Healthy Rivers
PLAN FOR CHANGE

Wai Ora
HE RAUTAKI WHAKAPAIPAI

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Te Kaunihera ā Rohe o Waikato

State of Waikato-Waipa Waterways

Report back from TLG on analysis of river/lake state against Attributes (CSG7 discussion)

CSG8 – Pukekawa 2 December 2014

Mike Scarsbrook - TLG

Overview

- Provide overview of current state of Waikato-Waipa River and lakes
- WRC analysis of last 5 yrs (2009-2013) monitoring data
- Sites classified into A-D bands in relation to Attributes discussed at CSG7

Value	Human health for recreation		
Freshwater Body Type	Lakes and rivers		
Attribute	*E. coli**		
Attribute Unit	*E. coli*/100 mL (number of *E. coli* per hundred millilitres)		
Attribute State	Numeric Attribute State	Sampling Statistic	Narrative Attribute State
A	≤260	Annual median	People are exposed to a very low risk of infection (less than 0.1% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating)
		95th percentile	People are exposed to a low risk of infection (up to 1% risk) when undertaking activities likely to involve full immersion.
B	>260 and ≤540	Annual median	People are exposed to a low risk of infection (less than 1% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).
		95th percentile	People are exposed to a moderate risk of infection (less than 5% risk) when undertaking activities likely to involve full immersion. 540 / 100ml is the **minimum acceptable state** for activities likely to involve full immersion.
C	>540 and ≤1000	Annual median	People are exposed to a moderate risk of infection (less than 5% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating). People are exposed to a high risk of infection (greater than 5% risk) from contact with water during activities likely to involve immersion.
National Bottom Line	1000	Annual median	
D	>1000	Annual median	People are exposed to a high risk of infection (greater than 5% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).

