Rangitāiki Freshwater Futures Community Group

Surface water quality

Workshop 10, 27 May 2019

Moemoeā – Vision

E ora ana te mauri o te awa Rangitāiki,

e manaakitia ana e te iwi,

e tiakina ana mō ngā whakatipuranga ō muri mai.

Tihei Mauri Ora

A healthy Rangitāiki River, valued by the community, protected for future generations. Tihei Mauri Ora.

1.
Technical modelling discussion (optional)

Welcome

- Apologies
- Welcome
  - Rangitāiki River Forum members
  - New attendees (alternates and visitors)

Housekeeping

- Fire protocol
- Toilets
- Meals
- Recording and sharing notes
- Make yourself at home

Purpose of this group

To help Council implement the National Policy Statement for Freshwater Management:

- confirm values, express preferred objectives
- provide feedback on limits for freshwater quality and quantity within this Water Management Area
- provide input to solutions for managing activities to meet those limits
- advise Council in their decision-making for Plan Change 12

Purpose today:

Focus – Surface water quality

- To demonstrate our journey – knit the story together of how your input has directed the work so far (values/desired objectives/options)
- To talk through surface water quality information and implications
- To seek approval in principle of draft objectives and potential policy direction

Agenda

1. Technical modelling discussion (optional)
2. Matahina HEP dam lake water quality
3. National and regional updates
4. The story so far
5. Scenarios – recap and explain mitigation scenario
6. Good management practice mitigation scenario results
7. Implications
8. Summary and next steps

am tea

lunch

Outcomes sought today

That you:

- understand and accept/confirm the key water quality issues and proposed focus of management approaches for the Rangitāiki Water Management Area.
- approve in principle the management options being explored.

2.
Updates

National Update – Essential Freshwater

Public consultation July/Aug 2019

Large policy package to:

- Stop degradation and loss
- Address past damage
- Address allocation issues

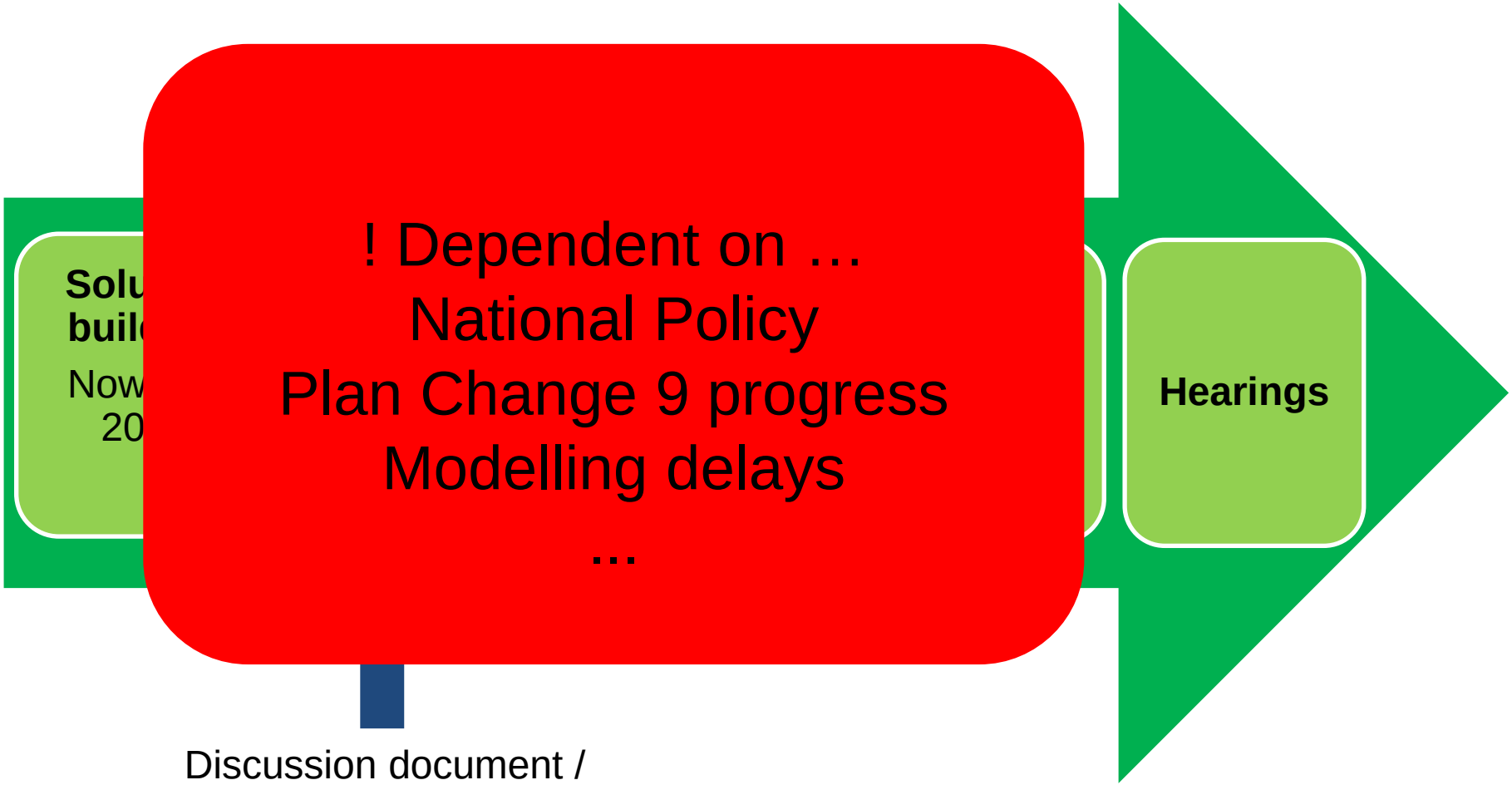
Proposed Plan Change 9:
Region-wide Water Quantity

