

# WAITIAKI



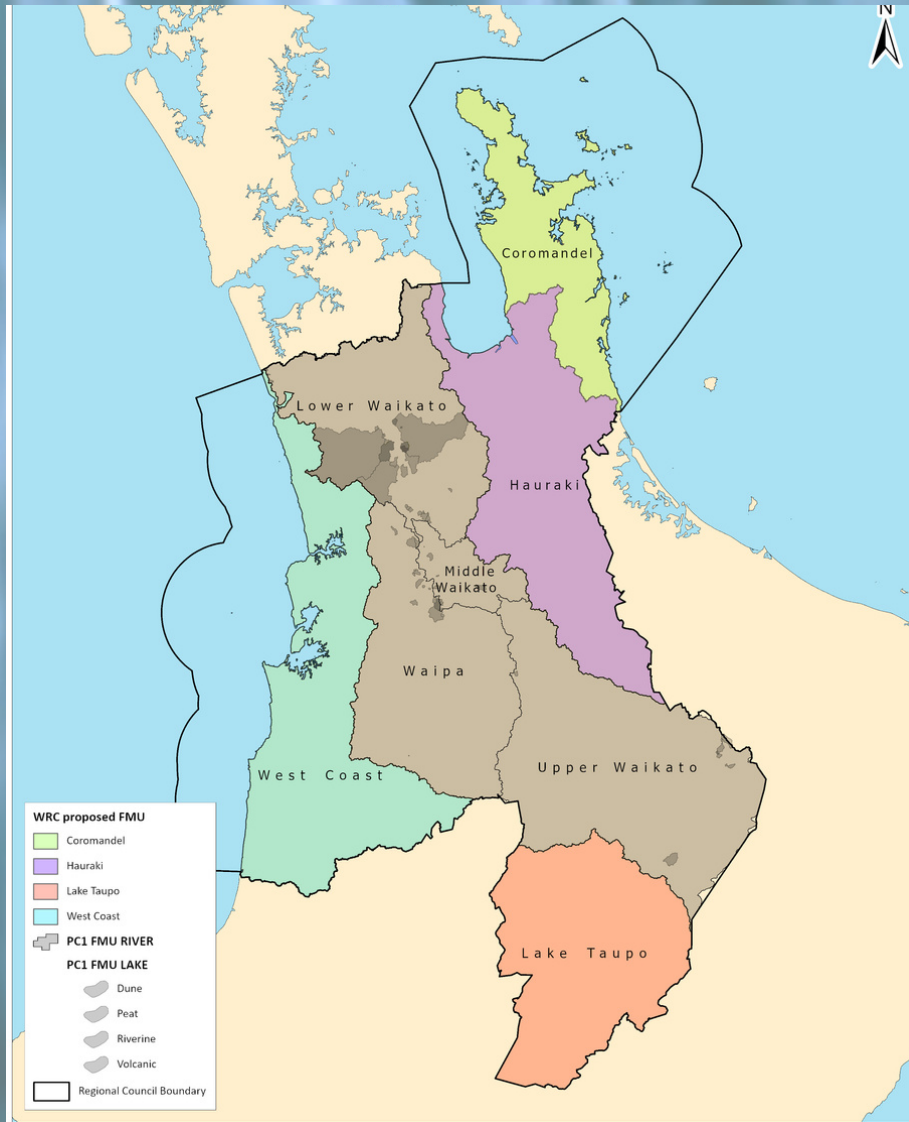
National Objectives Framework:  
Water Quality step-by-step Exemplar

# National Objectives Framework

Steps to achieve long term visions for our wai

1. Freshwater Management Units (FMU's)
2. Freshwater Values for each FMU
3. Environmental Outcomes for each Value
4. Attributes for each Value & Baselines
5. Target Attribute States
6. Limits & Action Plans

# Freshwater Management Units



- Subset of FMU = Freshwater Management Zone
- Identify your zone
- Identify your wai

# Freshwater Values

## Compulsory Values:

1. Ecosystem Health
2. Human Contact
3. Threatened Species
4. Mahinga Kai

## 5 components of Ecosystem Health:

1. Water Quality
2. Water Quantity
3. Habitat
4. Aquatic Life
5. Ecological Processes

# Environmental Outcomes



## Water Quality:

- The health and wellbeing of our wai is protected and restored
- Water quality is maintained or improved where there is degradation

# Attributes



## Attributes for Ecosystem Health (Water Quality):

- Ammonia (toxicity)
- Nitrate (toxicity)
- Visual Clarity /  
Suspended Fine Sediment
- E.coli
- Dissolved Reactive Phosphorus

# Water Quality

## crash course



### Nitrogen

2 types of Nitrogen:

Organic Nitrogen - Total Kjeldahl Nitrogen (naturally occurring) &

Inorganic Nitrogen:  
Nitrates (which leach)  
Ammonia (usually point source)  
indicative of pollution.

Indicative of land use in the catchment.

Excessive Nitrogen can cause decline in water quality creating toxic conditions, making habitat unlivable for aquatic species and cause algal blooms.

# Water Quality

## crash course

### Clarity - Visual & Turbidity

Visual Clarity - field measurement  
using

Secchi Disc & periscope.

Determines clarity by measuring  
distance one can see under the wai.

Turbidity - laboratory measurement  
using Turbidity meter.

Determines clarity of sample by  
measuring amount of light that can  
pass through



# Water Quality

## crash course

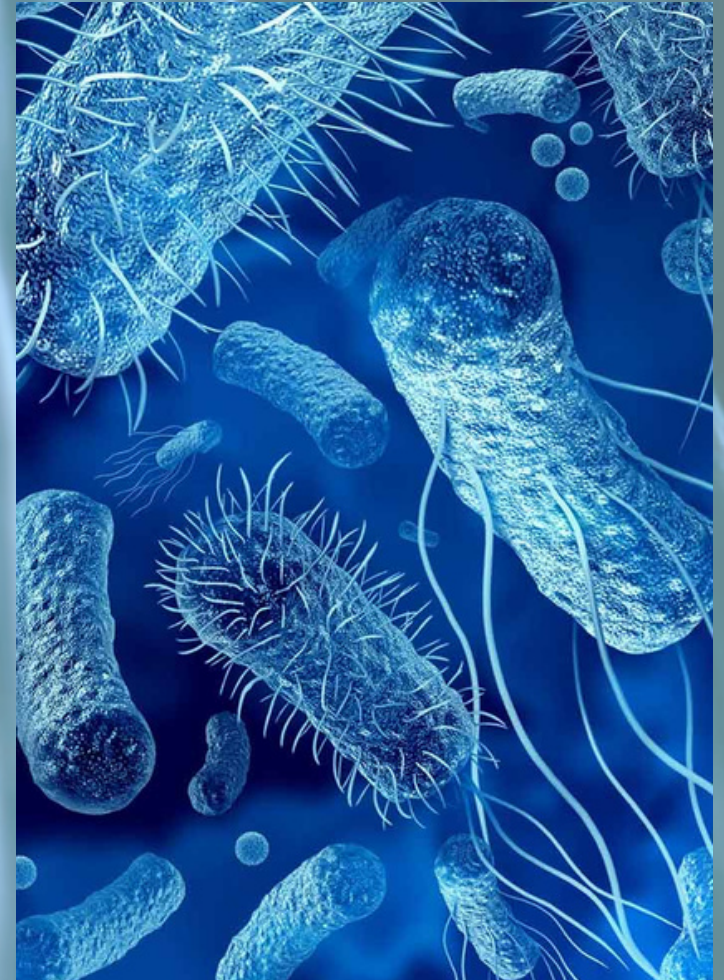
E-coli

*Escherichia coli*

Bacteria commonly found in the lower  
gut of warm blooded animals  
(mammals & birds)

