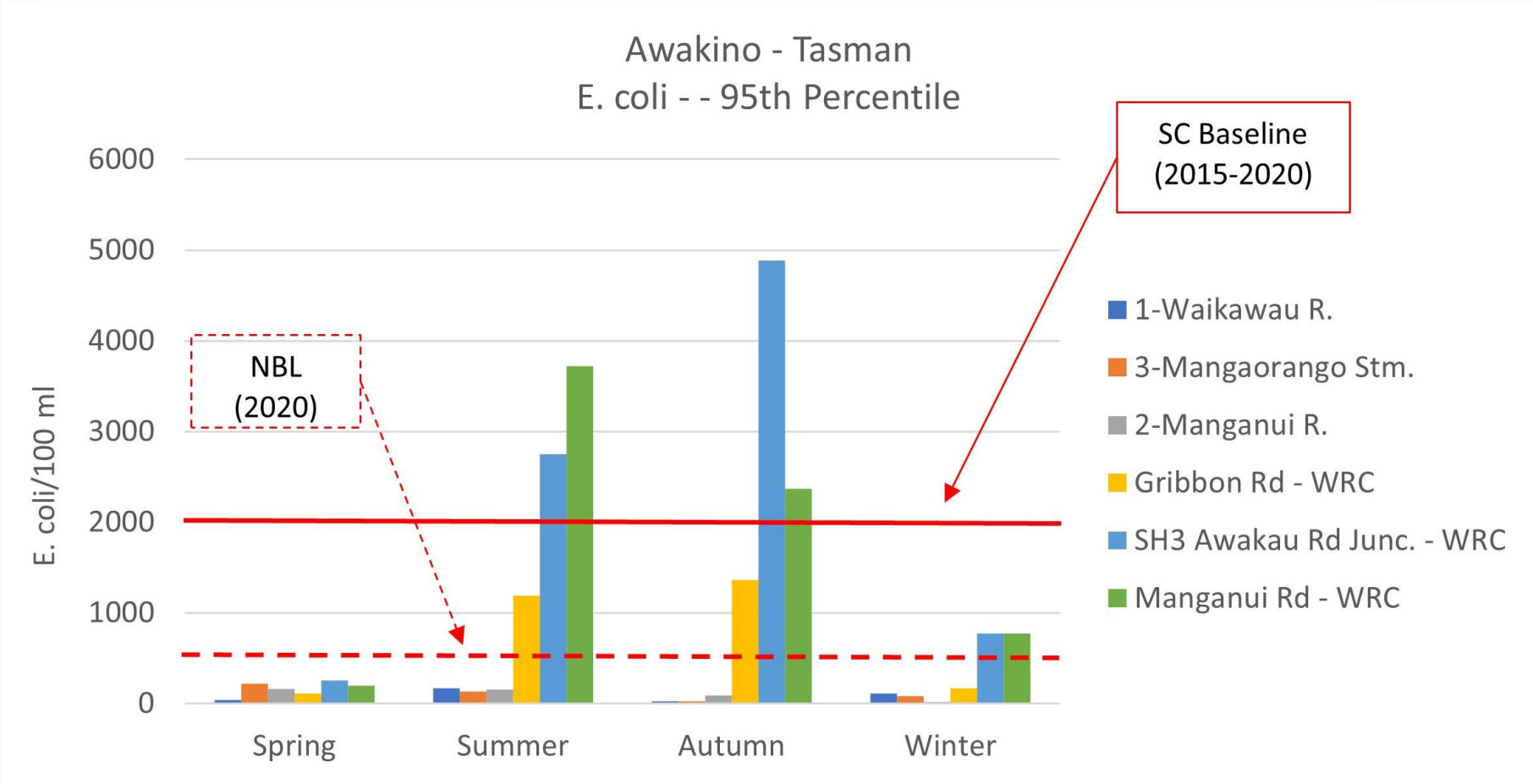
Adaptive
Environmental Consulting

AWAKINO RIVER AND TASMAN Annual Summary 2021 Labs: Hill/Analytica	Human Contact	Ecosystem Health							
		Water Quality						Sediment	
		Nitrate Toxicity (TON mg N/L)		Ammonia Toxicity (mg N/L)		Dissolved Reactive Phosphorus (mg P/L)		Water Clarity Value[1]	National Bottom Line
KCRC WQ SITES	E. coli/100 ml 95th Percentile	Median	95th Percentile	Median	95th Percentile	Median	95th Percentile	Median	
1-Waikawau R.	161 ↓	0.07 ↓	0.10 ↓	0.003 ↓	0.008 ↓	0.016 ↑	0.019 ↑	1.76 ↑	0.61
2-Manganui R.	159 ↓	0.12 ↓	0.17 ↓	0.003 ↓	0.003 ↓	0.013 ↑	0.015 ↓	1.70 ↑	0.61
3-Mangaorango Stm	207 ↓	0.51 ↑	0.68 ↑	0.004 ↓	0.010 ↓	0.011 →	0.014 ↓	1.38 ↓	0.61
WRC WQ SITES									
Gribbon Road	1365 ↓	0.07 ↓	0.13 ↓	< 0.01 →	< 0.01 →	0.011 →	0.013 ↓	2.56 ↑	2.22
SH3 Awakau Road Junction	4320 ↑	0.20 ↑	0.36 ↓	< 0.01 →	0.0136 ↓	0.008 ↓	0.011 ↓	0.92 ↓	0.61
Manganui Road	3425 ↑	0.09 ↓	0.23 ↓	<0.01 →	<0.01 →	0.011 →	0.014 ↓	1.13 ↓	0.61
Awakino R. Baseline (Jan-2015 to Aug-2020)	**2070**	**0.13**	**0.40**	**0.009**	**0.016**	**0.011**	**0.018**	**1.54**	**0.61**