Environment Court appeal topics

- Māori values and relationships
- Governance and decision making
- Cultural use and economic development
- Tangata whenua general
- NPSFM, Planning and WMA
- Unauthorised dairy takes
- Renewable electricity
- Limits, flows and levels, over allocation
- Rules, consents schedule 7
- Municipal water supplies
- Rootstock survival water
- Transfer of permits

Timeline:

Rangitāiki (PC12)



Calendar

Workshop 8: Sept 2018

- Modelling results - baseline and development

Workshop 9: Mar 2019

- Groundwater quantity

Workshop 10: May

- Water quality - Dam lake water quality, good practice modelling results, policy options.

Workshop 11: Aug 2019

- Surface water quantity

Public engagement

Lowland modified watercourses

You have said (in summary) …

- Water quality will be suitable for swimming, customary and ceremonial activities
- Ecosystem health and habitat for indigenous species will be improved
- Natural character will be improved
- Enable navigation/tauranga waka that does not impact river banks

Lowland - drainage canal and drain water quality and ecology report

- Poor habitat at all sites
  - *heavily modified channels, lack of bank vegetation and shade*
- Poor water quality
  - *high nutrients (ammonia in particular), high turbidity, low DO levels*
- Low macroinvertebrate (MCI) scores
  - *poor ecological conditions*
- Relatively diverse fish fauna (18 species)
- Low richness and Fish_IBI
- Eel mortality at pump stations
- Drainage focus to protect from flooding has adversely affected other values

Management focus

National requirements …

In modified natural watercourses:

- Action plan to improve MCI where it is <80
- Reduce ammonia levels to at least C band for toxicity