**Escherichia coli*

E. coli

Existing NPS-FM attribute

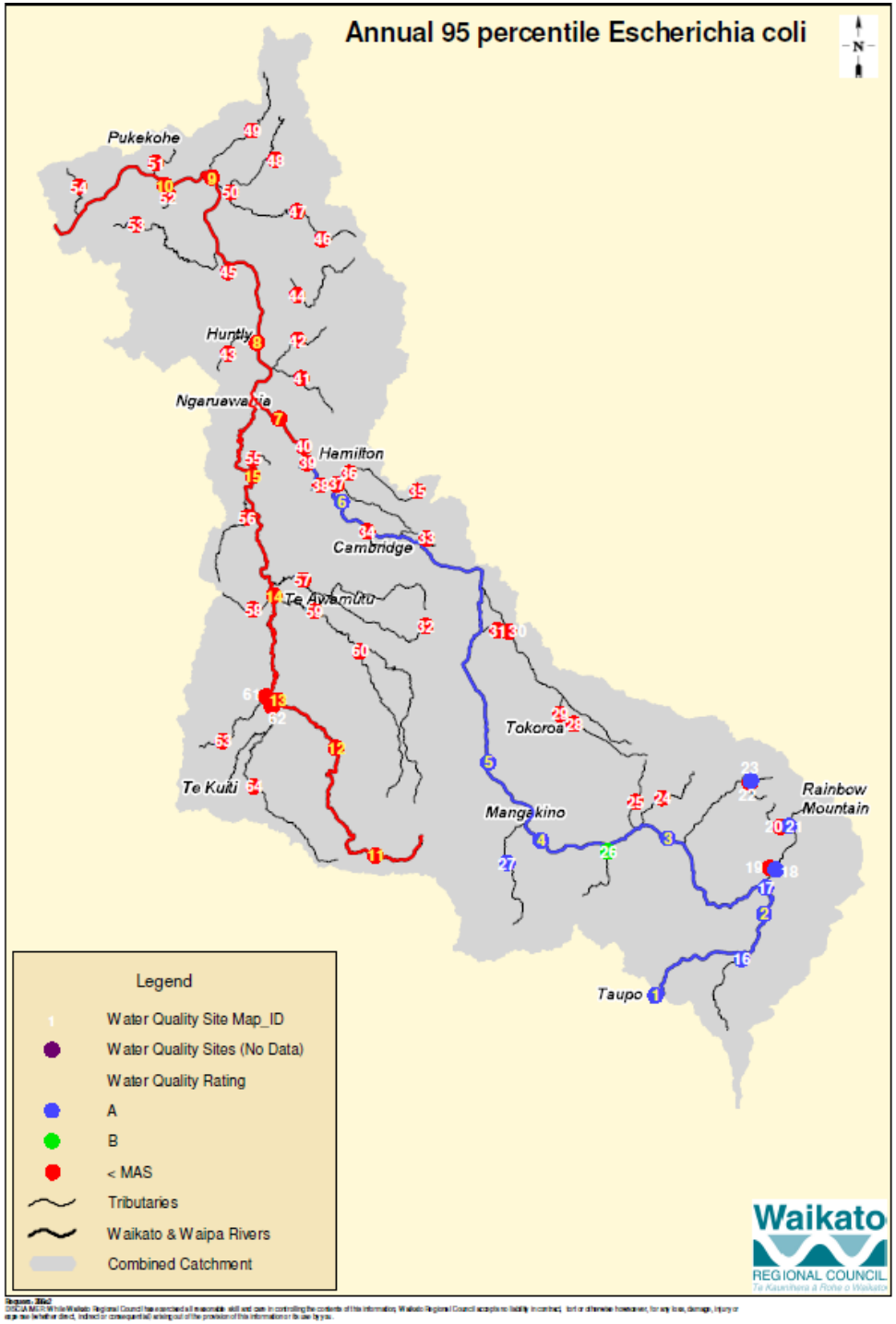
Apply to all Waikato lakes and rivers

- Acceptable for swimming
- Unacceptable for swimming

Swimmability

E. coli

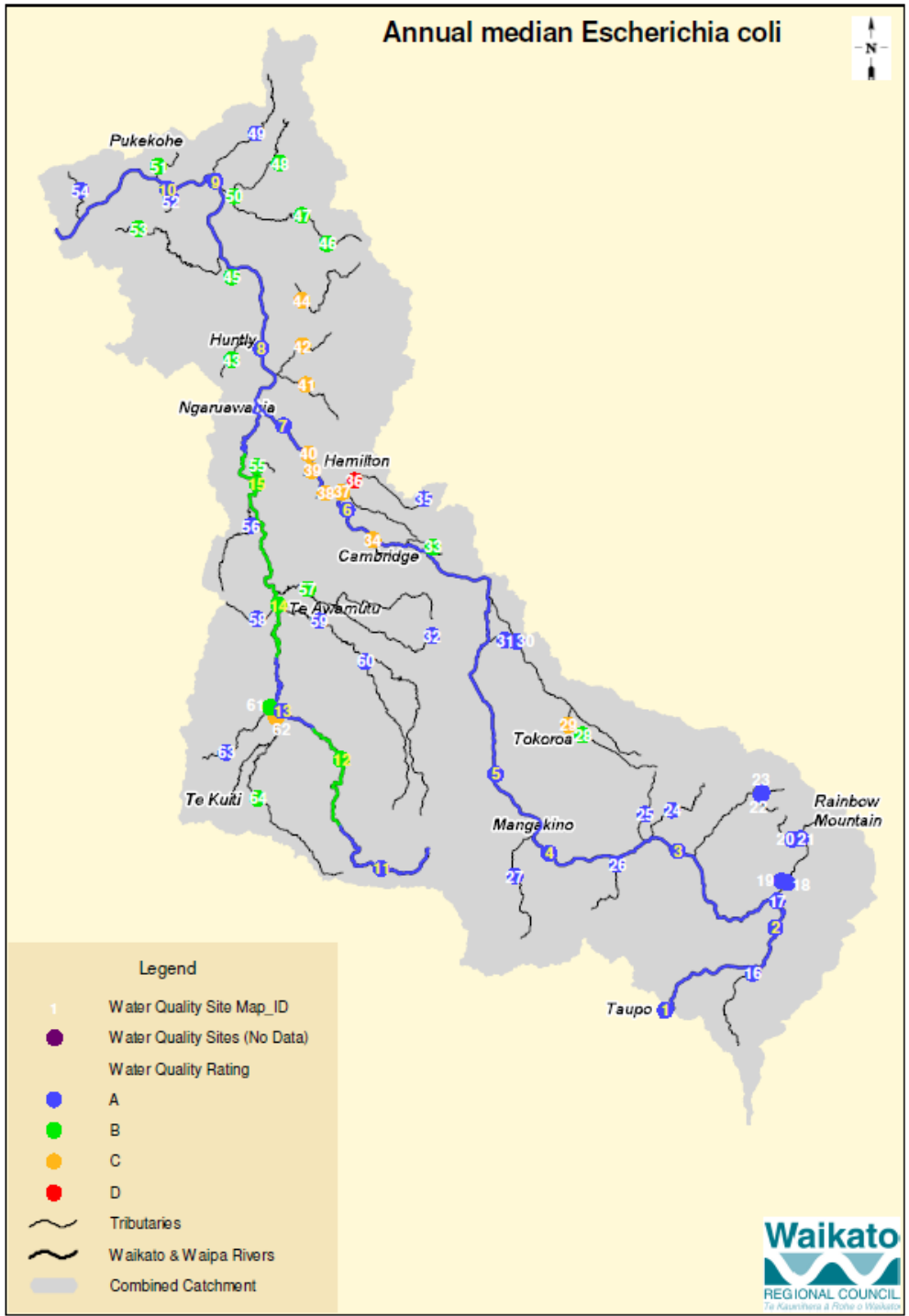
- 80% of sites fail
- Waikato mainstem ‘swimmable’ down to Narrows
- Where is *E. coli* coming from?



Wading/Boating

E. coli

- 56% in ‘A’ band
- 27% in ‘B’ band
- 16% in ‘C’ band – low gradient streams
- Mangaonua @ Hoeka Rd fails National Bottom Line



‘Swimmability’ – Water clarity (NEW)

Value	‘Swimmability’	
Freshwater Body Type	Lakes & rivers	
Attribute	Water clarity	
Attribute Unit	m (measured using agreed methods e.g. horizontal Black disc in rivers)	
Attribute State	**Numeric Attribute State**	**Narrative Attribute State**
	Median of samples (excluding flood flows*)	**Lakes with naturally low clarity (e.g. peat-stained) will need to be treated separately**
A	≥4	Water clarity is deemed excellent for swimming (WRISS)
B	≥1.6 and <4	Water clarity is deemed suitable for swimming**
C	≥1.0 and <1.6	**Water clarity is deemed marginally suitable for swimming****
Minimum acceptable state	**1.0**	
D	<1.0	Water clarity is deemed unsuitable for swimming

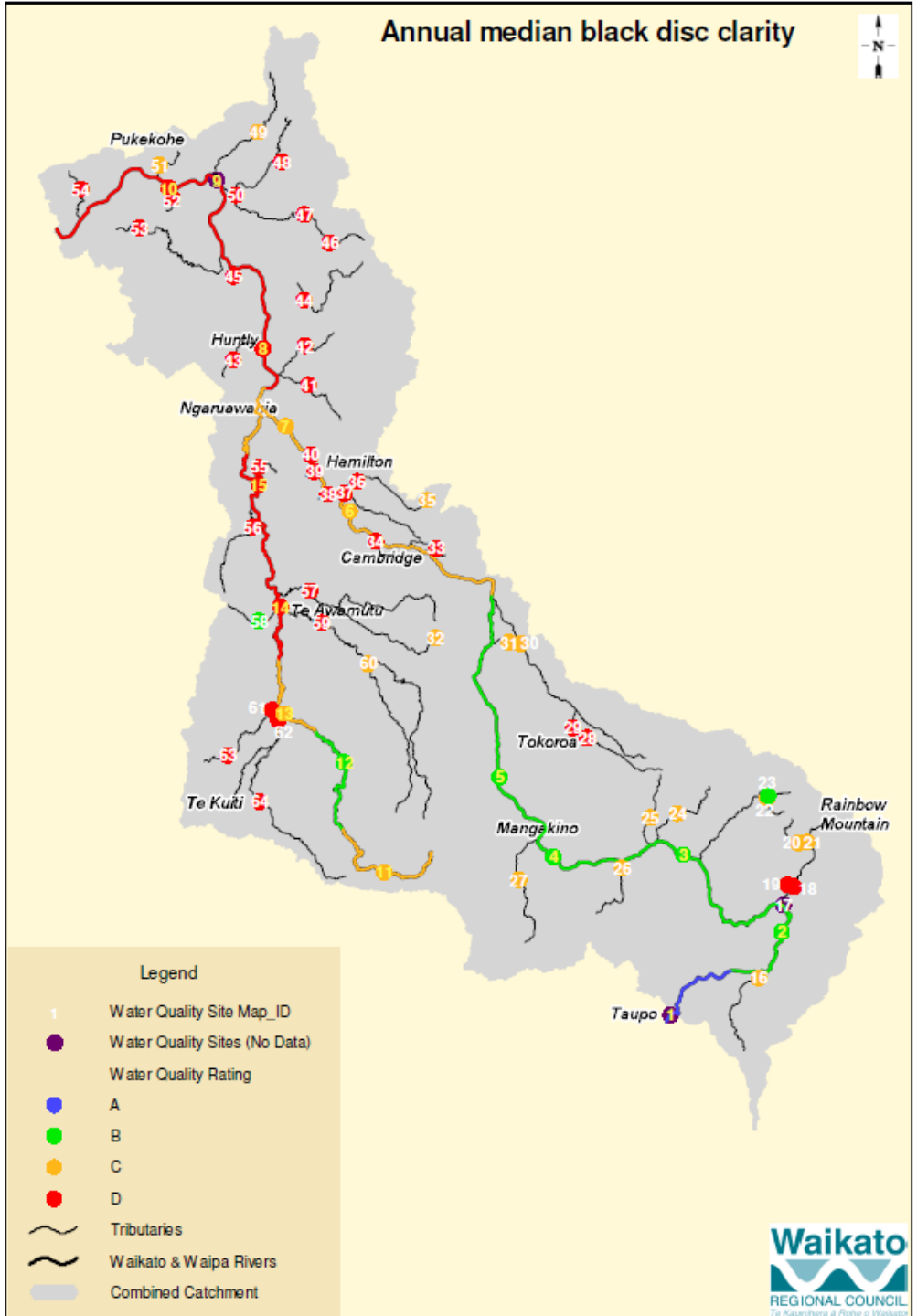
* WRC analysis of water clarity excludes the top 10% of flows