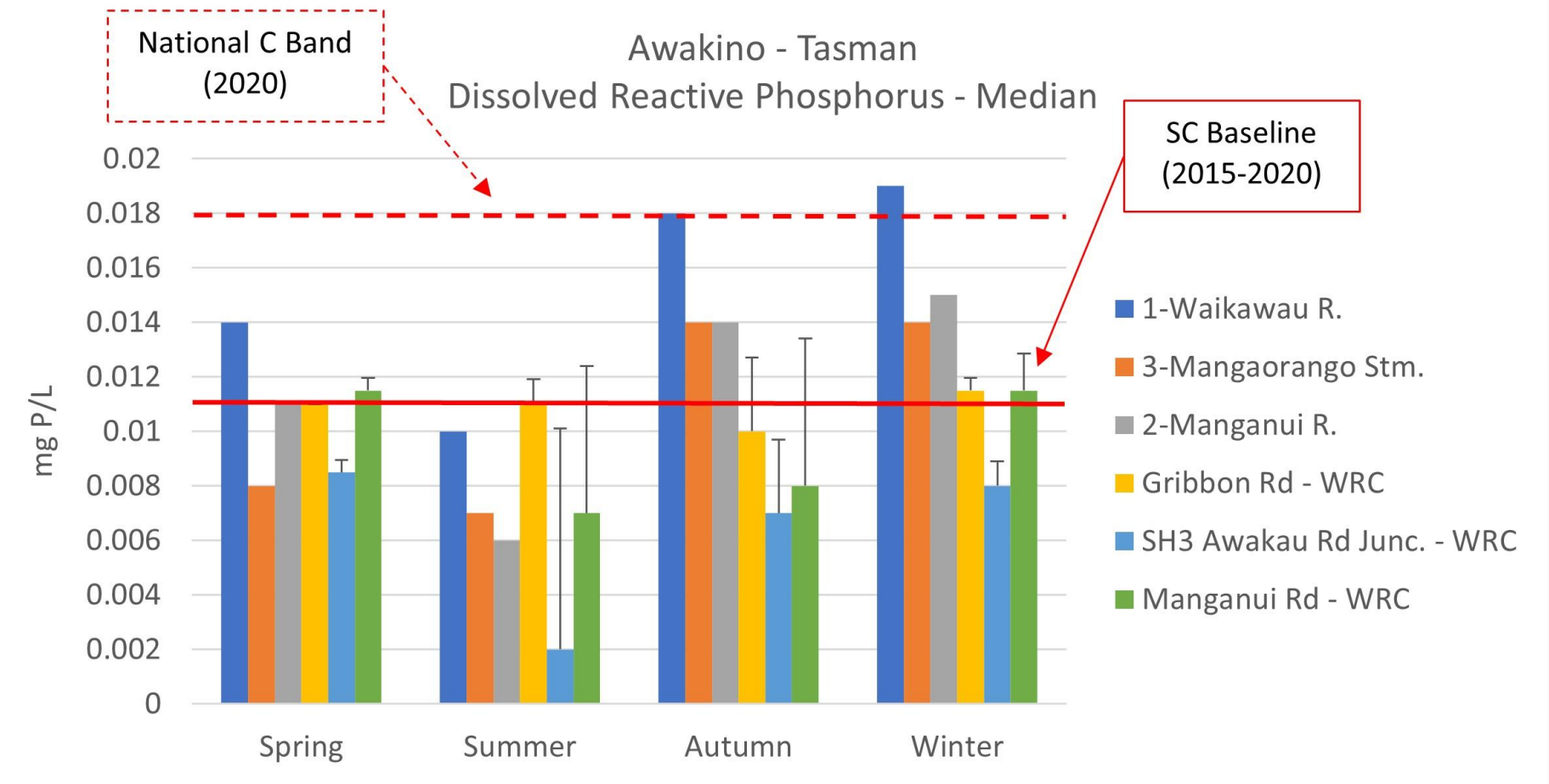
Annual Summary

Attribute Band - Current State

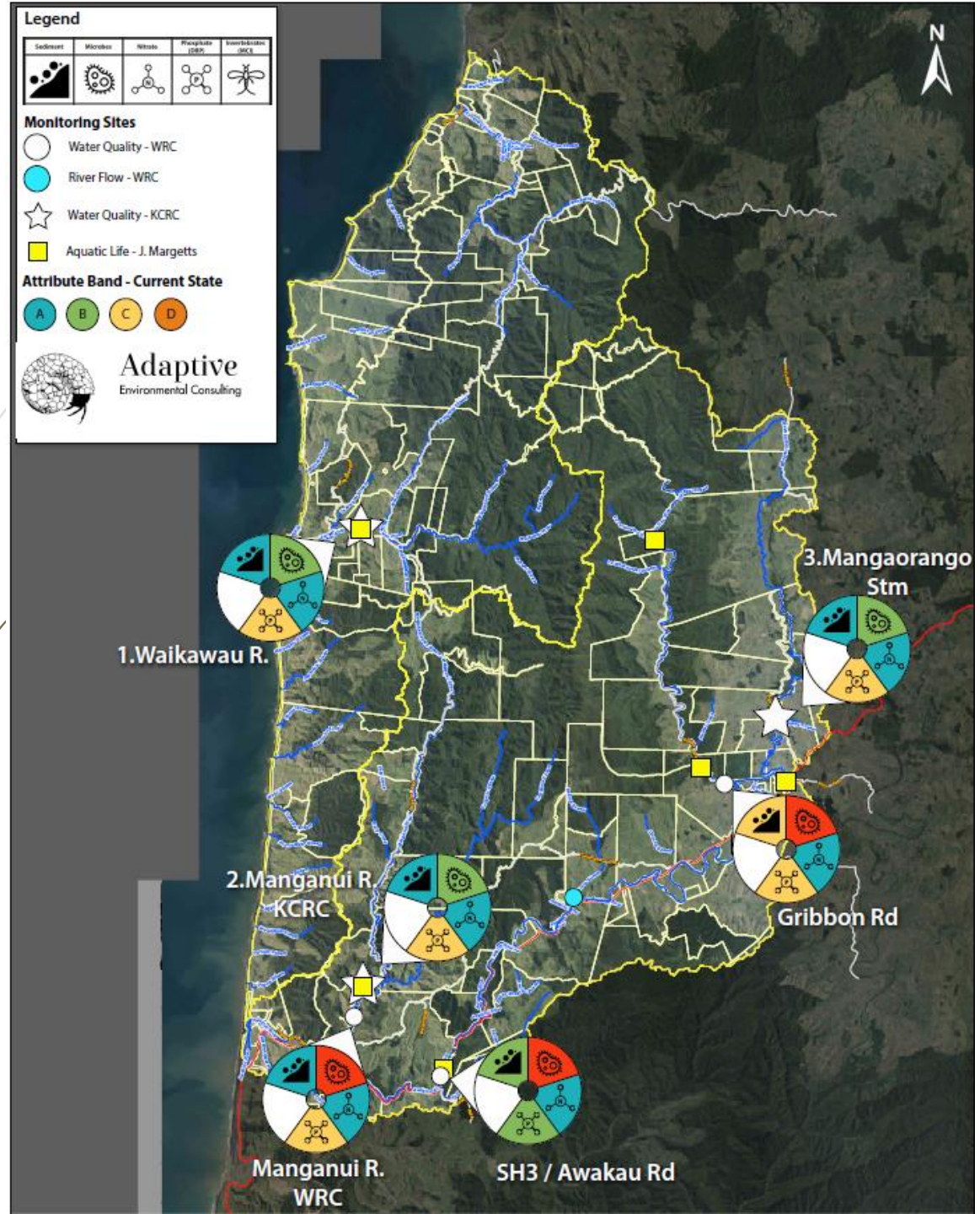
A B C D E



E. Coli – Seasonal Results



DRP – Seasonal Results

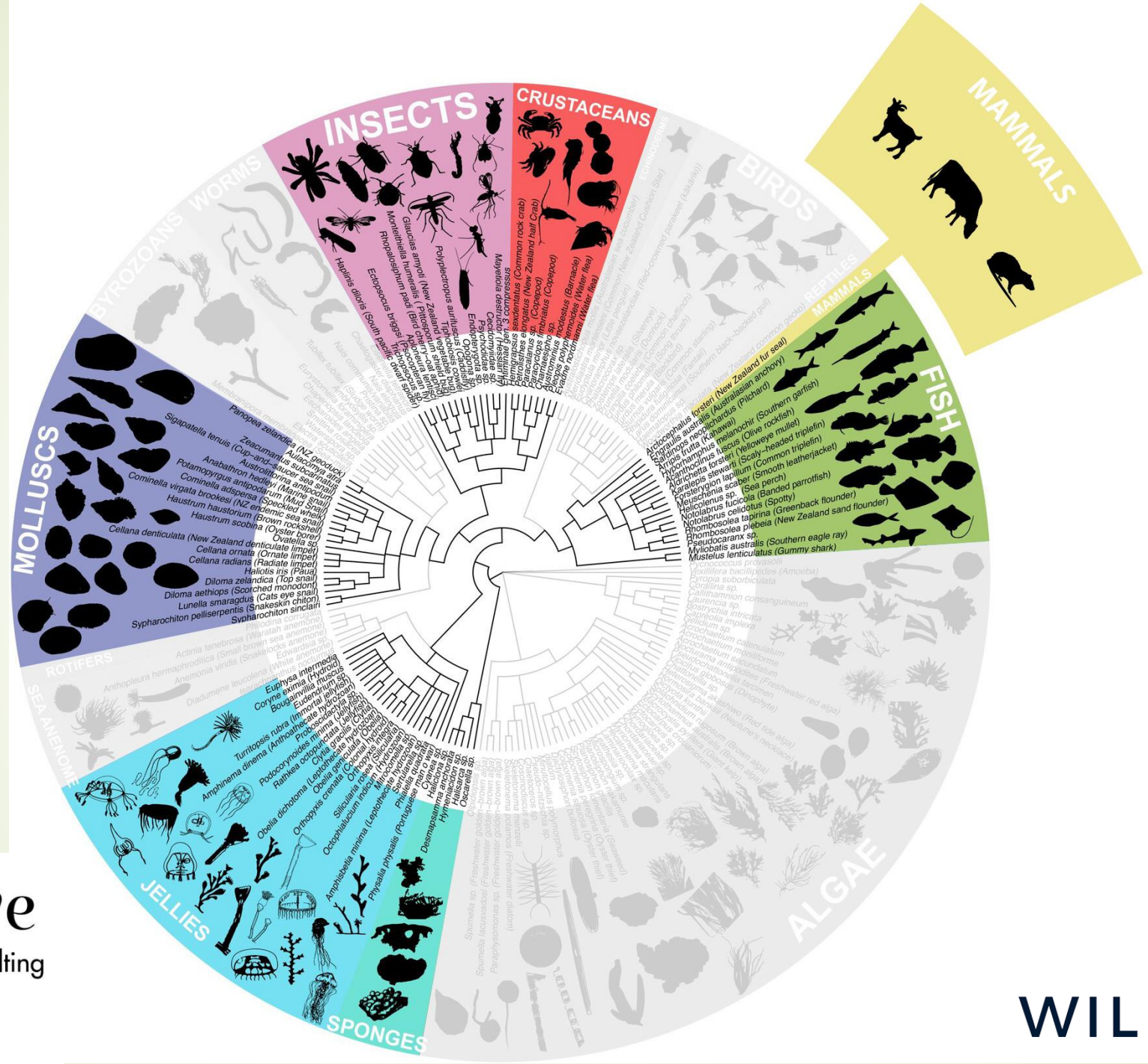


Key Results

- E. coli and DRP are the attributes to watch
- E. coli is elevated lower in the catchment
- DRP is elevated at all sites
- Water clarity is lower at Gribbon Rd
- In general WQ is highest at 1. Waikawau R. and 2. Manganui R.
- WQ is lowest at Gribbon Rd.

Environmental DNA (eDNA)