Also needed …

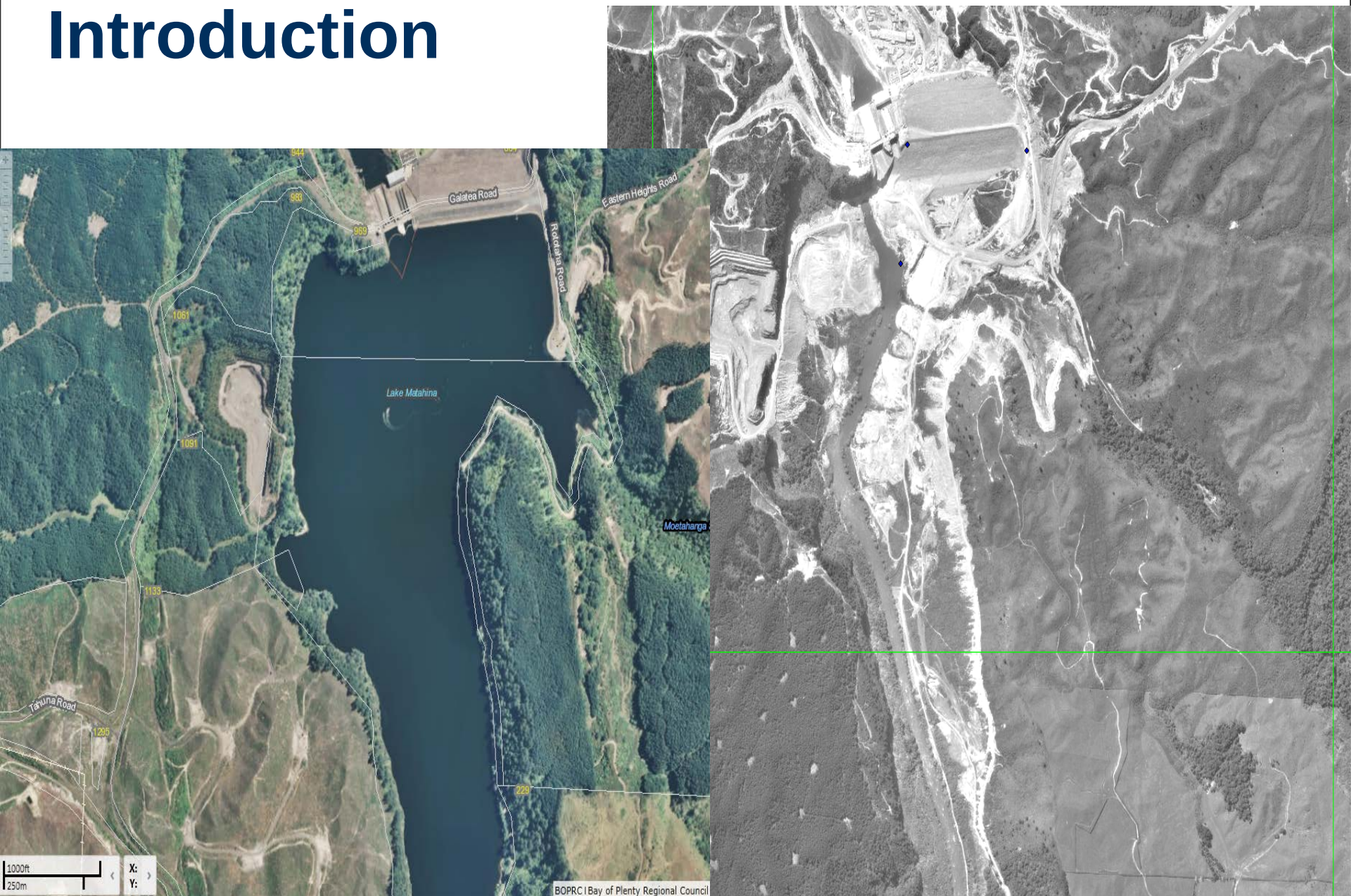
- Reduce temperature
- Reduce *E.coli*
- Reduce turbidity
- Improve habitat and fish passage

3.
Matahina HEP dam lake water quality

Outline

- Introduction
- Lake or River?
- Current State/Issues
- Recommendations
- Summary

Introduction



Lake or River?