** Smith, D. G. & Davies-Colley, R. J. 1992. Perception of water clarity and colour in terms of suitability for recreational use. Journal of Environmental Management 36: 225-235.

Swimmability

Water Clarity

- Taupo = only ‘A’ state
- ‘B’ = 11%
- ‘C’ = 31%
- 57% of sites below Minimum Acceptable State (‘D’; i.e. <1 m)



Value	Human health for recreation	
Freshwater Body Type	Lakes and lake fed rivers	
Attribute	Cyanobacteria - Planktonic	
Attribute Unit	Biovolume - mm^3/L (cubic millimetres per litre) OR Cell Count - cells/mL (cells per millilitre)	
Attribute State	**Numeric Attribute State**	**Narrative Attribute State**
	80th percentile*	
A	≤0.5 mm^3/L biovolume equivalent for the combined total of all cyanobacteria OR ≤500 cells/mL of total cyanobacteria	Risk exposure from cyanobacteria is no different to that in natural conditions (from any contact with fresh water).
B	N/A	
C	>0.5 and ≤1.8 mm^3/L biovolume equivalent of potentially toxic cyanobacteria OR >0.5 and ≤10 mm^3/L total biovolume of all cyanobacteria	Low risk of health effects from exposure to cyanobacteria (from any contact with fresh water).
National Bottom Line	**1.8 mm^3/L Biovolume equivalent of potentially toxic cyanobacteria OR 10 mm^3/L total biovolume of all cyanobacteria**	
D	Biovolume equivalent of >1.8 mm^3/L of potentially toxic cyanobacteria OR >10 mm^3/L total biovolume of all cyanobacteria	Potential health risks (eg, respiratory, irritation and allergy symptoms) exist from exposure to cyanobacteria (from any contact with fresh water).

* The 80th percentile must be calculated using a minimum of 12 samples collected over 3 years. 30 samples collected over 3 years is recommended.

Cyanobacteria

Existing NPS-FM attribute

Apply to Lakes and lake-fed rivers

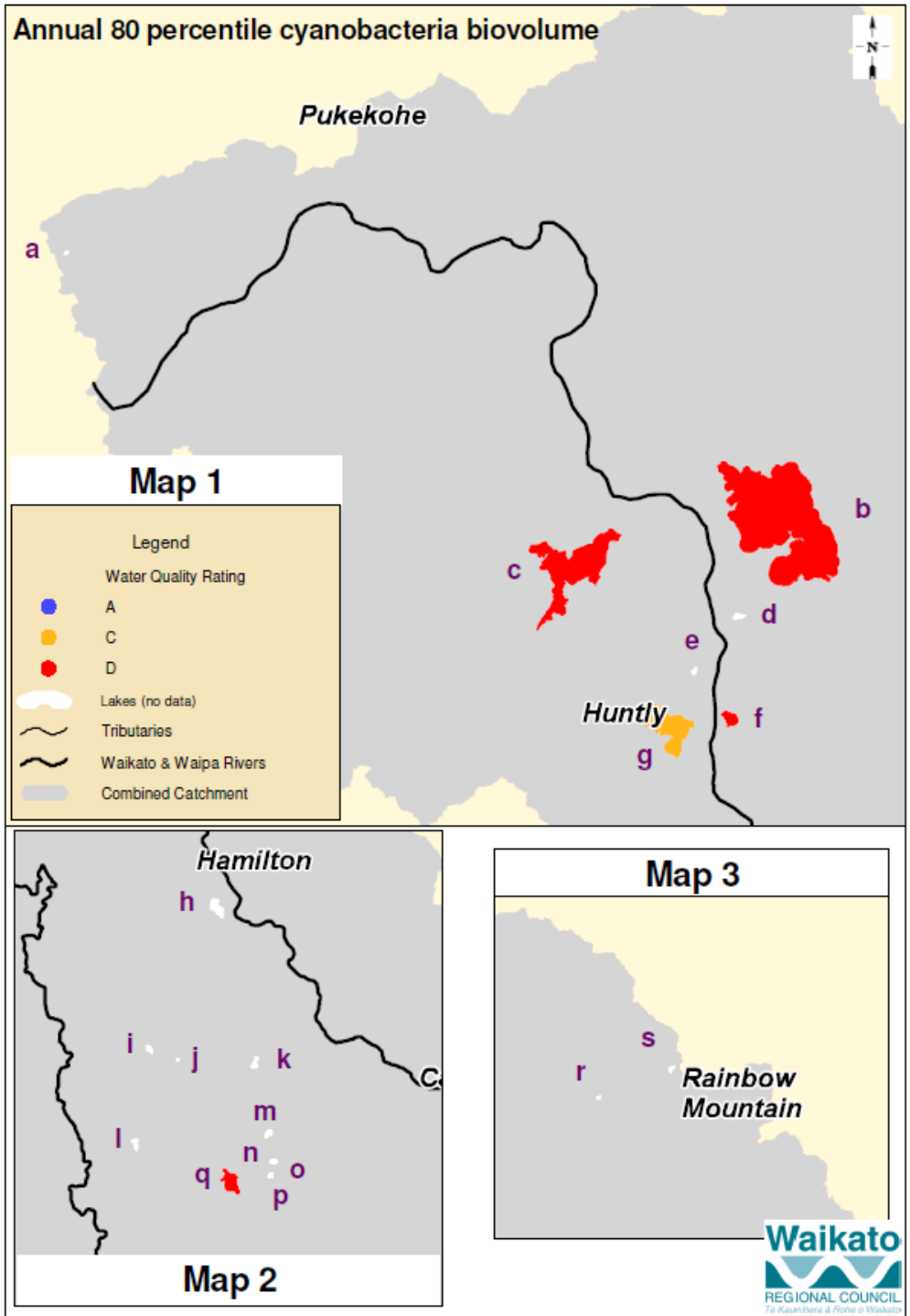
Extend to some lowland rivers above Waikato River junction