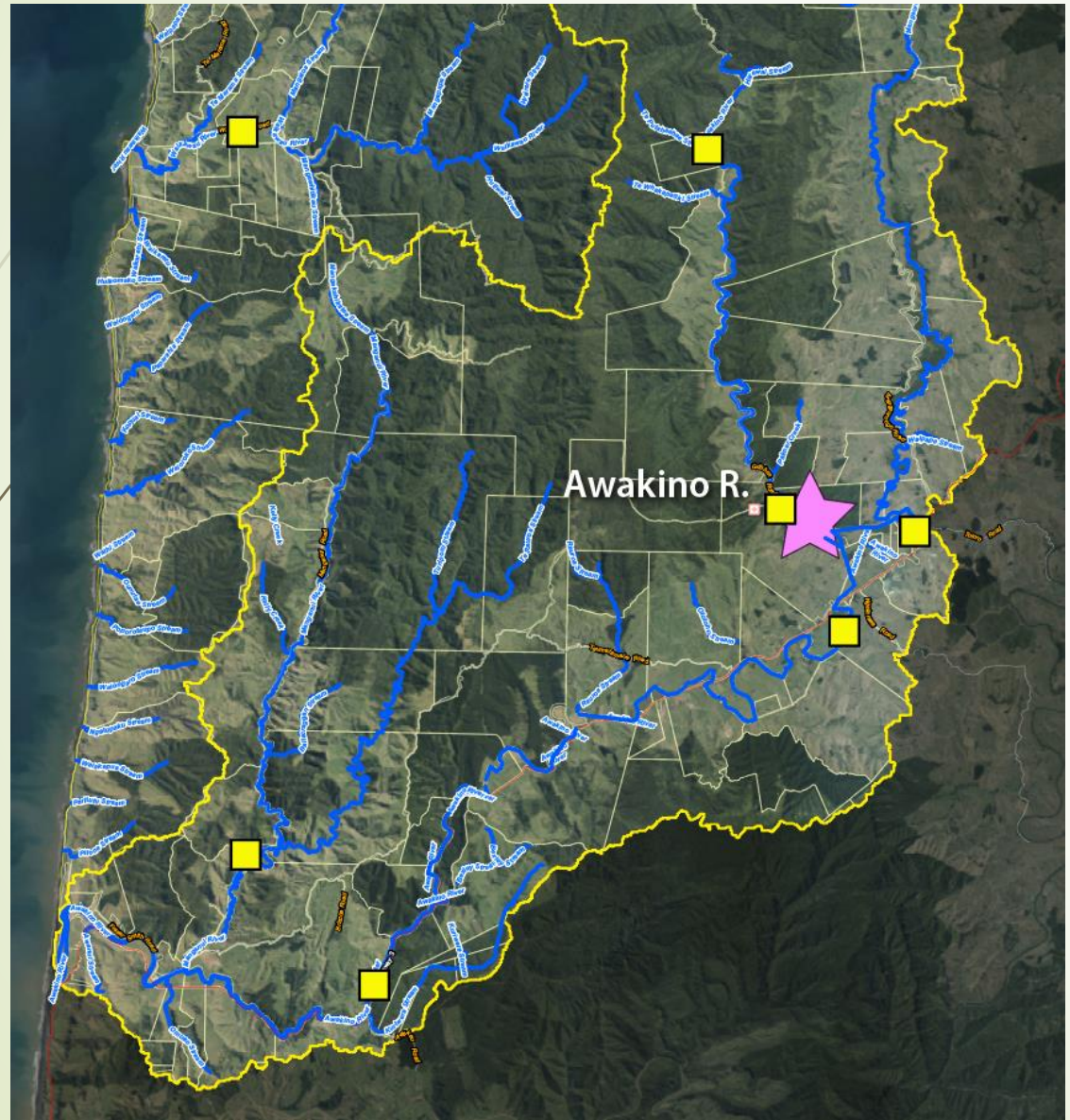
WILDERLAB



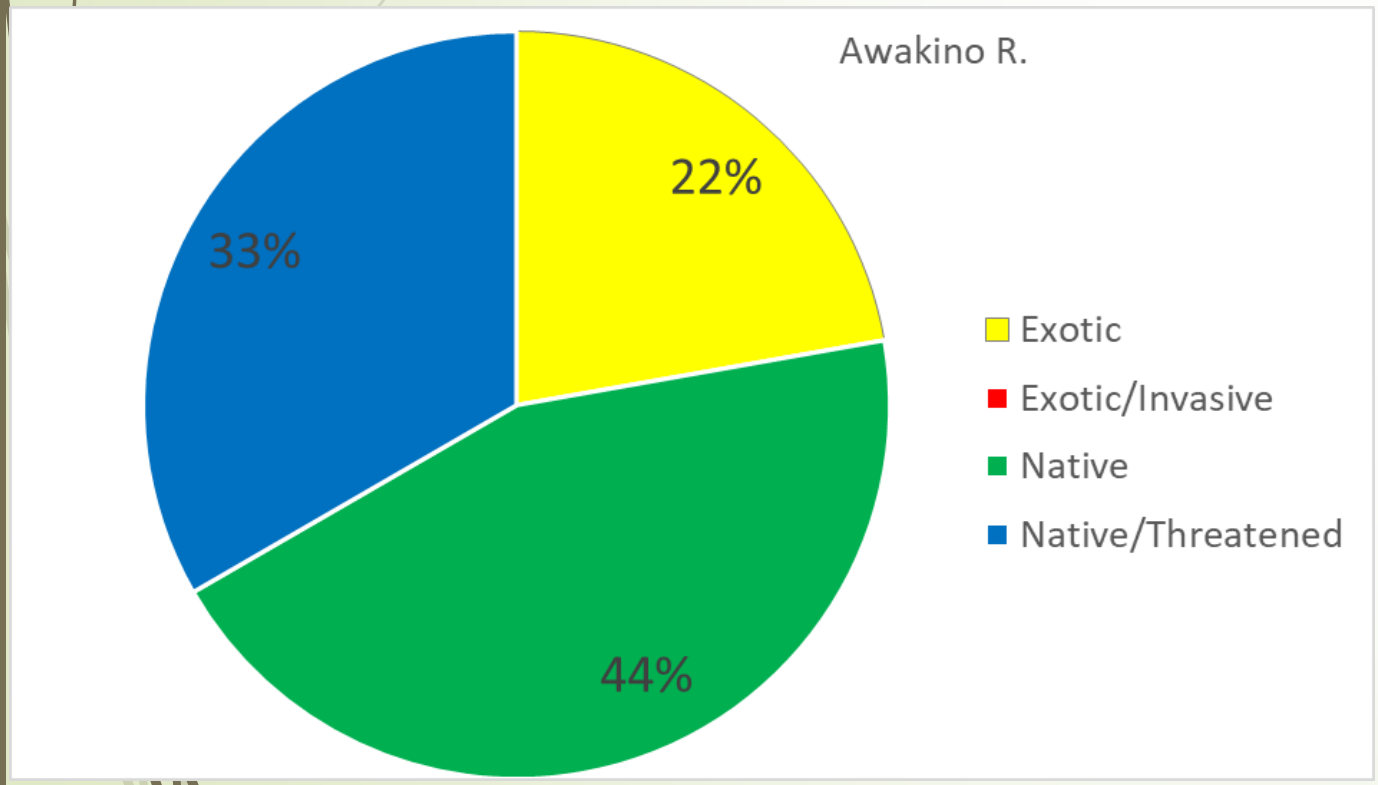
Adaptive
Environmental Consulting

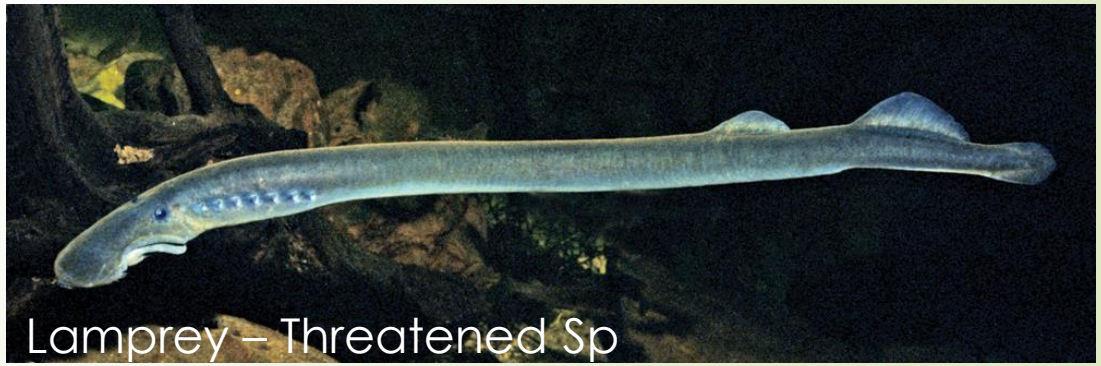
WILDERLAB

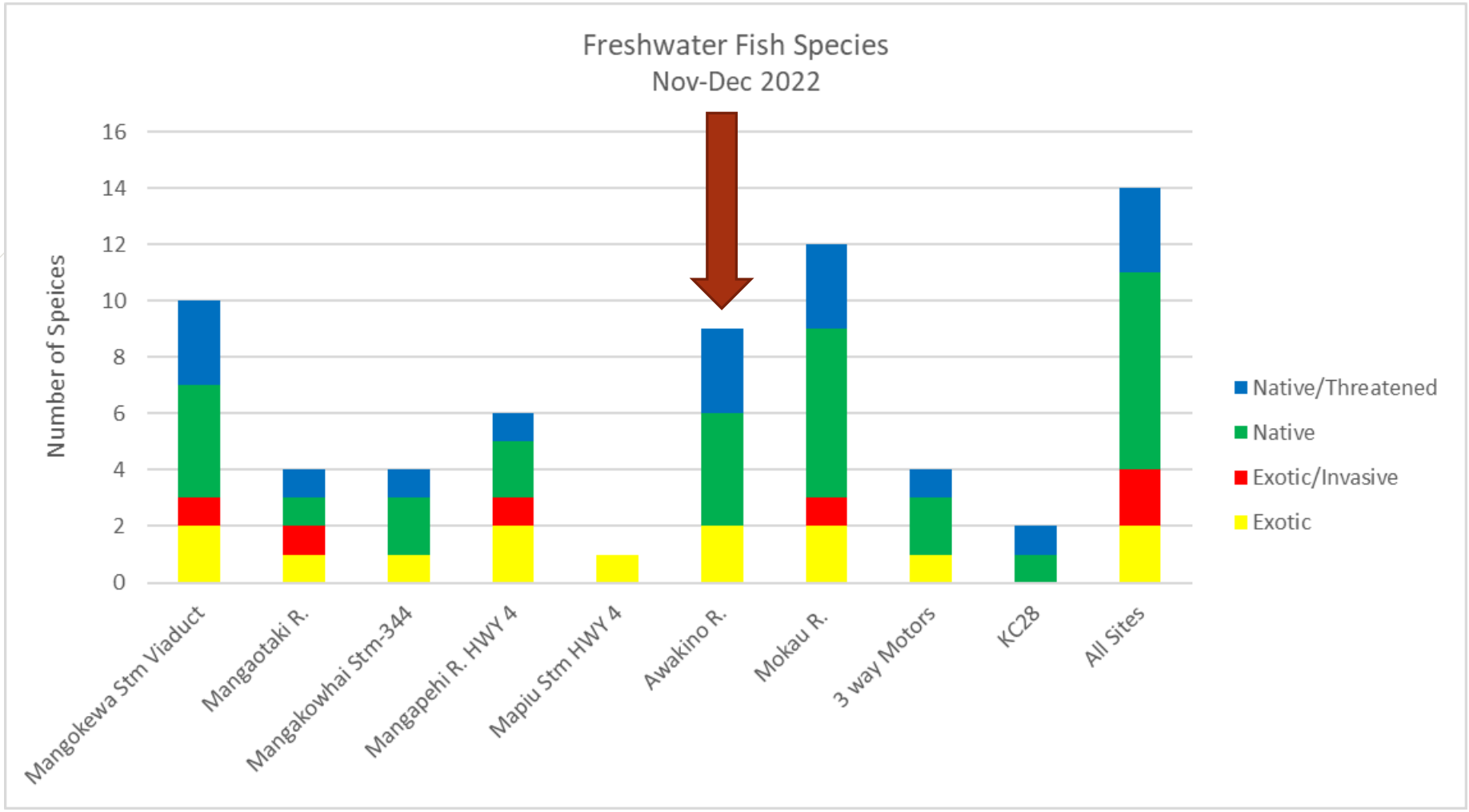
eDNA site Awakino River @ Gribbon Rd



Freshwater Fish Species
Threat status







Freshwater Fish
Number of species detected and their threat status

Adaptive
Environmental Consulting

Sensitive taxa (values of 8 or more)