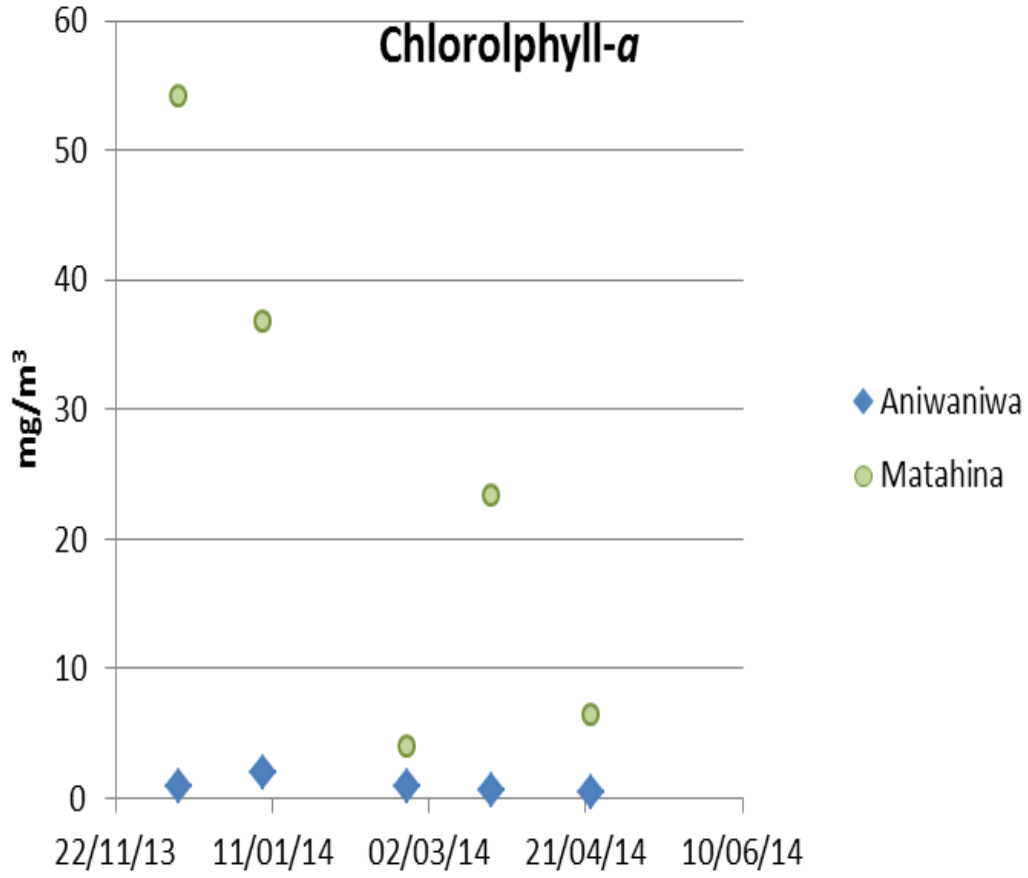
How do these impoundments function?