Indicator of fecal contamination

Ingestion of E-coli can make you  
mauiui



# Water Quality

## crash course



### Phosphorus

2 types of Phosphorus: Total Phosphorus & Dissolved Reactive Phosphorus (ready for use by plants, can be indicative of pollution, erosion or Geothermal activity).

Indicative of land use in the catchment.

Excessive Phosphorus can cause increased growth of aquatic plants and algae which can choke waterways and deplete the wai of oxygen leading to eutrophication.

**Table 6 – Nitrate (toxicity)**

| Value (and component)                                                                                                                                                                                                                                                                                                                                                                                                               | Ecosystem health (Water quality)                                 |                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------|
| Freshwater body type                                                                                                                                                                                                                                                                                                                                                                                                                | Rivers                                                           |                        |
| Attribute unit                                                                                                                                                                                                                                                                                                                                                                                                                      | mg NO <sub>3</sub> – N/L (milligrams nitrate-nitrogen per litre) |                        |
| Attribute band and description                                                                                                                                                                                                                                                                                                                                                                                                      | Numeric attribute state                                          |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                     | Annual median                                                    | Annual 95th percentile |
| <b>A</b><br>High conservation value system. Unlikely to be effects even on sensitive species.                                                                                                                                                                                                                                                                                                                                       | ≤1.0                                                             | ≤1.5                   |
| <b>B</b><br>Some growth effect on up to 5% of species.                                                                                                                                                                                                                                                                                                                                                                              | >1.0 and ≤2.4                                                    | >1.5 and ≤3.5          |
| <b>National bottom line</b>                                                                                                                                                                                                                                                                                                                                                                                                         | <b>2.4</b>                                                       | <b>3.5</b>             |
| <b>C</b><br>Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.                                                                                                                                                                                                                                                                                                                       | >2.4 and ≤6.9                                                    | >3.5 and ≤9.8          |
| <b>D</b><br>Impacts on growth of multiple species, and starts approaching acute impact level (that is, risk of death) for sensitive species at higher concentrations (>20 mg/L).<br><br>This attribute measures the toxic effects of nitrate, not the trophic state. Where other attributes measure trophic state, for example periphyton, freshwater objectives, limits and/or methods for those attributes may be more stringent. | >6.9                                                             | >9.8                   |

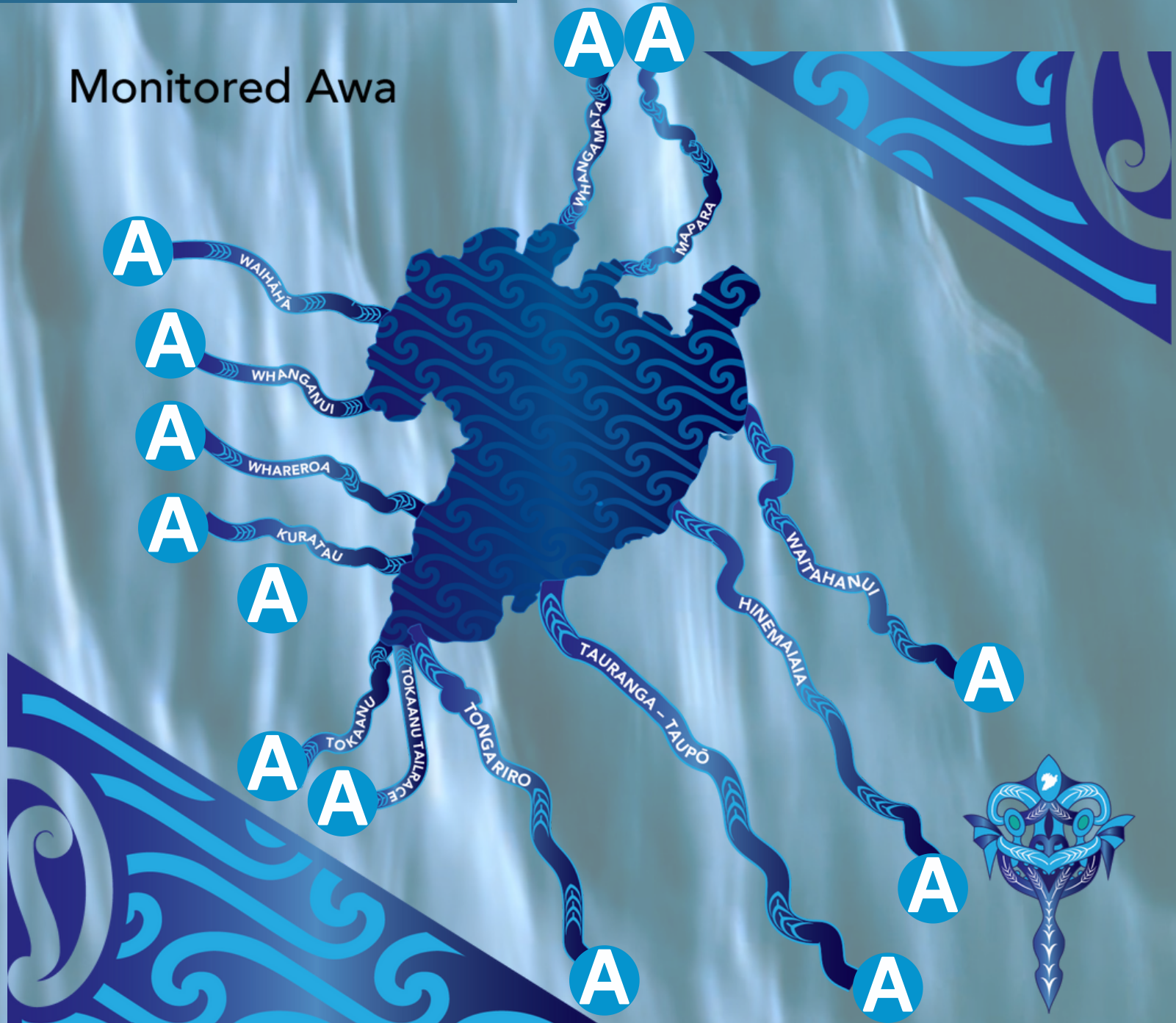
**Table 20 – Dissolved reactive phosphorus**