Limited data available

Swimmability

Cyanobacteria in lakes

- 4 of 5 monitored lakes breach National Bottom Line



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Value	Ecosystem health		
Freshwater Body Type	Lakes		
Attribute	Phytoplankton (Trophic state)		
Attribute Unit	mg/m^3 (milligrams chlorophyll-a per cubic metre)		
Attribute State	Numeric Attribute State		Narrative Attribute State
	Annual Median	Annual Maximum	
A	≤2	≤10	Lake ecological communities are healthy and resilient, similar to natural reference conditions.
B	>2 and ≤5	>10 and ≤25	Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrients levels that are elevated above natural reference conditions.
C	>5 and ≤12	>25 and ≤60	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrients levels that are elevated well above natural reference conditions.
National Bottom Line	12	60	
D	>12	>60	Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state, due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

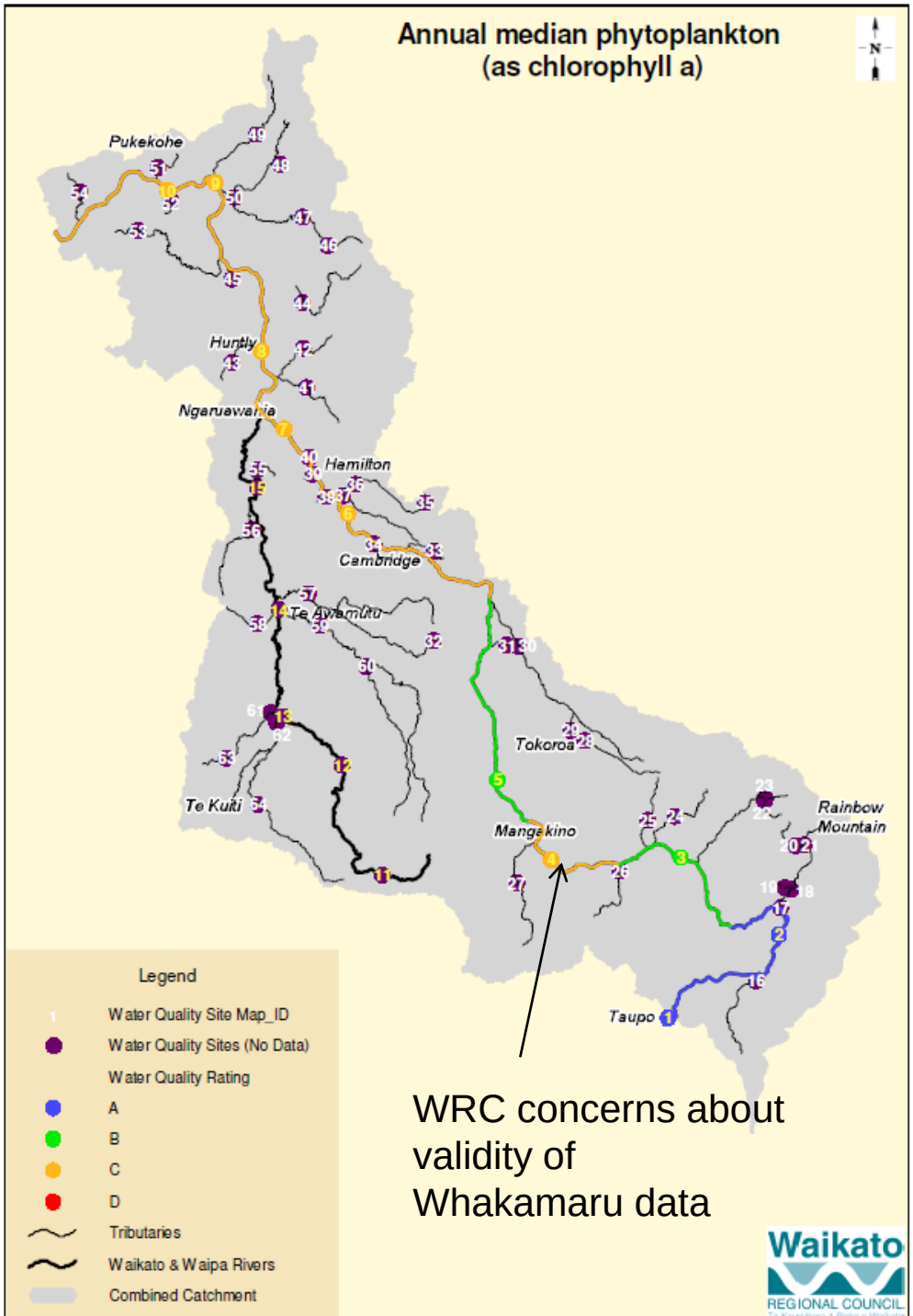
Ecosystem Health – Phytoplankton

- Apply to whole of Waikato River mainstem (including hydrolakes)
- Extend to some lowland rivers above Waikato River junction – data not currently available

Ecosystem Health

Phytoplankton

- A, B, or C states are acceptable
- No ‘D’ sites
- CSG needs to recommend where to set the limit



WRC concerns about validity of Whakamaru data

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Value	Ecosystem health		
Freshwater Body Type	Lakes		
Attribute	Total Nitrogen (Trophic state)		
Attribute Unit	mg/m^3 (milligrams per cubic metre)		
Attribute State	Numeric Attribute State		Narrative Attribute State
	Annual Median	Annual Median	
	Seasonally Stratified and Brackish*	Polymictic	
A	≤160	≤300	Lake ecological communities are healthy and resilient, similar to natural reference conditions.
B	>160 and ≤350	>300 and ≤500	Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrients levels that are elevated above natural reference conditions.
C	>350 and ≤750	>500 and ≤800	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrients levels that are elevated well above natural reference conditions
National Bottom Line	**750**	**800**	
D	>750	>800	Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state, due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

* Intermittently closing and opening lagoons (ICOLs) are not included in brackish lakes.