Double gill mayfly (*Tepakia*)
Mayflies

Green stonefly (*Stenoperla*)
Stoneflies

Spiral cased caddis (*Helicopsyche*)
Cased caddisflies

Swimming mayfly (*Nesameletus*)
Mayflies

Stonefly (*Zelandoperla*)
Stoneflies

FACTSHEET

Tolerant taxa (values of 3 or less)

Oligochaete worms (Oligochaeta)
Segmented worms

Snail (*Physa*)
Snails

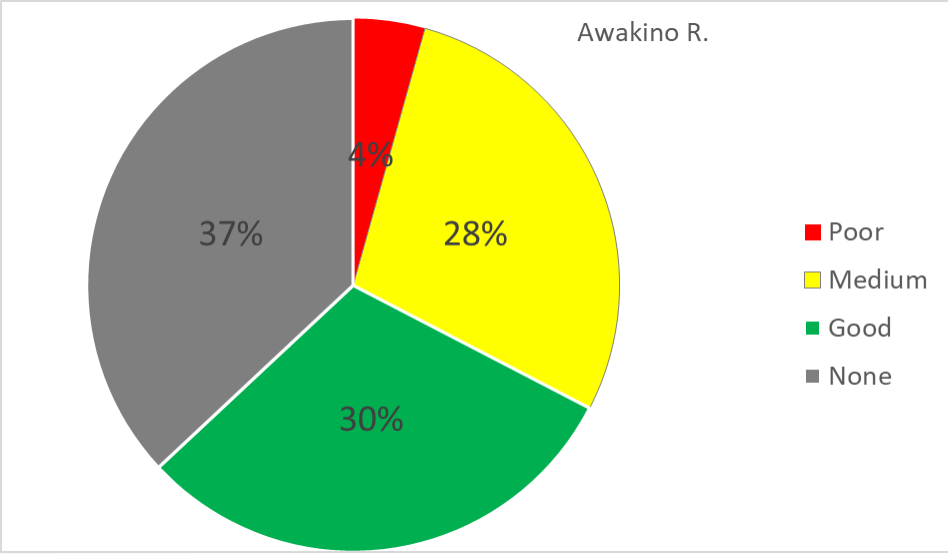
FACTSHEET

Chironomid midge (*Chironomus*)
Midges

Rat tail maggots (Syrphidae)
Other true flies

Macroinvertebrate Community Index Scores (MCI) 1 - 10

29 Nov 2021 – All Invertebrates



Sites	KC4 Mangokewa Stm Viaduct	KC11 Mangaotaki R.	KC12 Mangakowhai Stm-344	KC14 Mangapehi R. HWY 4	KC20 Mapiu Stm HWY 4	KC25 Awakino R.	KC26 Mokau R.	KC27 3 way Motors	KC28 KC28
MCI Score	119	126	109	112	112	127	105	101	121
National Grade	B	B	C	B	B	B	C	C	B

Freshwater Invertebrate Community Health Index (MCI) eDNA Results 2021

Awakino River
Site Characteristics

Riparian vegetation

- Mixture of native, gorse and exotic grasses

Stock Access

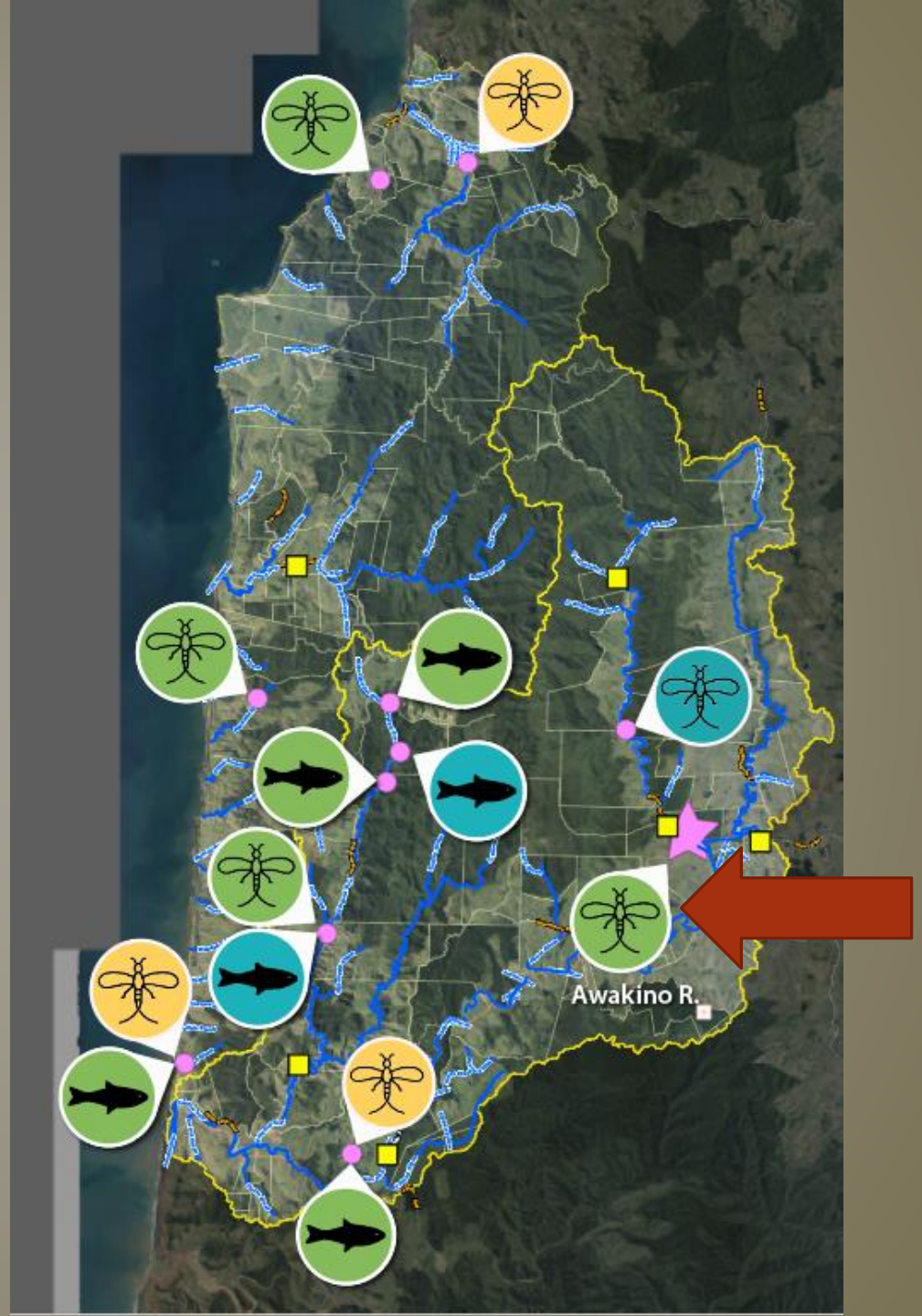
- Goats & deer on unfenced, northern side