| Value (and component)                                                                                                                                                                                                                                                                                                                    | Ecosystem health (Water quality) |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------|
| Freshwater body type                                                                                                                                                                                                                                                                                                                     | Rivers                           |                     |
| Attribute unit                                                                                                                                                                                                                                                                                                                           | DRP mg/L (milligrams per litre)  |                     |
| Attribute band and description                                                                                                                                                                                                                                                                                                           | Numeric attribute state          |                     |
|                                                                                                                                                                                                                                                                                                                                          | Median                           | 95th percentile     |
| <b>A</b><br>Ecological communities and ecosystem processes are similar to those of natural reference conditions. No adverse effects attributable to dissolved reactive phosphorus (DRP) enrichment are expected.                                                                                                                         | ≤ 0.006                          | ≤ 0.021             |
| <b>B</b><br>Ecological communities are slightly impacted by minor DRP elevation above natural reference conditions. If other conditions also favour eutrophication, sensitive ecosystems may experience additional algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.             | > 0.006 and ≤0.010               | > 0.021 and ≤0.030  |
| <b>C</b><br>Ecological communities are impacted by moderate DRP elevation above natural reference conditions. If other conditions also favour eutrophication, DRP enrichment may cause increased algal and plant growth, loss of sensitive macro-invertebrate and fish taxa, and high rates of respiration and decay.                    | > 0.010 and ≤ 0.018              | > 0.030 and ≤ 0.054 |
| <b>D</b><br>Ecological communities impacted by substantial DRP elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DRP enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia are lost. | >0.018                           | >0.054              |

Based on a monthly monitoring regime where sites are visited on a regular basis regardless of weather and flow conditions. Record length for grading a site based on 5 years.

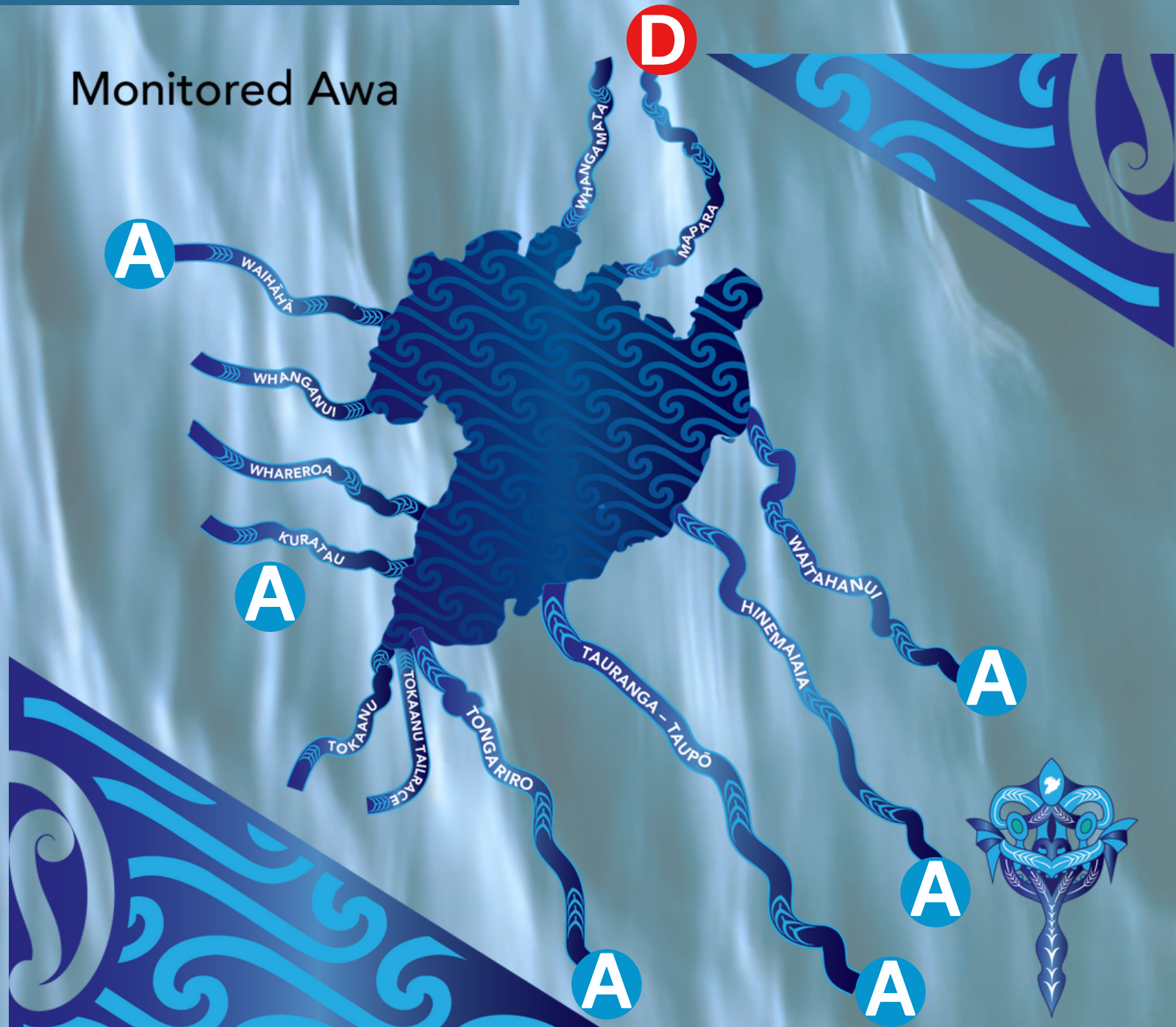
# Ammonia (toxicity)