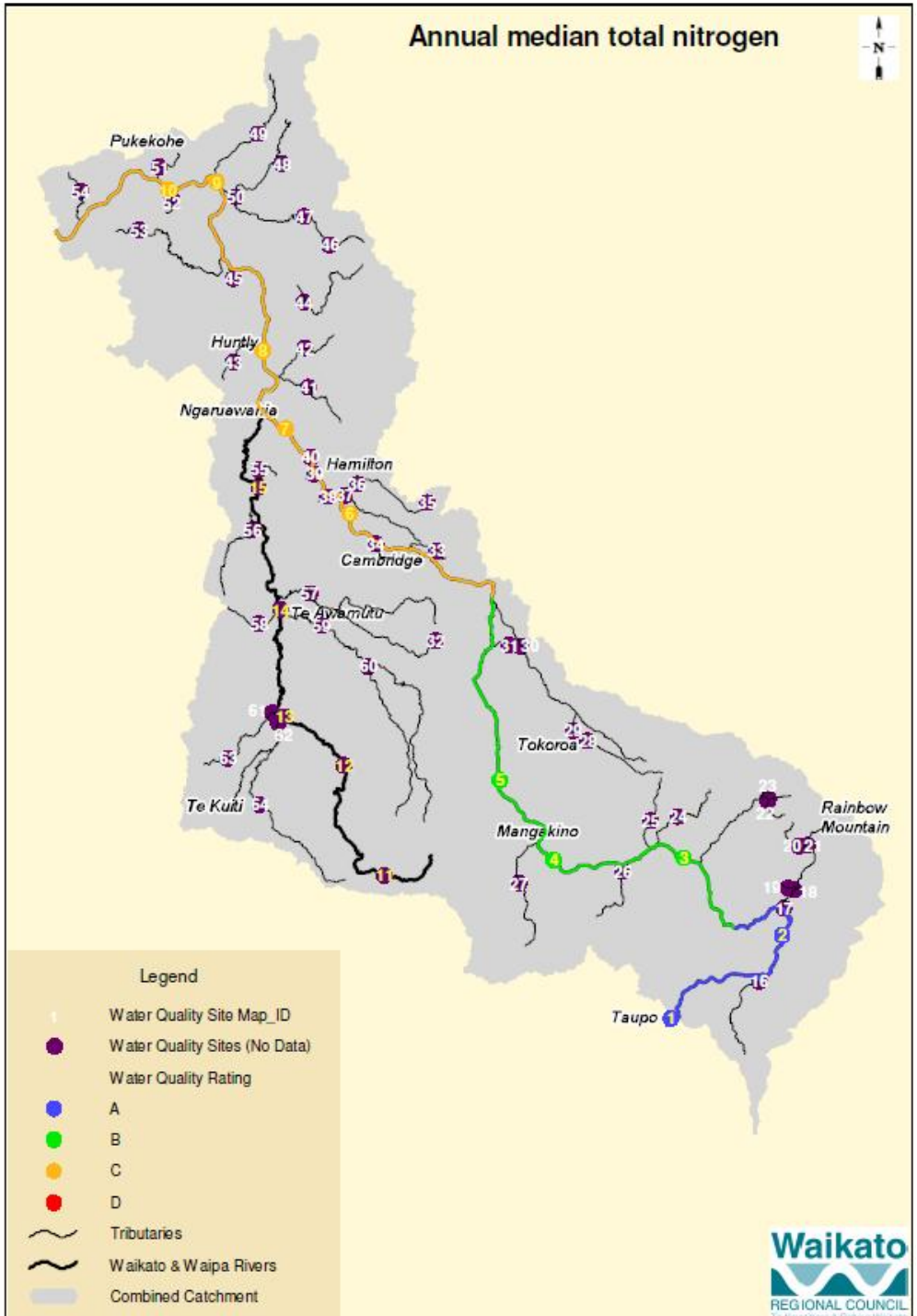
Ecosystem Health – TN

- Apply to whole of Waikato River mainstem (including hydrolakes)
- Extend to some lowland rivers above Waikato River junction
- Use numbers for 'Seasonally Stratified'

Ecosystem Health

TN

- ‘C’ band from Karapiro downstream
- No ‘D’ band breaches



Ecosystem Health - TP

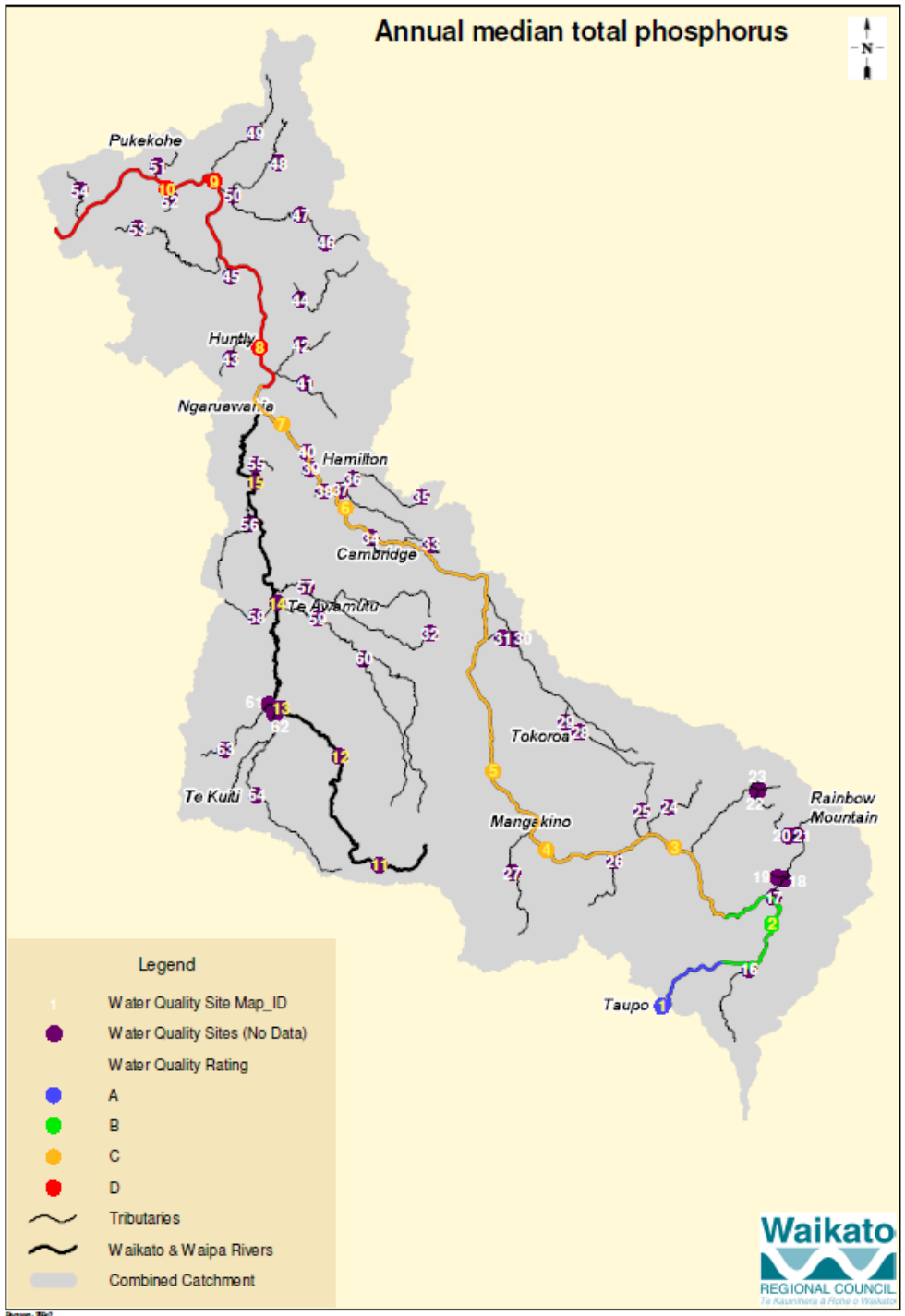
Value	Ecosystem health	
Freshwater Body Type	Lakes	
Attribute	Total Phosphorus (Trophic state)	
Attribute Unit	mg/m^3 (milligrams per cubic metre)	
Attribute State	**Numeric Attribute State**	**Narrative Attribute State**
	Annual Median	
A	≤10	Lake ecological communities are healthy and resilient, similar to natural reference conditions.
B	>10 and ≤20	Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrients levels that are elevated above natural reference conditions.
C	>20 and ≤50	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrients levels that are elevated well above natural reference conditions.
National Bottom Line	**50**	
D	>50	Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state, due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