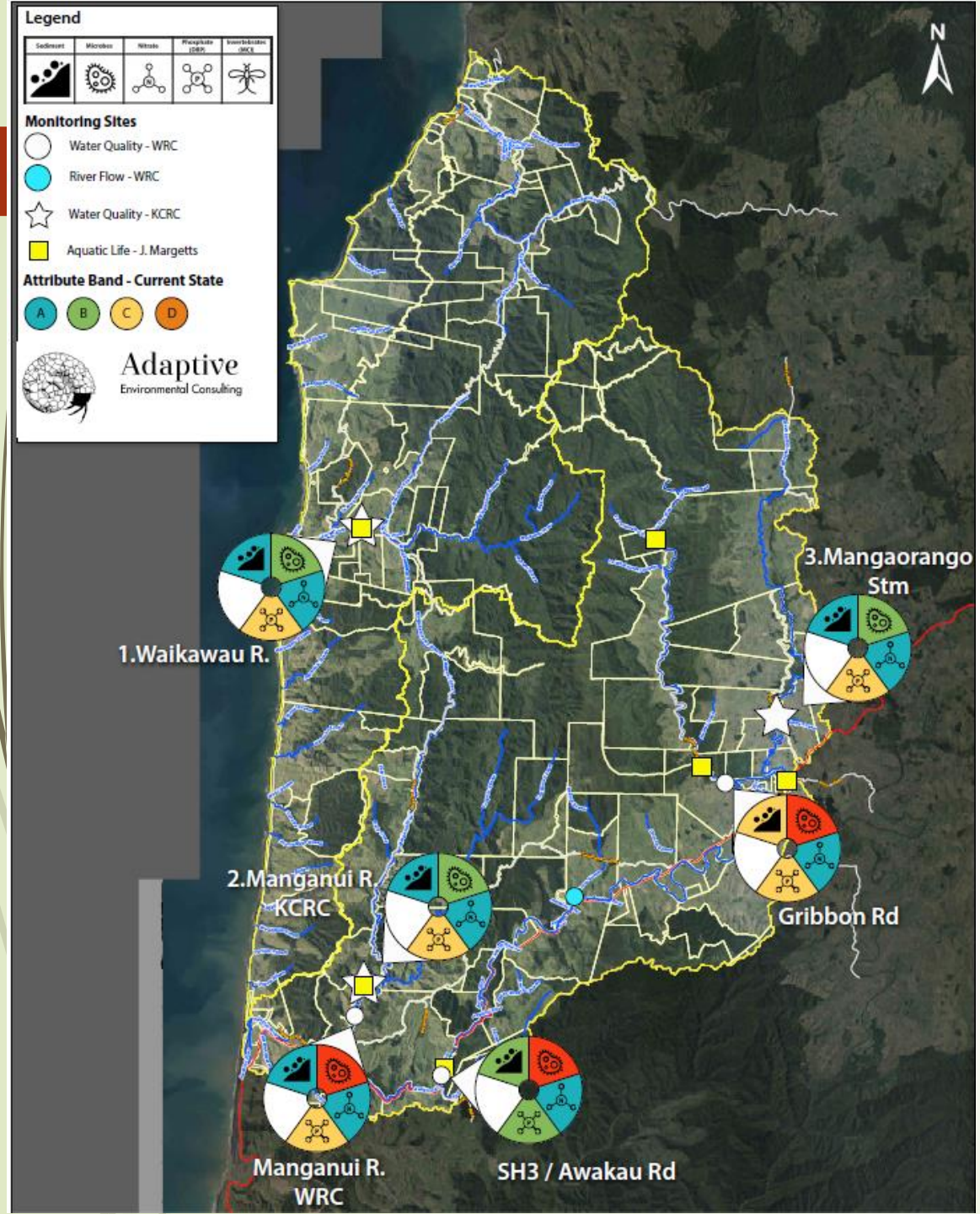
Water temperature

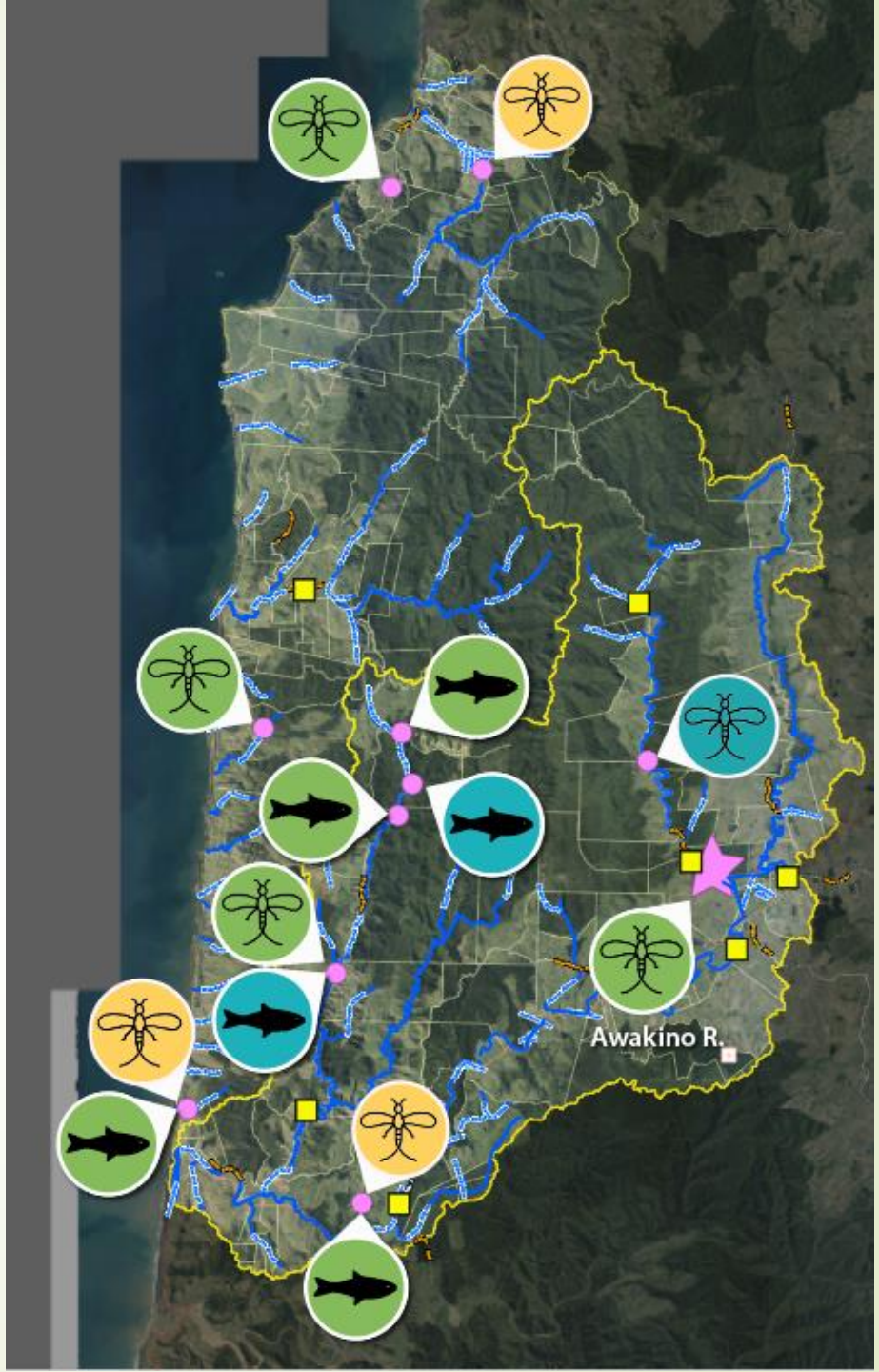
- Feb = 18.6 °C

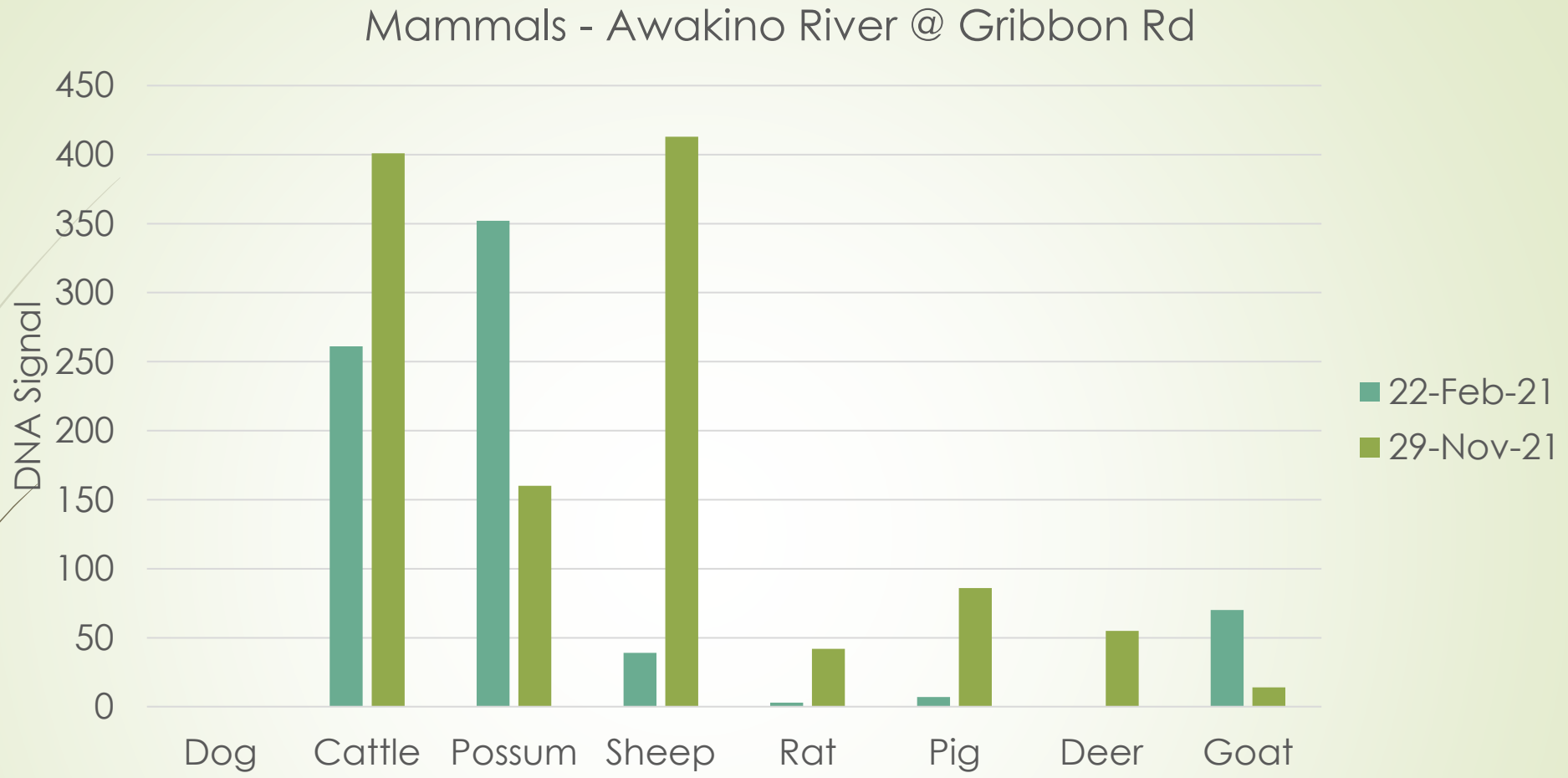
Conductivity (µS/cm)

- Feb = 103




Legend
Monitoring Sites
Water Quality - WRC
River Flow - WRC
Water Quality - KCRC
Aquatic Life - J. Margetts
Attribute Band - Current State
A
B
C
D
Adaptive
Environmental Consulting
N
1.Waikawau R.
2.Manganui R. KCRC
3.Mangaorango Stm
Gribbon Rd
Manganui R. WRC
SH3 / Awakau Rd


Awakino R.