# Monitored Awa



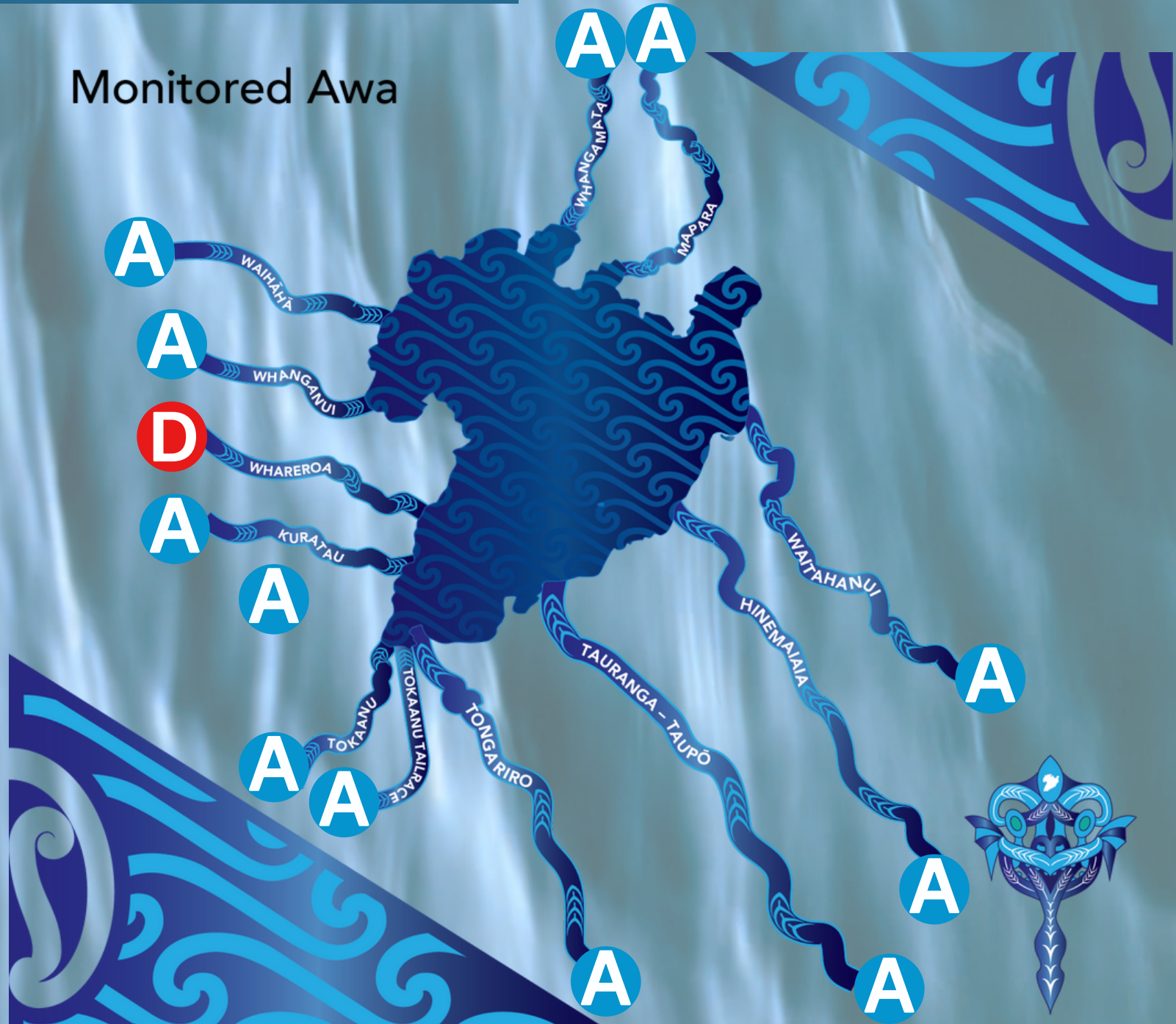
# Visual Clarity

Monitored Awa



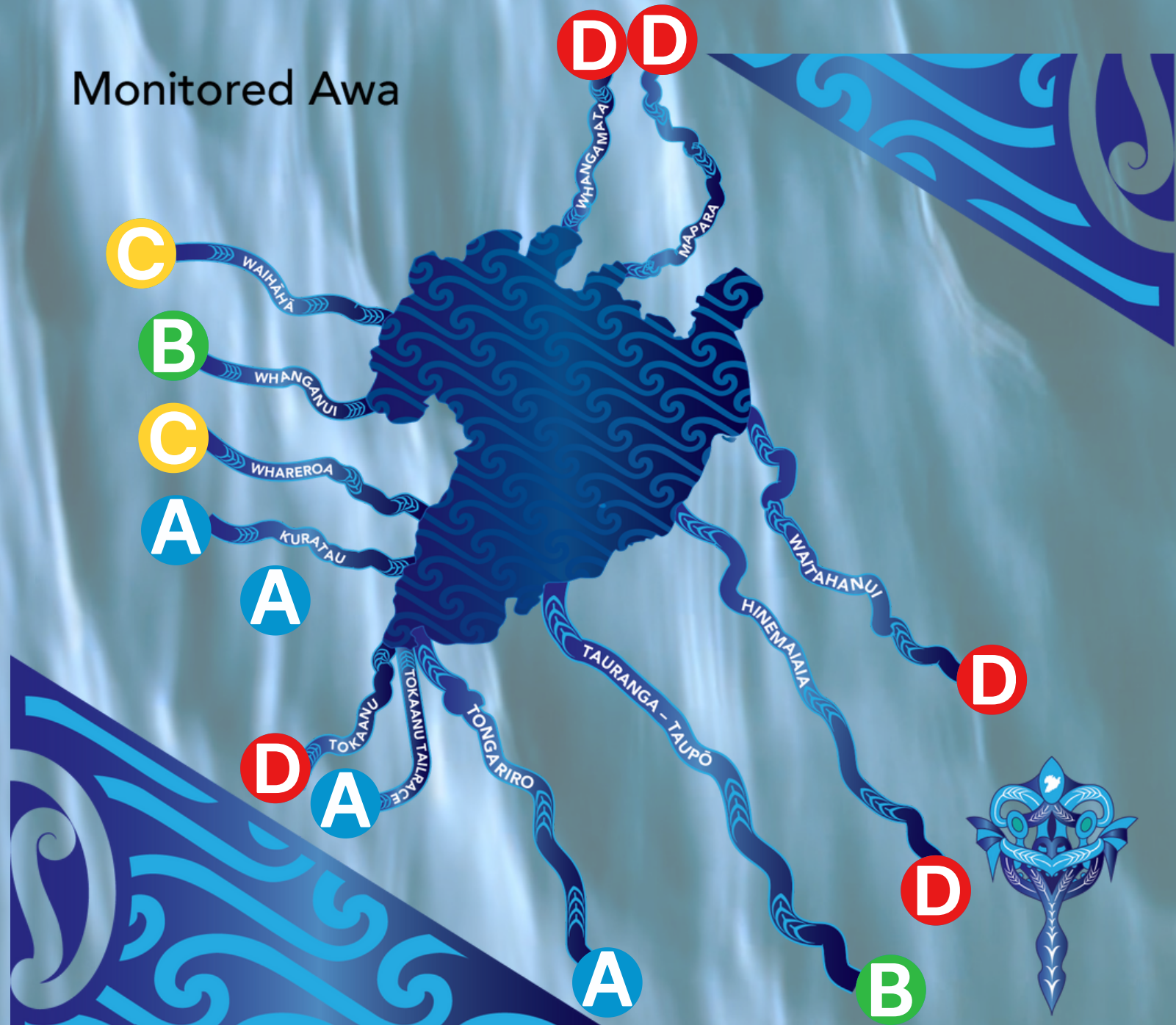
# E.coli

# Monitored Awa



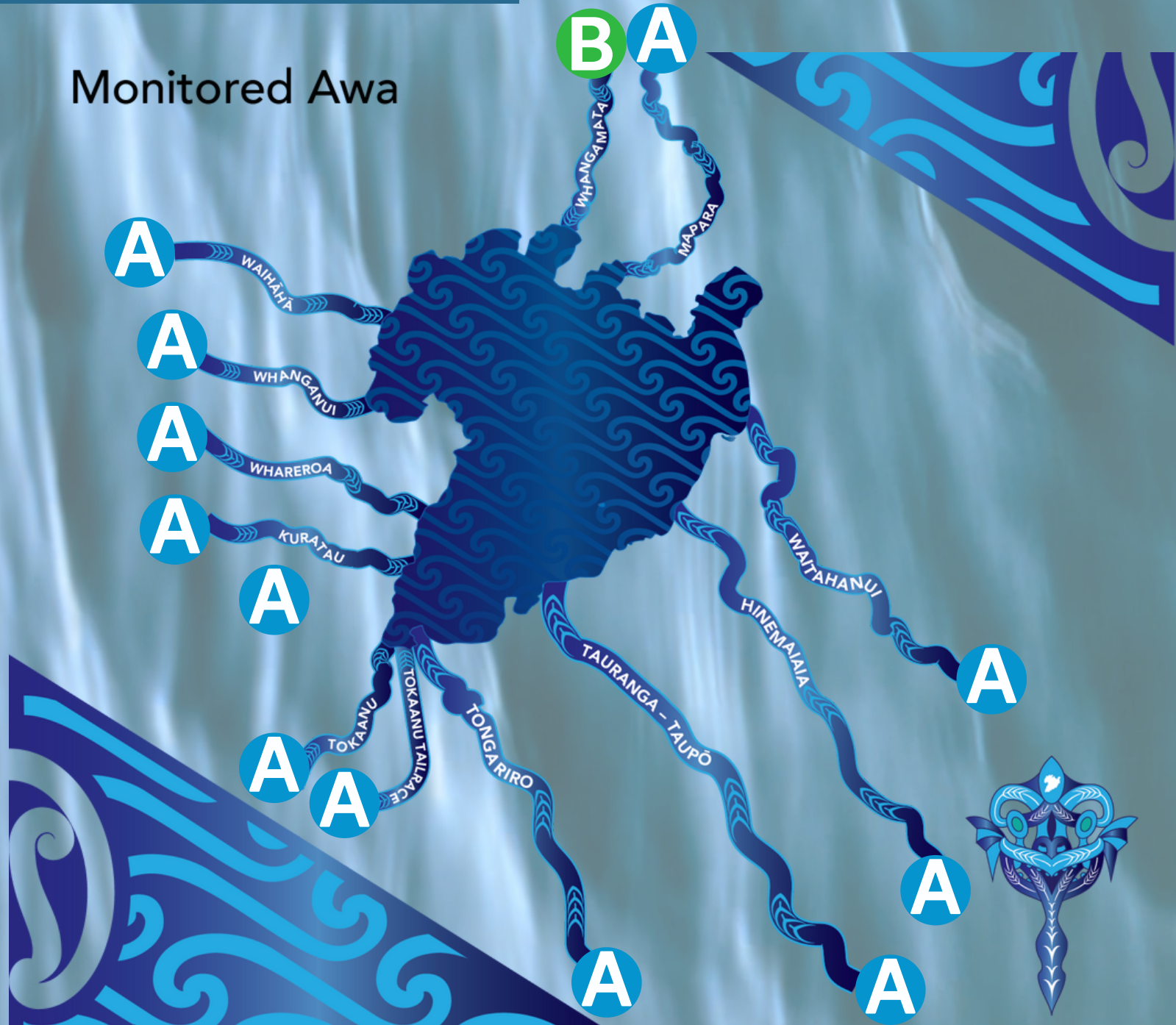
# Dissolved Reactive Phosphorus

Monitored Awa



# Nitrate (toxicity)

Monitored Awa



# WRC Guideline Limits vs NPS

## Guidelines and standards

The table below lists the water quality guidelines and standards used.

**Table 2: Guidelines and standards used to assess water quality for ecological health**

| Water quality variable<br>(units)    | Relevance                             | Categories |              |                |
|--------------------------------------|---------------------------------------|------------|--------------|----------------|
|                                      |                                       | Excellent  | Satisfactory | Unsatisfactory |
| Dissolved oxygen (% of saturation)   | Oxygen for aquatic animals to breathe | >90        | 80–90        | <80            |
| pH (acidity)                         | Can affect plants and fish            | 7–8        | 6.5–7 or 8–9 | <6.5 or >9     |
| Turbidity (NTU)                      | Can restrict plant growth             | <2         | 2–5          | >5             |
| Ammonia (g N/m <sup>3</sup> )        | Toxic to fish                         | <0.1       | 0.1–0.88     | >0.88          |
| Temperature (°C)                     | Fish spawning May-Sep                 | <10        | 10–12        | >12            |
|                                      | Fish health Oct-Apr                   | <16        | 16–20        | >20            |
| Total phosphorus (g/m <sup>3</sup> ) | Causes nuisance plant growth          | <0.01      | 0.01–0.04    | >0.04          |
| Total nitrogen                       | Causes nuisance plant growth          | <0.1       | 0.1–0.5      | >0.5           |

**Table 6 – Nitrate (toxicity)**

| Value (and component)                                                                                                                                                            | Ecosystem health (Water quality)                                 |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------|
| Freshwater body type                                                                                                                                                             | Rivers                                                           |                        |