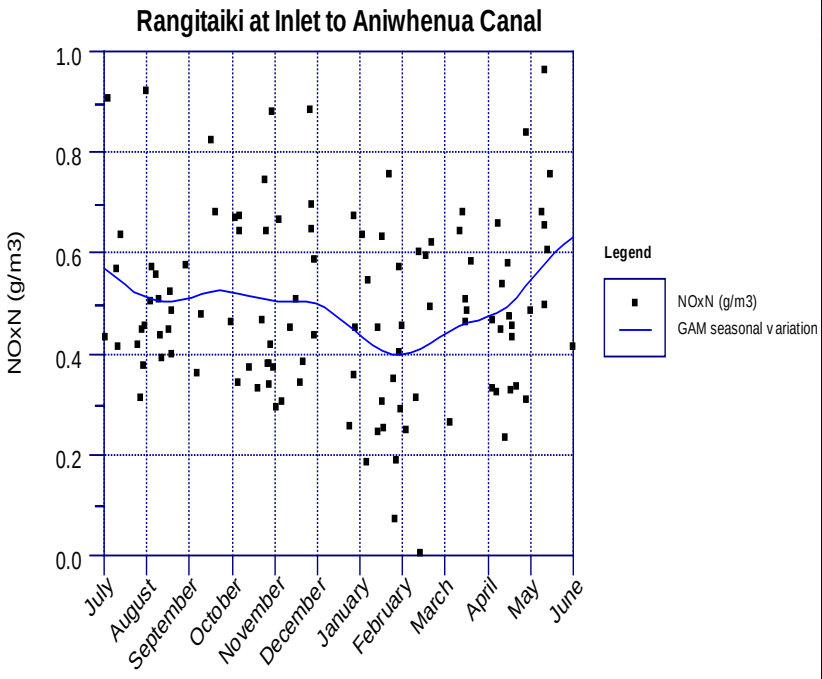
	River	Lake
Residence time	Seconds/minutes	Hours/days
Deposition	Transitional	Permanent
Algal structure	Periphyton	Phytoplankton
Stratification/ mixing	Well mixed	Vertical density changes
Light regime	Full euphotic zone	Depth limited
Energy	Unstable	Stable

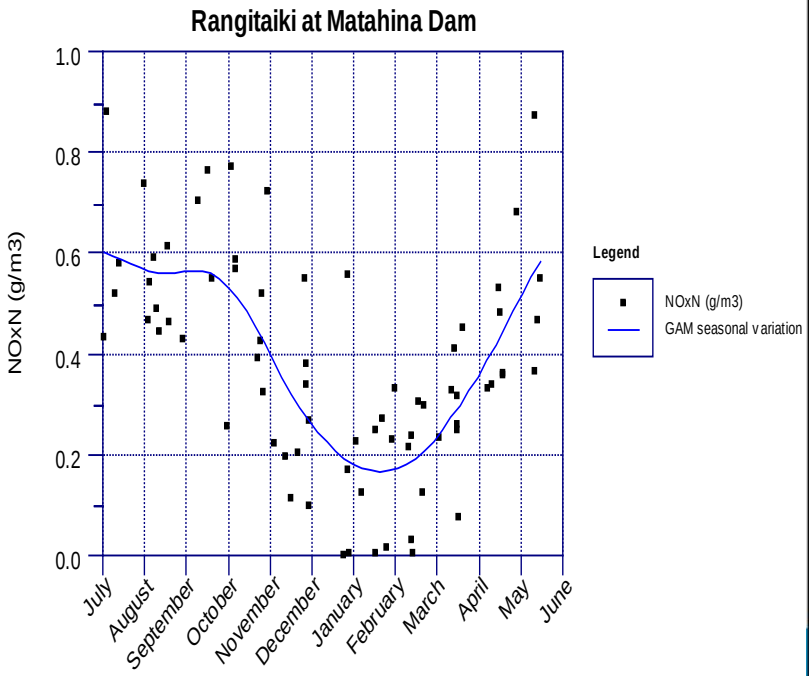
Hydrological characteristics

	Aniwaniwa	Matahina
Surface area	104 ha	230 ha
Operating level	146.8 to 146.6m RL	73.15 to 76.2m RL
Depth (max range)	8-10m	40-50m
Depth (shallow range)	1-3m	1-4m
Storage volume	385,000m^3 *1	~105.5 Mm^3
Mean outflow	38.97 m^3/s *3	71 m^3/s *2
Residence time	2.7 hours	12 (spring) 21 (autumn) days
Stratifies	No??	Yes – Sept-May

Nutrient and Productivity







Issues Risks

Ecological risk from damming

- Reduced connectivity – food web changes
- Sedimentation – feeding, foraging, & habitat impacts
- Changing nutrient status – algae (productivity) shifts
- Bottom water oxygen loss – habitat loss, nutrient release
- Toxicity risk ammonia & nitrate – risk to sensitive species