Mammalian eDNA Signal Strength

Ecological Monitoring using SHMAK
John Margetts

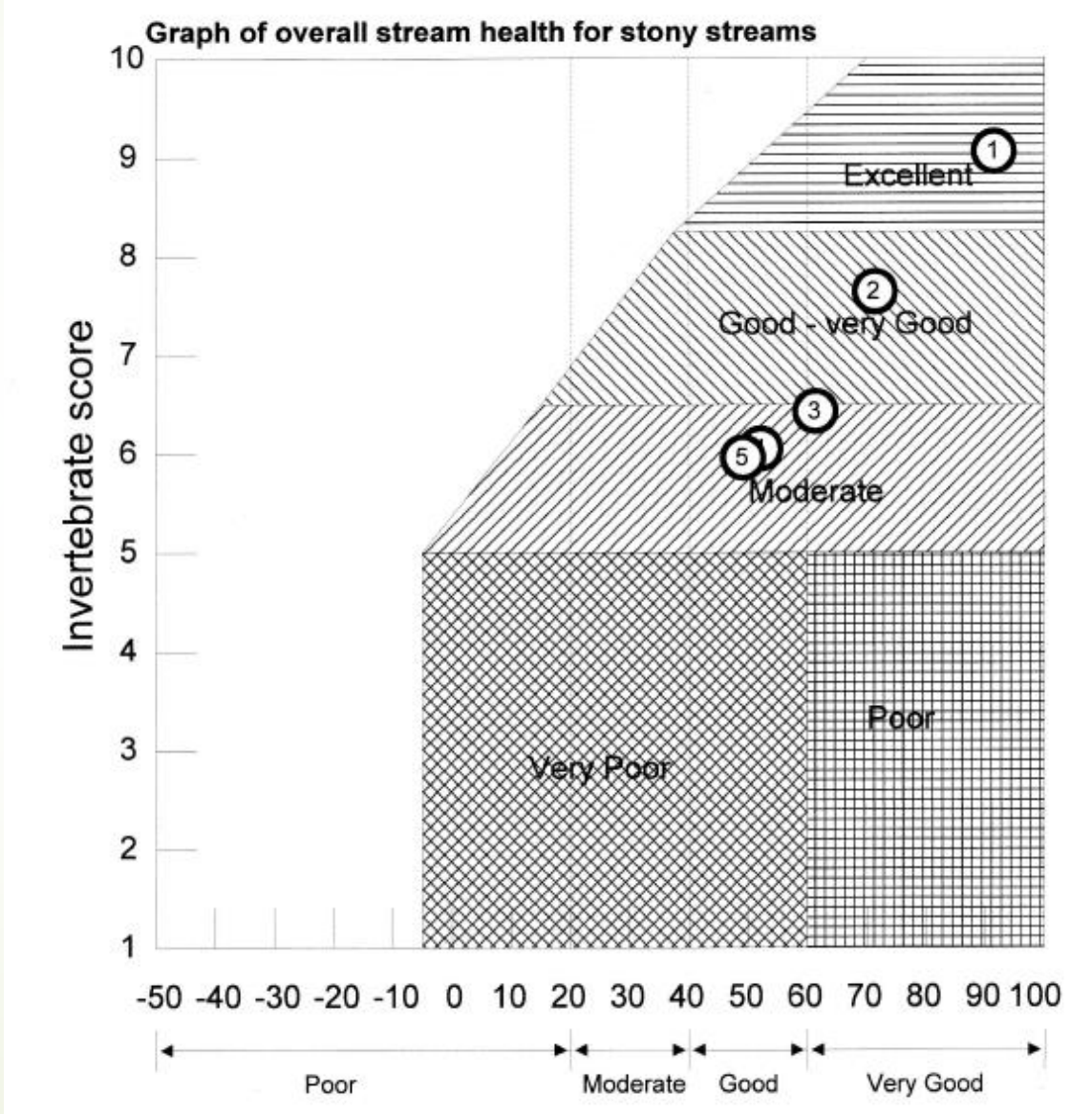
- 7 sites
- 5 sites in the Awakino R. catchment
- 2 sites in the Manganui R. catchment

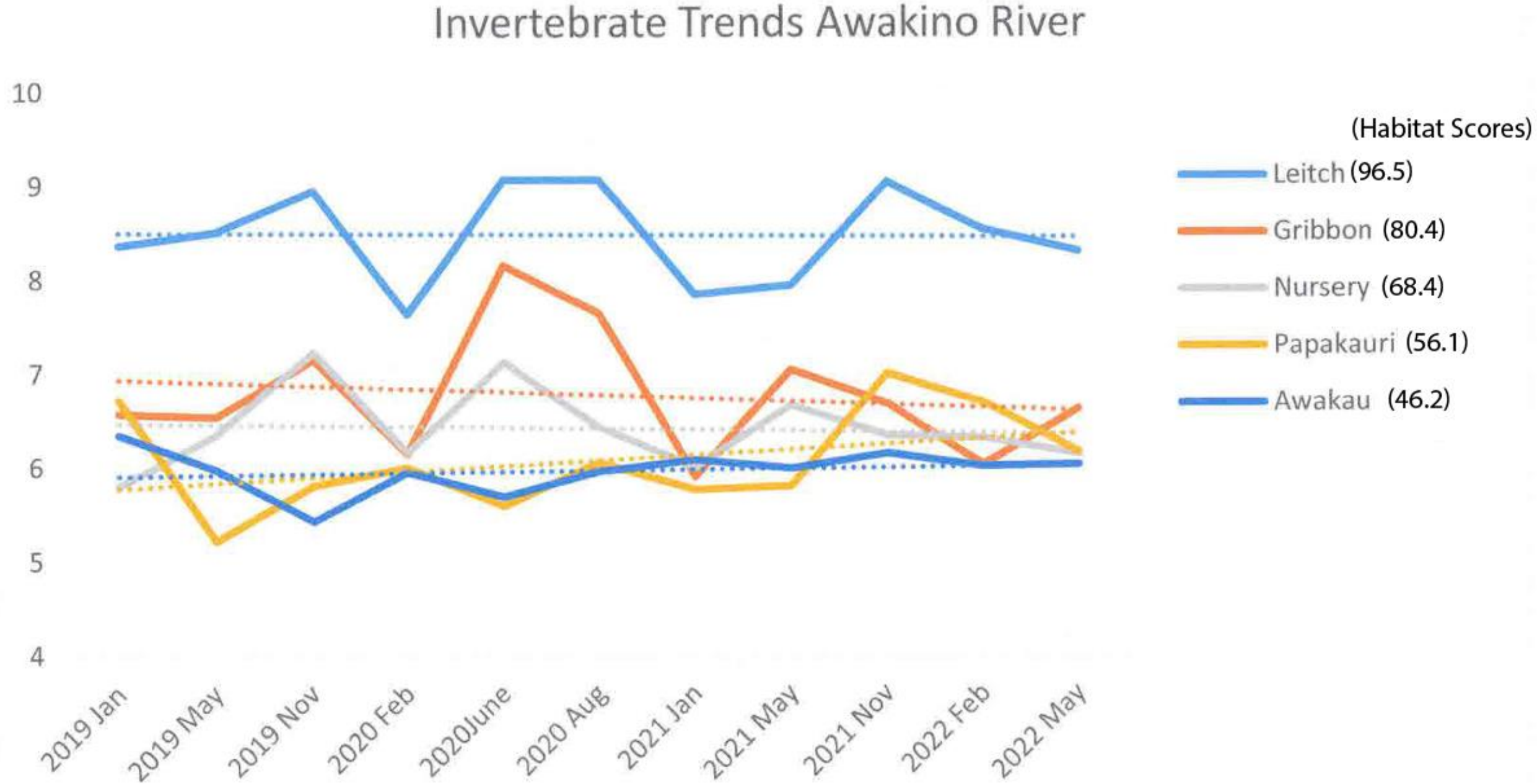
- Monitoring Started in 2018
- 3 x per year