| Attribute unit                                                                                                                                                                   | mg NO <sub>3</sub> – N/L (milligrams nitrate-nitrogen per litre) |                        |
| Attribute band and description                                                                                                                                                   | Numeric attribute state                                          |                        |
|                                                                                                                                                                                  | Annual median                                                    | Annual 95th percentile |
| <b>A</b><br>High conservation value system. Unlikely to be effects even on sensitive species.                                                                                    | ≤1.0                                                             | ≤1.5                   |
| <b>B</b><br>Some growth effect on up to 5% of species.                                                                                                                           | >1.0 and ≤2.4                                                    | >1.5 and ≤3.5          |
| <b>National bottom line</b>                                                                                                                                                      | <b>2.4</b>                                                       | <b>3.5</b>             |
| <b>C</b><br>Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.                                                                    | >2.4 and ≤6.9                                                    | >3.5 and ≤9.8          |
| <b>D</b><br>Impacts on growth of multiple species, and starts approaching acute impact level (that is, risk of death) for sensitive species at higher concentrations (>20 mg/L). | >6.9                                                             | >9.8                   |

This attribute measures the toxic effects of nitrate, not the trophic state. Where other attributes measure trophic state, for example periphyton, freshwater objectives, limits and/or methods for those attributes may be more stringent.