- Apply to whole of Waikato River mainstem (including hydrolakes)
- Extend to some lowland rivers above Waikato River junction

Ecosystem Health

TP

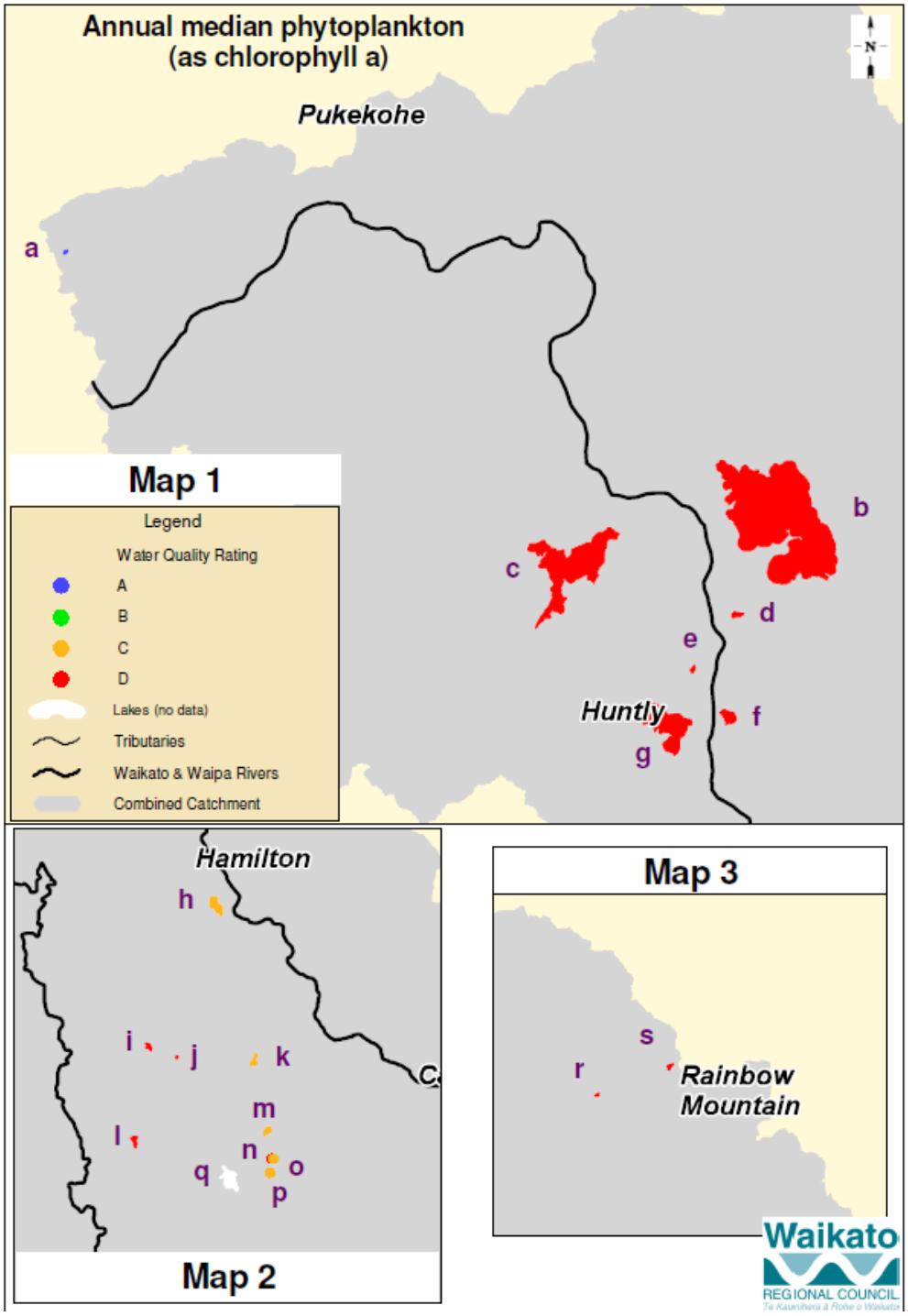
- ‘C’ band from Ohakuri to Horotiu
- Sites below Ngaruawahia breach National Bottom Line



Ecosystem Health - Lakes

Phytoplankton

- 12 of 18 monitored lakes breach National Bottom Line
- TN - 16 of 18 are in ‘D’ band
- TP – 11 of 14 are in ‘D’ band



Ecosystem Health - Ammonia

Value	Ecosystem health		
Freshwater Body Type	Lakes and rivers		
Attribute	Ammonia (Toxicity)		
Attribute Unit	mg NH_4-N/L (milligrams ammoniacal-nitrogen per litre)		
Attribute State	Numeric Attribute State		Narrative Attribute State
	Annual Median*	**Annual Maximum***	
A	≤0.03	≤0.05	99% species protection level: No observed effect on any species tested
B	>0.03 and ≤0.24	>0.05 and ≤0.40	95% species protection level: Starts impacting occasionally on the 5% most sensitive species
C	>0.24 and ≤1.30	>0.40 and ≤2.20	80% species protection level: Starts impacting regularly on the 20% most sensitive species (reduced survival of most sensitive species)
National Bottom Line	**1.30**	**2.20**	
D	>1.30	>2.20	Starts approaching acute impact level (ie risk of death) for sensitive species

* Based on pH 8 and temperature of 20°C.