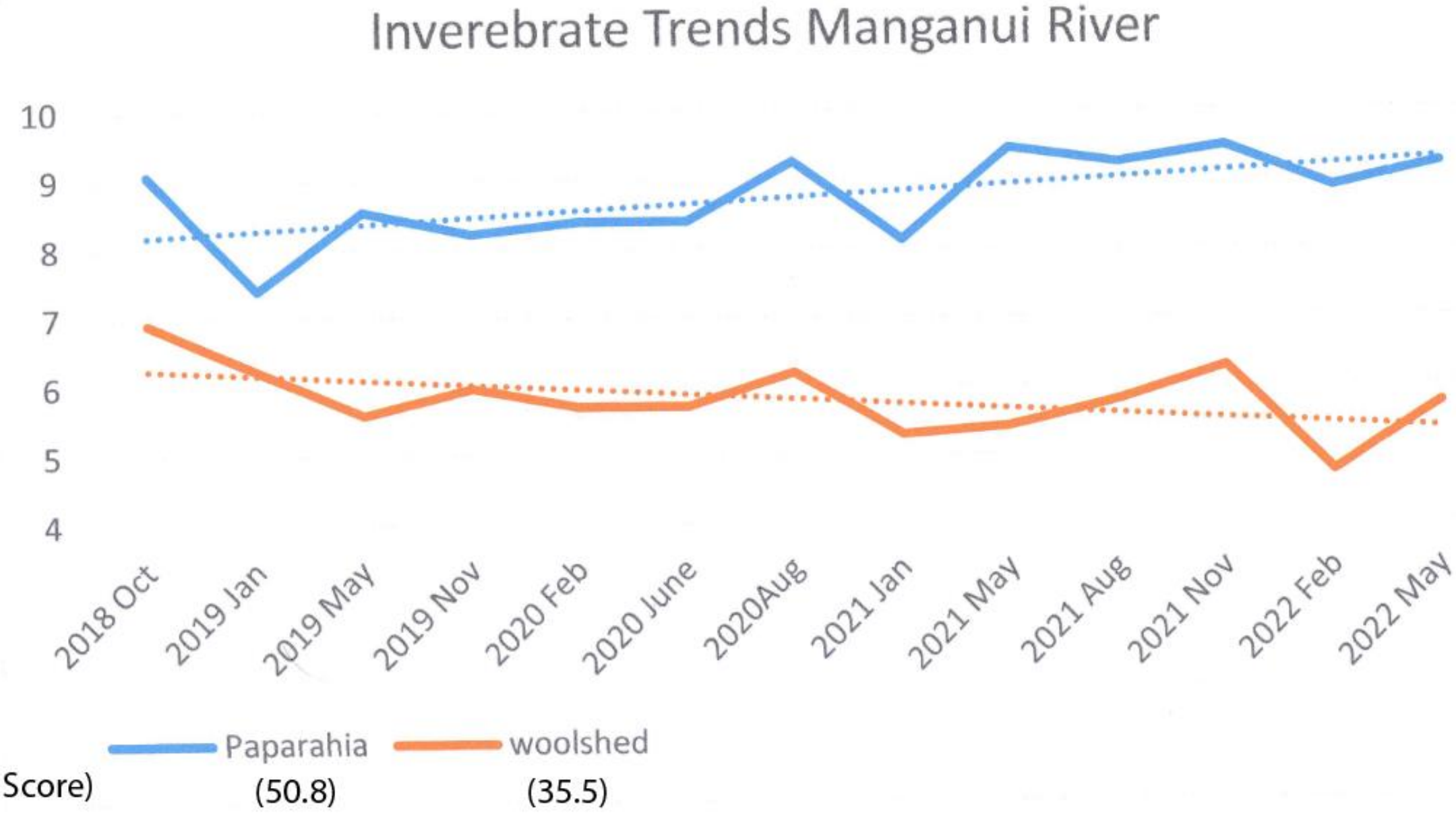
Example SHMAK Graph Awakino

Habitat score

No.	File	Habitat	Invertebrate	Periphyton
1	A Leitch 9 10 20	91.5	9.06	8.5
2	B Gribbon 10 10 20	71.4	7.64	7.
3	C Nursery 10 10 20	61.4	6.43	7.
4	D Papakauri 10 10 20	52.1	6.05	10.
5	E Awakau 10 10 20	49.2	5.96	10.




Invertebrate Trends Awakino River
10
9
8
7
6
5
4
2019 Jan
2019 May
2019 Nov
2020 Feb
2020June
2020 Aug
2021 Jan
2021 May
2021 Nov
2022 Feb
2022 May
(Habitat Scores)
Leitch (96.5)
Gribbon (80.4)
Nursery (68.4)
Papakauri (56.1)
Awakau (46.2)



(Habitat Score) (50.8) (35.5)

Summary Points - Awakino & Tasman

Summary of 2021 KCRC Water Quality

- E. coli and Phosphorus (DRP) are the key attributes to investigate
- Water clarity is lowest at Gribbon Rd
- Phosphorus may be naturally elevated in the catchments
- In general, WQ is highest at 1. Waikawau R. (Tasman) and 2. Manganui R.
- WQ is lowest at Gribbon Rd.

Water Quality Baseline 2015-20

- E.coli, DRP and Sediment were elevated in Awakino River
- No data available for Tasman

eDNA

- Good native fish community, no invasive exotic species recorded
- MCI is 127 = B Grade @ Gribbon Rd

How Farm Management Influences Catchment Health

Management Actions

https://www.farmmenus.org.nz/drystock-farms/

Impact	N	P, Sed, E. coli
High	>25%	>50%
Medium	10-25%	20-50%
Low	<10%	<20%

Actions - Drystock Farms	Greatest Potential Reduction/WQ Benefit			
	Sediment	E. coli	N	P
Nutrient Management	20-50%	-	10-25%	>50%
Stock Management	>50%	20-50%	10-25%	>50%
- To improve herd fertility and finishing rate	-	-	10-25%	<20%
- To reduce erosion & soil damage	>50%	20-50%	<10%	>50%
Planting to Reduce Erosion	>50%	20-50%	10-25%	20-50%
Managing Critical Source Areas	>50%	>50%	<10%	>50%
Riparian Management	>50%	>50%	10-25%	>50%
- Sediment Traps	>50%	<20%	<10%	>50%
- Provide deer wallows away from waterways	>50%	>50%	<10%	20-50%
Management of Fodder Crop Areas	>50%	20-50%	>25%	>50%
FEP - Good farmer buy-in	>50%	>50%	>25%	>50%
FEP - Poor buy-in	<20%	<20%	<10%	<20%

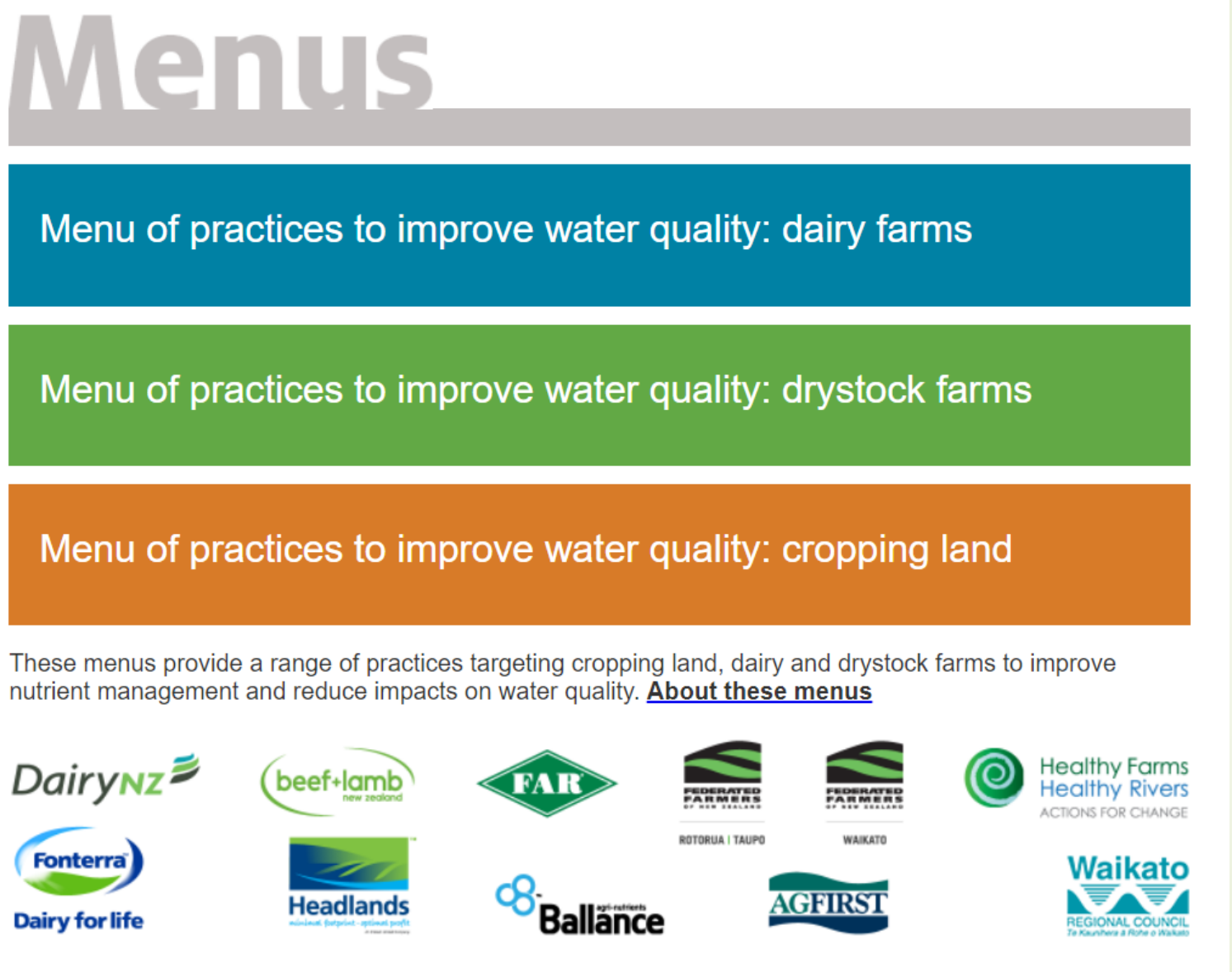
Management Actions

https://www.farmmenus.org.nz/dairy-farms/

Impact	N	P, Sed, E. coli
High	>25%	>50%
Medium	10-25%	20-50%
Low	<10%	<20%

Actions - Dairy Farms	Greatest Potential Reduction/WQ Benefit			
	Sediment	E. coli	N	P
Nutrient Management	-	-	10-25%	20-50%
Riparian Management	>50%	>50%	10-25%	20-50%
- Sediment Traps	20-50%	<20%	<10%	20-50%
- Constructed wetlands	20-50%	20-50%	10-25%	20-50%
Effluent management	20-50%	>50%	10-25%	>50%
Feed pads - Off Pasture Options	>50%	>50%	>25%	>50%
Good Grazing Management - On Pasture Options	20-50%	20-50%	<10%	20-50%
Managing Critical Source Areas	>50%	>50%	>25%	>50%
Cropping Management	>50%	20-50%	>25%	>50%
FEP - Good farmer buy-in	>50%	>50%	>25%	>50%
FEP - Poor buy-in	<20%	<20%	<10%	<20%

- **Reference**



https://www.farmmenus.org.nz/

Drystock farms

Click on the arrows on the variables in the header row to reorder the farm practices based on that variable. Use this menu in conjunction with your consultant or your Land Environment Plan.