# Water Quality

## crash course

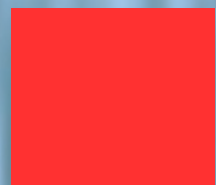
### Total Nitrogen



Excellent



Satisfactory

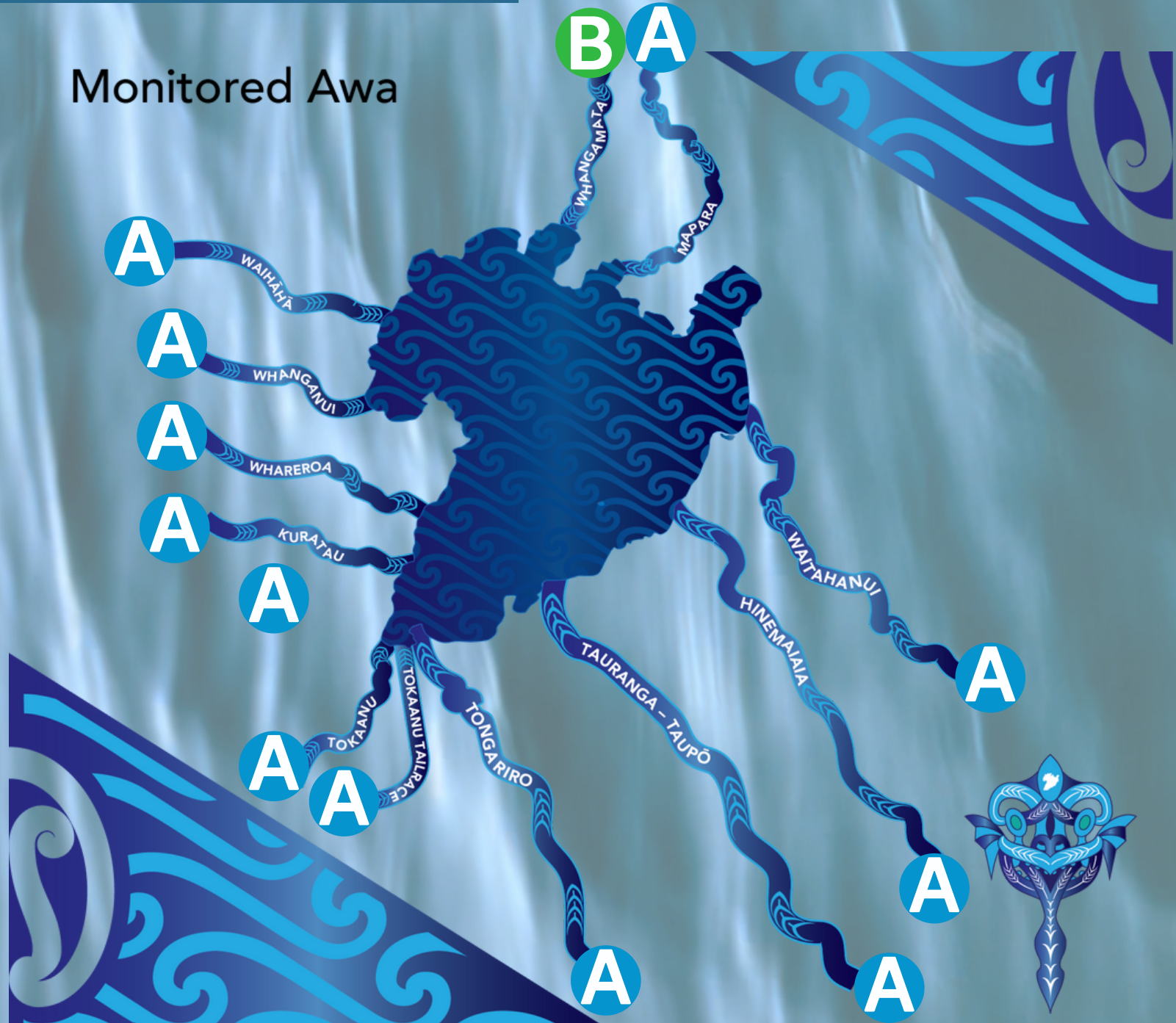


Undesirably nutrient  
enriched

|                     |                   |                     |
|---------------------|-------------------|---------------------|
| Whangamatā          | Mapara            | Waitahanui          |
| Hinemaiaia          | Tauranga-Taupō    | Tokaanu             |
| Tokaanu<br>Tailrace | Kuratau<br>Te Rae | Kuratau<br>Moerangi |
| Whareroa            | Whanganui         | Waihāhā             |

# Nitrate (toxicity)

# Monitored Awa



# LAWA

## Land Air Water Aotearoa

Attribute Bands =  
A-D grading

Limits set out in  
National Policy Statement for  
Freshwater Management (NPS-  
FM)



National Objectives Framework:

Freshwater Management Units



Freshwater Values



Environmental Outcomes



Attributes



Target Attribute State

# Target Attribute State

## W H A R E R O A

| ATTRIBUTE | BASELINE                                                                            | TARGET                                                                                | OUTCOME  |
|-----------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|
| Nitrate   |    |    | MAINTAIN |
| E.coli    |   |   | IMPROVE  |
| DRP       |  |  | IMPROVE  |
| Ammonia   |  |  | MAINTAIN |

# Limits & Action Plans

- Limits on resource use to achieve nutrient outcomes and target attribute states
- Limits set as rules in regional plan
- Action plans to reach target states
- Monitoring progress

Goal: achieve environmental outcomes

# Environmental Outcomes



## Water Quality:

- The health and wellbeing of our wai is protected and restored
- Water quality is maintained or improved where there is degradation