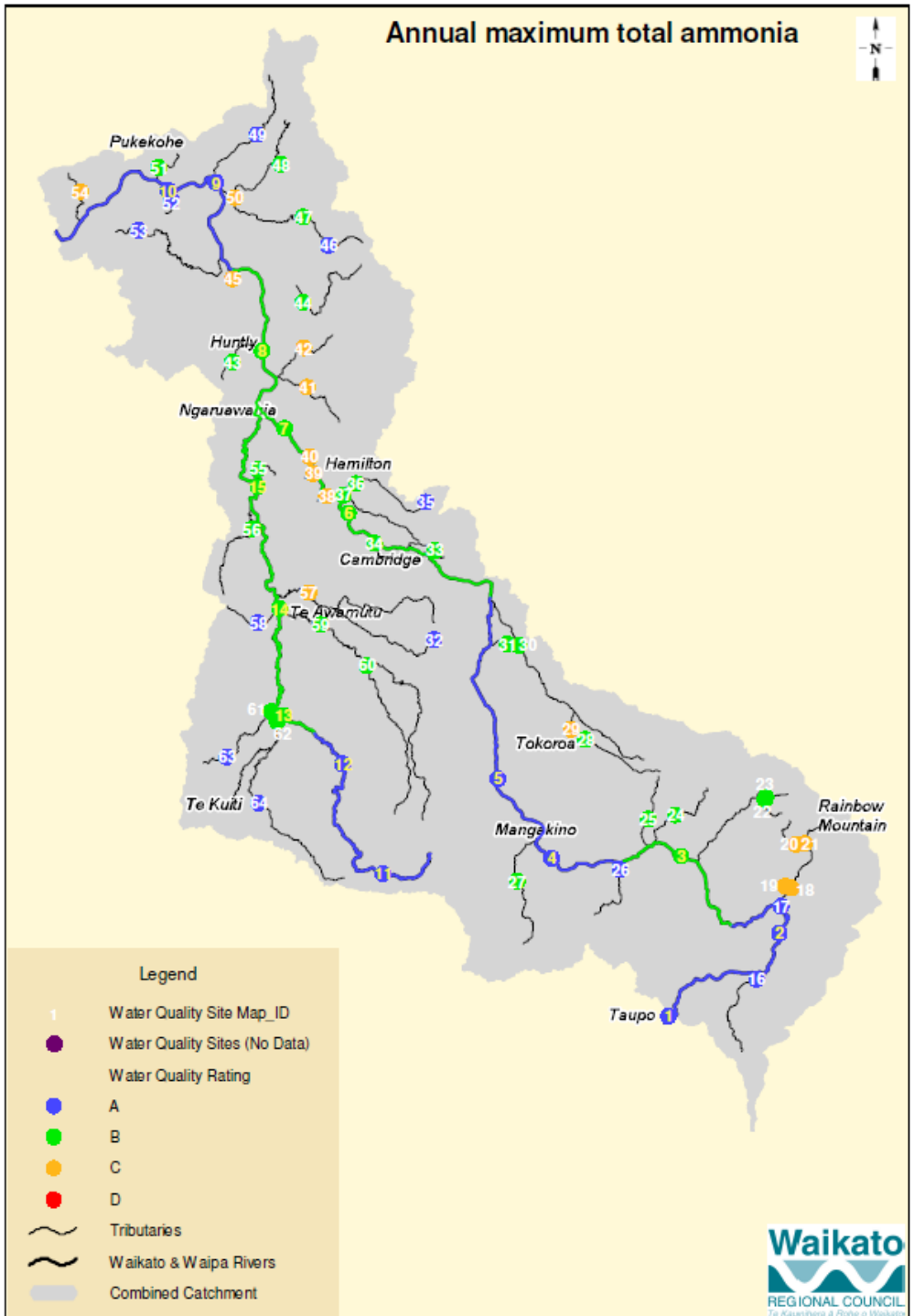
Compliance with the numeric attribute states should be undertaken after pH adjustment.

- Apply to all sites

Ecosystem Health

NH_4-N - Toxicity

- No ‘D band’ breaches
- ‘C’ band (80% species protection):
  - Reporoa
  - Tokoroa
  - Hamilton streams
  - Mangapiko
  - Lower river tribs



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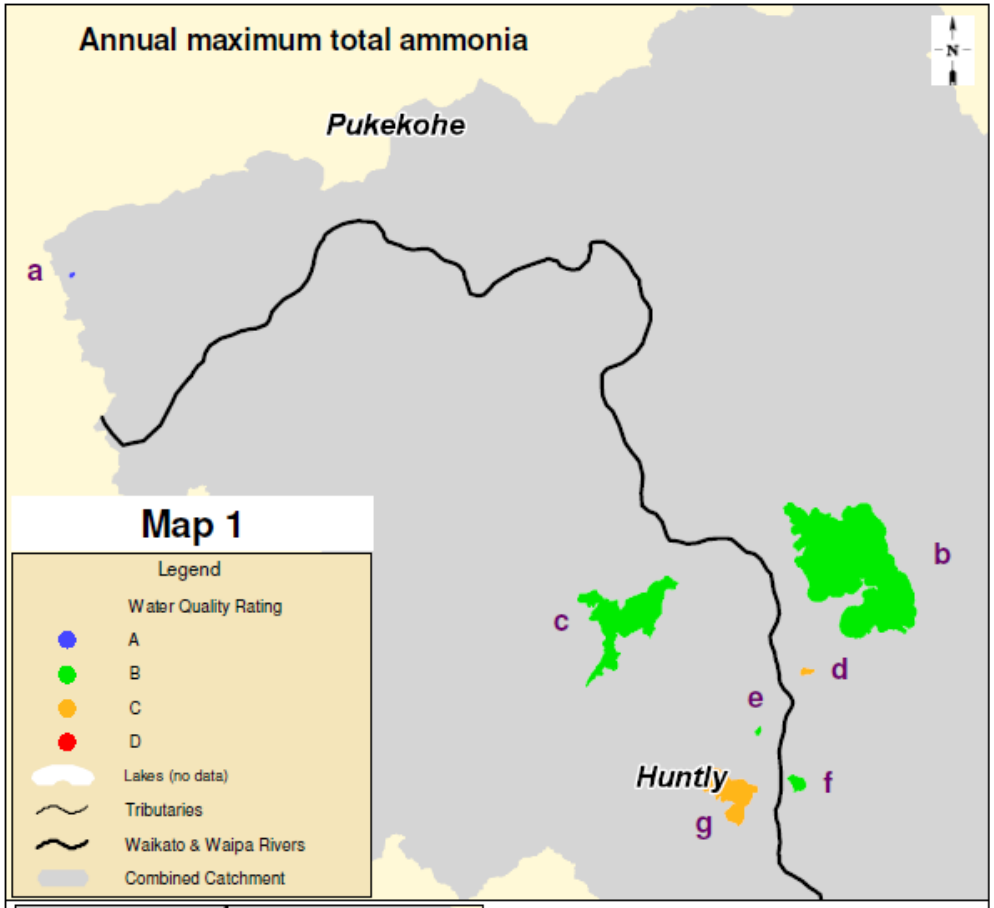
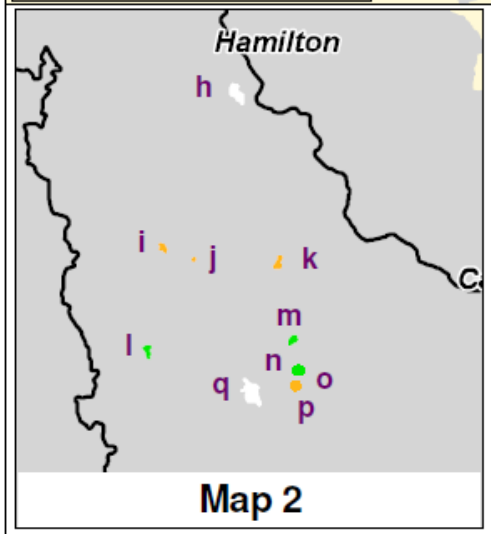
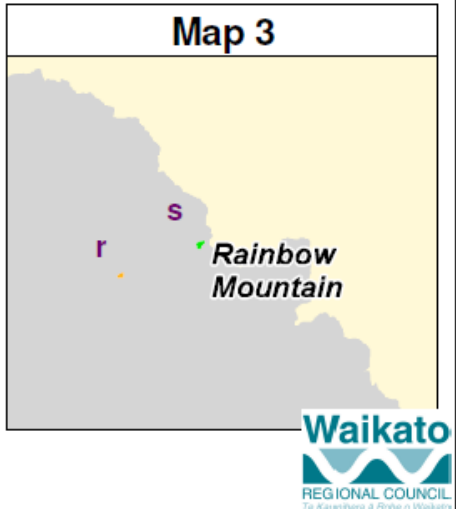
Ecosystem Health