Management area	On farm practice	N	P	Sed	Pa	Cost	Benefit	Factors to consider
Cropping management	Actively manage grazing of winter crop areas to reduce risk of N leaching, run off, soil loss and compaction	L	M	M	M	$$	$$$	Graze from top to bottom of paddock contour. Avoid leaving stock on during wet periods, for long periods, or concentrated on small sections of the crop.
Planting to reduce erosion	Afforestation of steep southern faces (above Land Use Capability 6e)	M	M	M	-	$$ - $$$	$ - $$	Protects areas of greatest erosion risk and replaces low growing slopes with long term productive investment. Best suited to areas with large weed burdens and minimal profitability. Profitability depends on forestry regime and market. Any afforestation plan should include a harvest plan to ensure all land is harvestable.

Soil Damage - Pugging

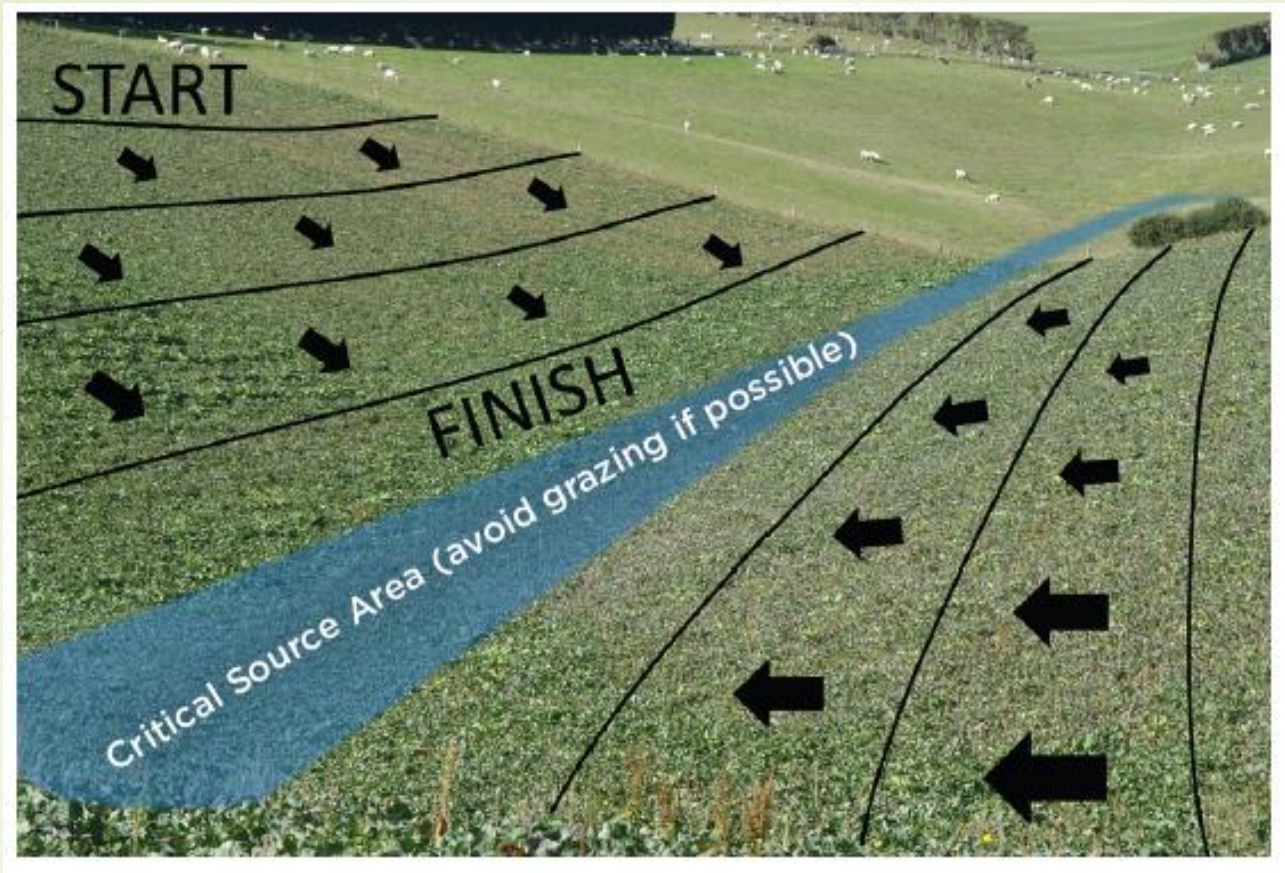
Source: Keith Betteridge, AgResearch

Source: Keith Betteridge, AgResearch

Overgrazing & soil damage

- Reduces spring pasture production by up to 80%
- Can take 3 or more years to recover.

Click here to find out more about soil erosion processes in New Zealand
Click here to find out more about soil and pasture management
Click here to learn about 11 ways to reduce pugging in your pasture

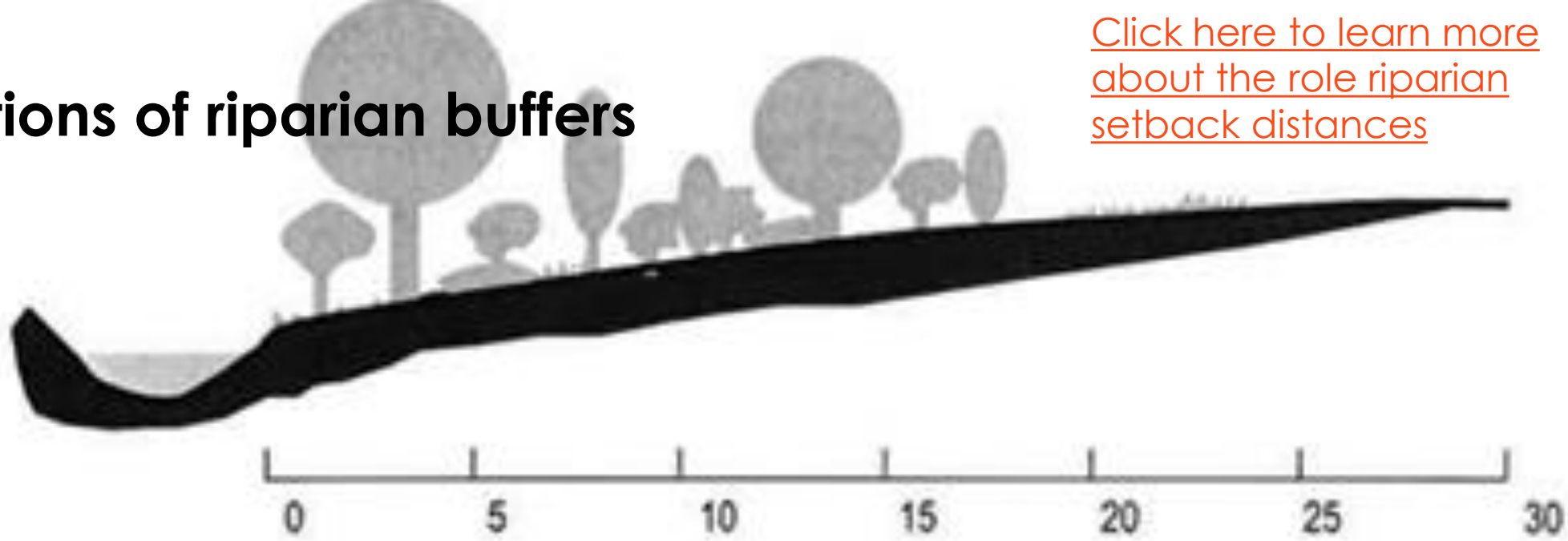


https://beeflambnz.com/wintergrazing/pre-grazing

Take action to reduce potential losses of sediment, nutrients and E. coli to waterways during wetter months

Functions of riparian buffers

[Click here to learn more about the role riparian setback distances]



Livestock damage
Fish habitat
Bank stability
Flood control
Shade
Leaf input
Filtration
Wood input
Nutrient uptake
Wildlife habitat

Diagram from conference paper by J Quinn (2012)

Riparian management - results from New Zealand

Riparian management schemes assessed, showing measures of water quality and stream health recorded as better (+), worse (–), or no change (=) in the buffer compared to the control reach for each variable.

Site	Time since planting (yr)	Planted length (m)	Average buffer width (m)	Difference in buffer relative to pasture control reach: Phosphorus (over 10% change in dissolved P)	Nitrogen (over 10% change in dissolved N)	Faecal inputs (over 10% change in *E. coli*)	Visual clarity (over 10% change)	Mean temp-perature (more than 1 deg change)	Stability (change in Pfankuch class)**	Invertebrates (change in QMCI class)***
Raglan	2	200	12.7	+	+	–	=	=	+	=
Matarawa	3	300	3.5	–	=	+	+	=	+	–
Little Waipa	4	660	10.6	+	=	+	+	–	=	=
Waitetuna	6	1600	7.2	=	–	nd	–	=	=	=
Mangawara	8	200	15.5	=	=	=	=	nd	=	+
Tapapakanga	10	2000	11.4	+	+	+	+	–	=	–
Kakahu*	20	3600	21	+	+	nd	+	+	=	+
Waitomo	20	100	18.8	=	=	–	–	=	=	=
Taupo*	24	4200	75	+	–	nd	+	+	+	+

Click here to view source publication

What can we do to improve catchment health?

- Retire & plant marginal land
- Exclude stock from streams, wetlands & boggy areas
- Plant retired riparian margins
- Manage nutrients & effluent conservatively
- Identify and address CSAs