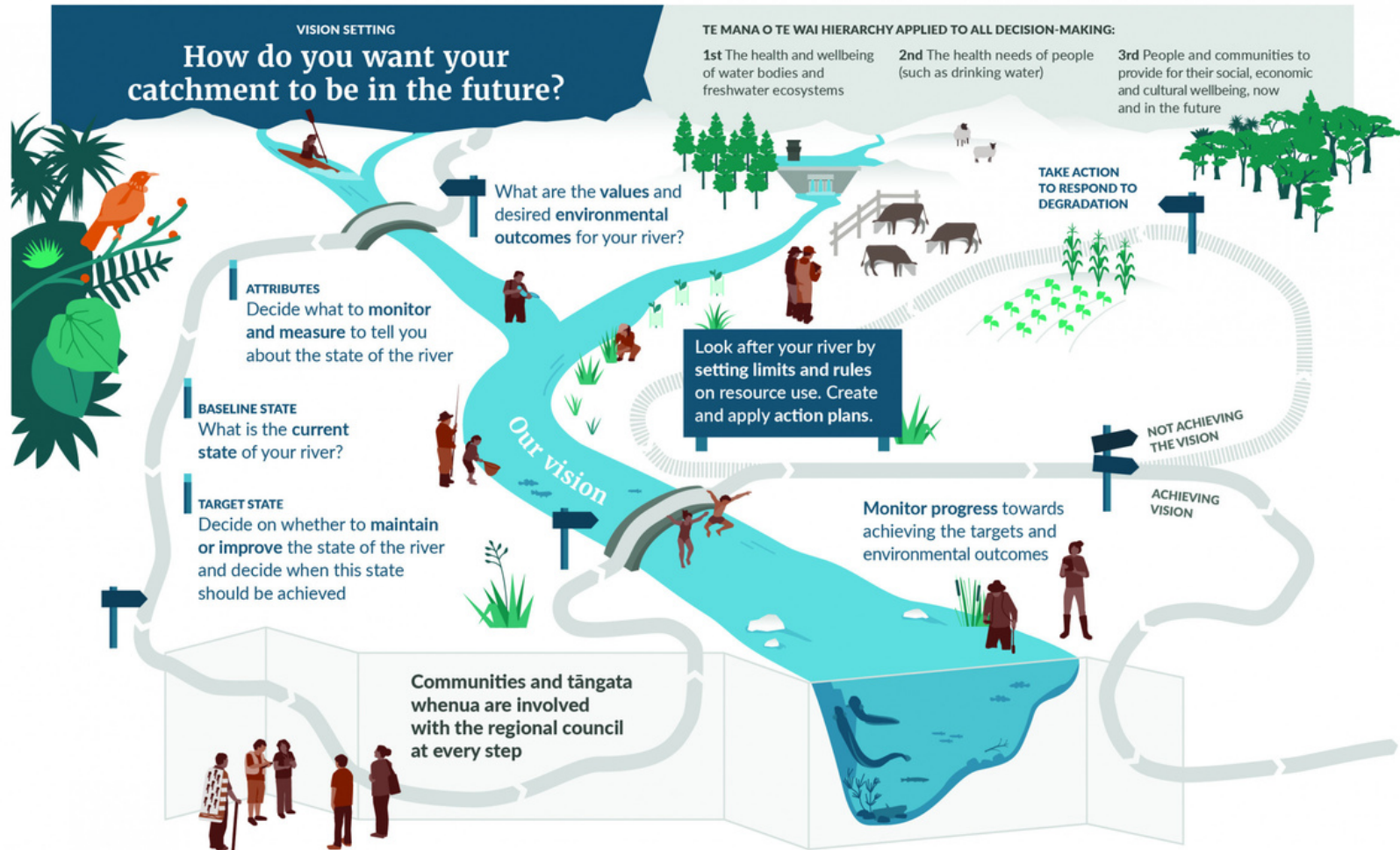


## Long-term Vision/ Objectives in Regional Plan:

- Water quality is maintained where good, and if degraded, improved for all freshwater attributes from the baseline state.

# NOF

## National Objectives Framework for the National Policy Statement for Freshwater Management 2020



Find out more at [environment.govt.nz](http://environment.govt.nz)

# Stream Health Monitoring & Assessment Kit (SHMAK)



National Institute for Water & Atmospheric research



**NIWA**  
Taihoro Nukurangi

# What else is in a SHMAK?

## What's included in the different SHMAK kits

**The Standard kit** includes metre ruler, tape measure, conductivity/temperature meter, clarity tube or black disc set, equipment (kick net, white tray, bug box, magnifying glass, brushes and tweezers) for macroinvertebrate sampling using the kick net method. Manual and identification guides included.

**The SHMAK+ kit** includes everything in Standard kit, as well as kits for *E. coli* bacteria, dissolved nitrate and phosphate.

## What can be measured with different SHMAK kits?

| Test                                 | Standard kit | SHMAK+ |
|--------------------------------------|--------------|--------|
| Site assessment                      | ✓            | ✓      |
| Visual clarity                       | ✓            | ✓      |
| Temperature                          | ✓            | ✓      |
| Continuous temperature*              |              |        |
| Conductivity                         | ✓            | ✓      |
| Nitrate                              |              | ✓      |
| Phosphate                            |              | ✓      |
| Bacteria                             |              | ✓      |
| Periphyton                           | ✓            | ✓      |
| Aquatic plants                       | ✓            | ✓      |
| Macroinvertebrates (stone method)    |              |        |
| Macroinvertebrates (kick net method) | ✓            | ✓      |
| Velocity and discharge               | ✓            | ✓      |
| Physical habitat                     | ✓            | ✓      |
| Stream bed composition               | ✓            | ✓      |
| Rubbish                              | ✓            | ✓      |

\*requires additional purchase of temperature logger.

**\$700-\$1660**

# Visual Clarity



## Black Disc

Small disc: 0.5 - 1.5m

Large disc: 1.5m +

- How far under water the human eye can see a black object
- Murky/cloudy wai = high fine suspended solids



## Clarity Tube

0 - 0.5m

# pH & EC



|                         | uS/cm      |
|-------------------------|------------|
| DISTILLED WATER         | 0.5 - 3    |
| MELTED SNOW             | 2 - 42     |
| TAP WATER               | 50 - 800   |
| POTABLE WATER IN THE US | 30 - 1500  |
| FRESHWATER STREAMS      | 100 - 2000 |
| INDUSTRIAL WASTEWATER   | 10000      |
| SEAWATER                | 55000      |

Potential of Hydrogen  
Wai ~ pH 6.5 - pH 9

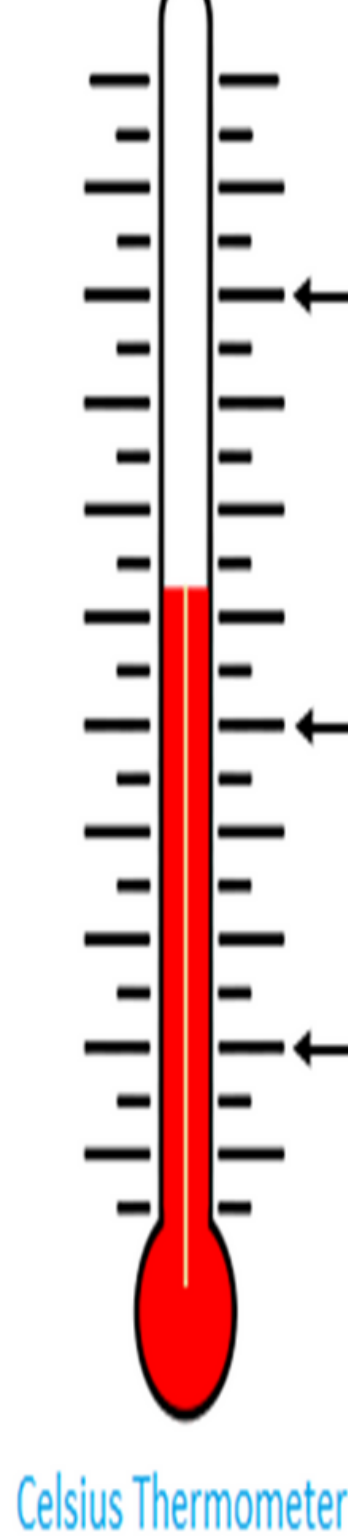
## Electrical Conductivity

- How well wai can hold an electrical charge
- The more dissolved salts in the wai the higher the EC