NH_4-N - Toxicity

- No ‘D band’ breaches in lakes
- 7 lakes in ‘C’ band
- 9 lakes in ‘B’ band
- 1 lake in ‘A’ band







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Ecosystem Health - Nitrate

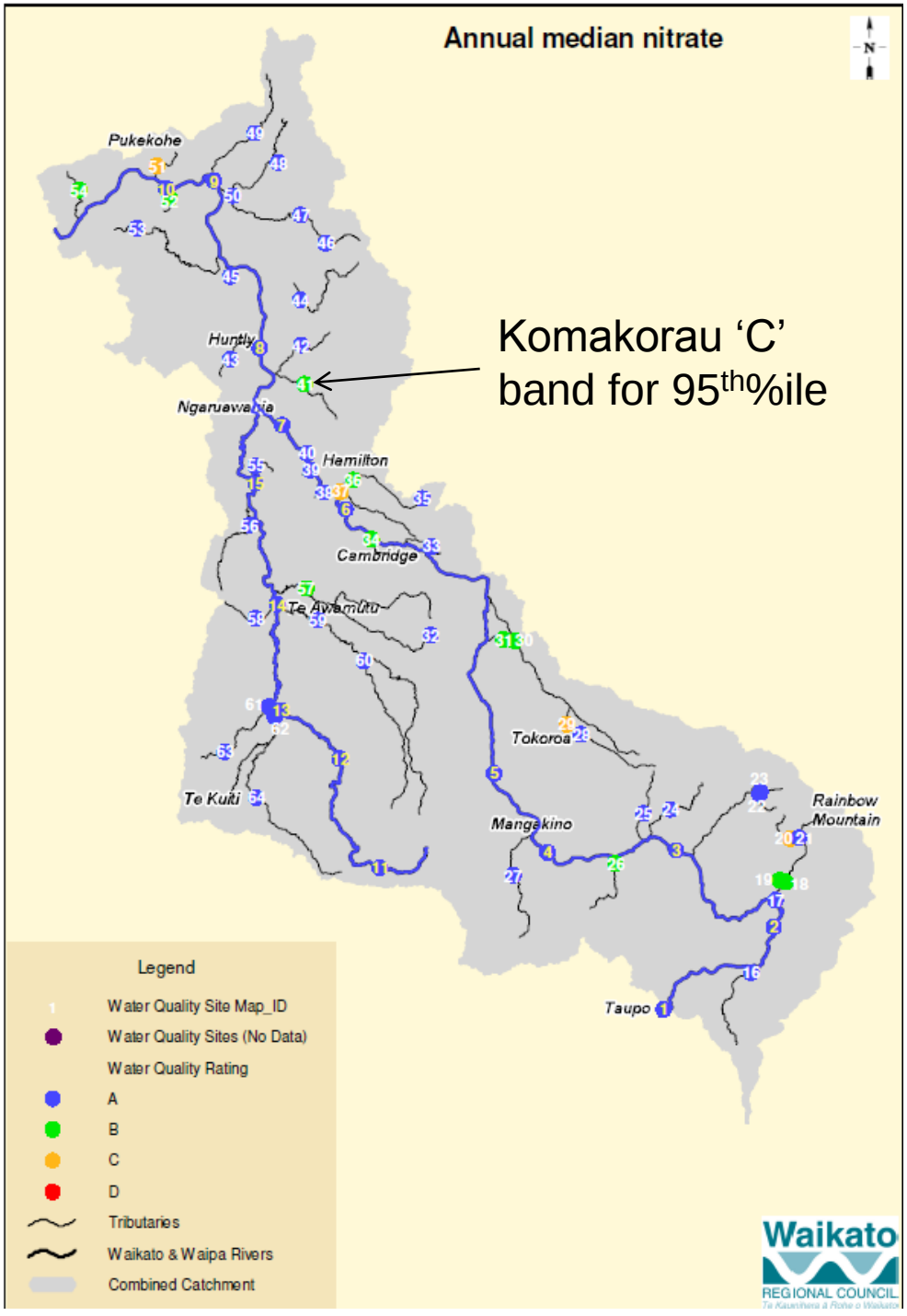
Value	Ecosystem health		
Freshwater Body Type	Rivers		
Attribute	Nitrate (Toxicity)		
Attribute Unit	mg NO_3-N/L (milligrams nitrate-nitrogen per litre)		
Attribute State	Numeric Attribute State		Narrative Attribute State
	Annual Median	Annual 95th Percentile	
A	≤1.0	≤1.5	High conservation value system. Unlikely to be effects even on sensitive species
B	>1.0 and ≤2.4	>1.5 and ≤3.5	Some growth effect on up to 5% of species.
C	>2.4 and ≤6.9	>3.5 and ≤9.8	Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.
National Bottom Line	6.9	9.8	
D	>6.9	>9.8	Impacts on growth of multiple species, and starts approaching acute impact level (ie risk of death) for sensitive species at higher concentrations (>20 mg/L)

- Apply to all river sites

Ecosystem Health

NO_3-N - Toxicity

- No ‘D band’ breaches
- ‘C’ band (80% species protection):
  - Whakapipi (51)
  - Mangaone (37)
  - Mangamingi (29)
  - Kawaunui (20)



Major water quality problem areas

- Lowland lakes are in a very poor state – breach National Bottom Lines for TN, TP, Chla and Cyanobacteria
- *E. coli* levels and water clarity are major constraints on swimmability
- Where CSG sets levels for other Attributes (A, B or C) will determine magnitude of challenge

Median TN & TP - streams