# Temperature

Fish spawning  
May-Sept:  
less than 12 degrees C

General fish health  
Oct-April:  
less than 20 degrees C



K Ō A R O

# Nitrates



- Colorimetric test
- Approximate concentrations of Nitrate
- Good interactive test for tamariki



# Hill Labs Testing

| Sample Type: Aqueous                                       |                     |                                  |
|------------------------------------------------------------|---------------------|----------------------------------|
| Sample Name:                                               |                     | 1300_1<br>25-Jul-2023<br>7:01 am |
| Lab Number:                                                |                     | 3328785.1                        |
| Faecal Coliforms and E. coli profile                       |                     |                                  |
| Faecal Coliforms                                           | cfu / 100mL         | 40 #2                            |
| Escherichia coli                                           | cfu / 100mL         | 30 #2                            |
| Microbiology profile for Environment Waikato (FC, EC, Ent) |                     |                                  |
| Enterococci                                                | cfu / 100mL         | 37 #1                            |
| Absorbance at 340, 440, 780nm                              |                     |                                  |
| Absorbance at 340 nm                                       | AU cm <sup>-1</sup> | 0.008                            |
| Absorbance at 440 nm                                       | AU cm <sup>-1</sup> | 0.002                            |
| Absorbance at 780 nm                                       | AU cm <sup>-1</sup> | < 0.002                          |
| Regional River Monitoring Profile                          |                     |                                  |
| Turbidity                                                  | NTU                 | 0.93                             |
| pH                                                         | pH Units            | 7.6                              |
| Electrical Conductivity (EC)                               | µS/cm               | 92                               |
| Total Ammoniacal-N                                         | g/m <sup>3</sup>    | < 0.010                          |
| Nitrate-N + Nitrite-N                                      | g/m <sup>3</sup>    | 1.81                             |
| Total Kjeldahl Nitrogen (TKN)                              | g/m <sup>3</sup>    | 0.20                             |
| Dissolved Reactive Phosphorus                              | g/m <sup>3</sup>    | 0.057                            |
| Total Phosphorus                                           | g/m <sup>3</sup>    | 0.068                            |

**\$210–\$280 per month (\$2,520–\$3,360 per year)**

# eDNA testing Wilder Lab



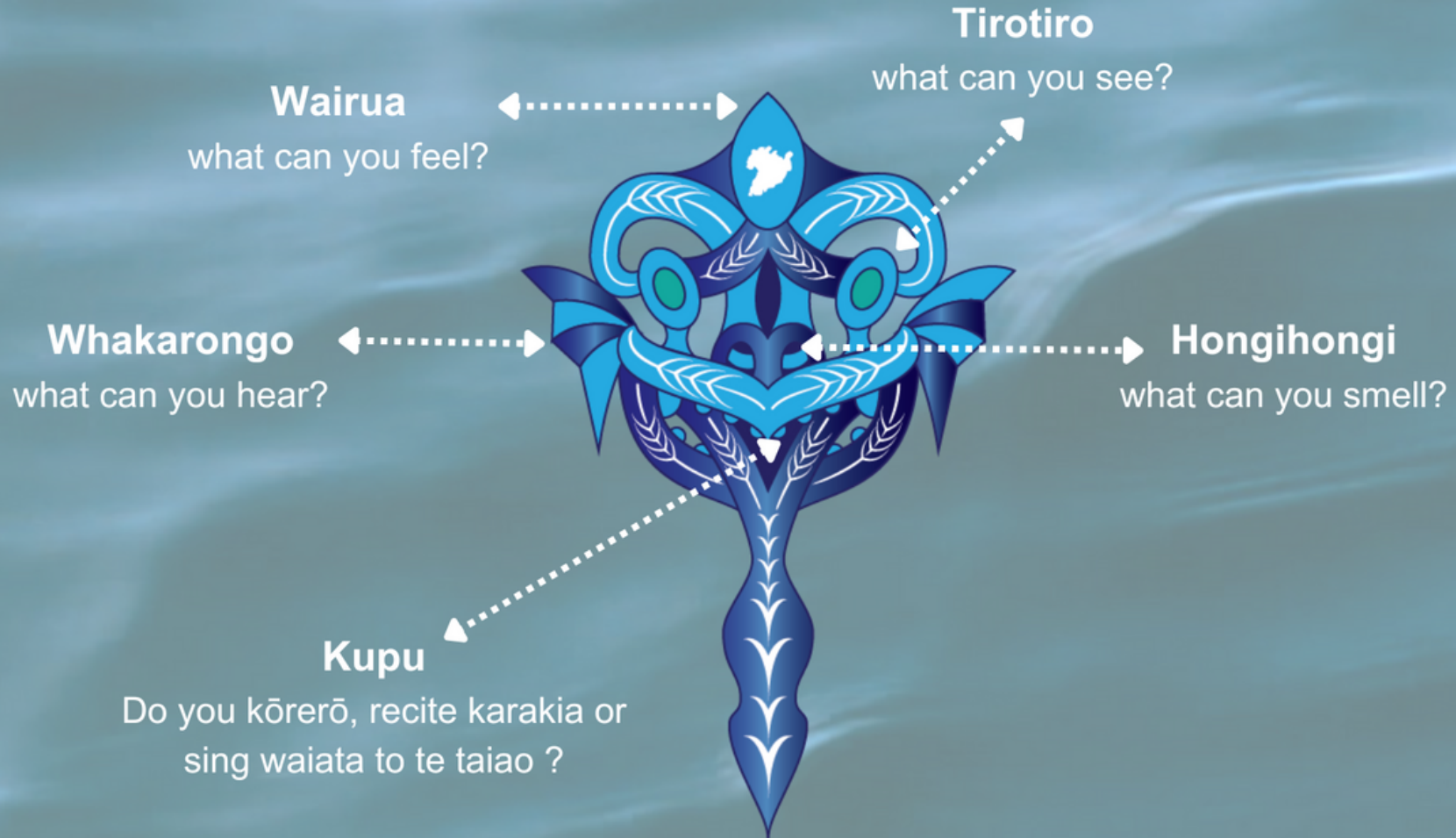
1 x replicate \$290

6 x replicates recommended

\$1740

# WAITIAKI

*mātauranga monitoring framework*



How can we support you to participate in the NOF?

[WAITIAKI@TUWHARETOA.CO.NZ](mailto:WAITIAKI@TUWHARETOA.CO.NZ)