Current State

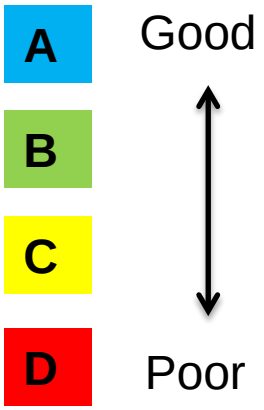


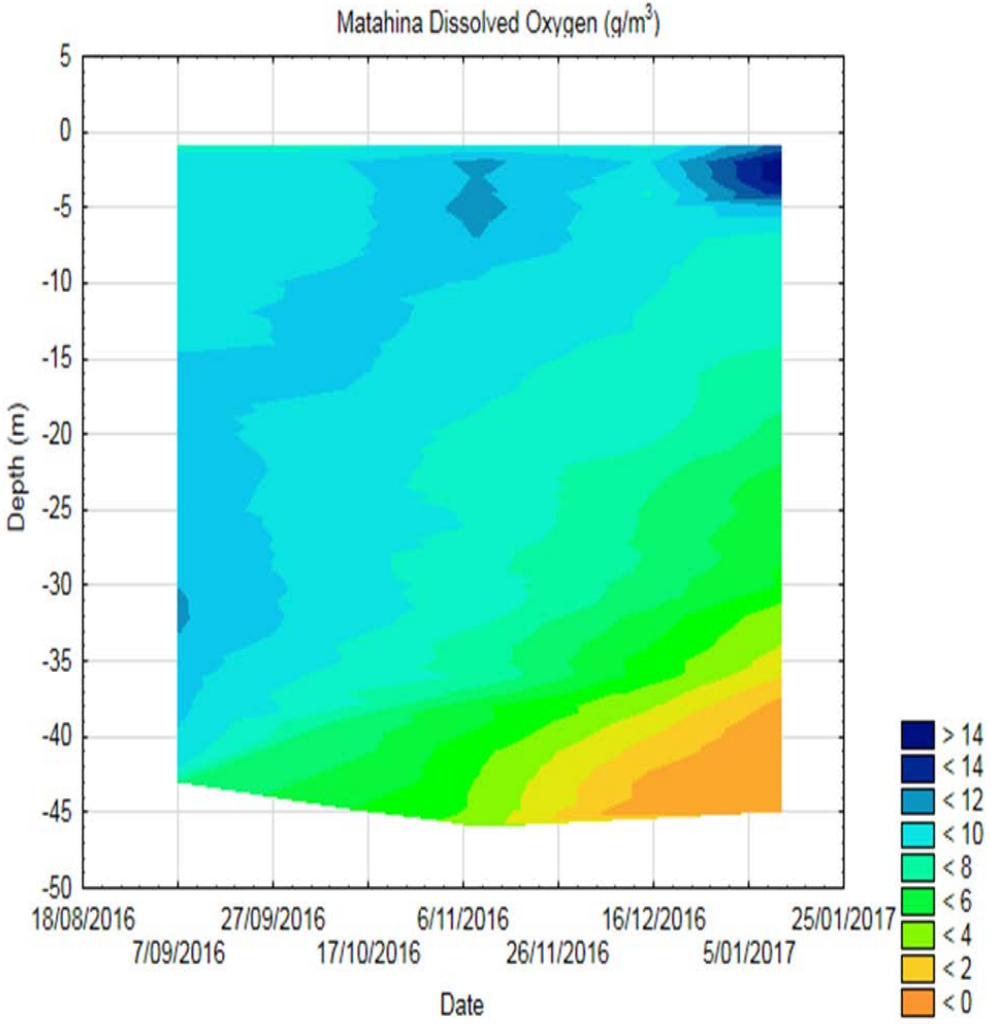
Table: NPS-FW Attribute State

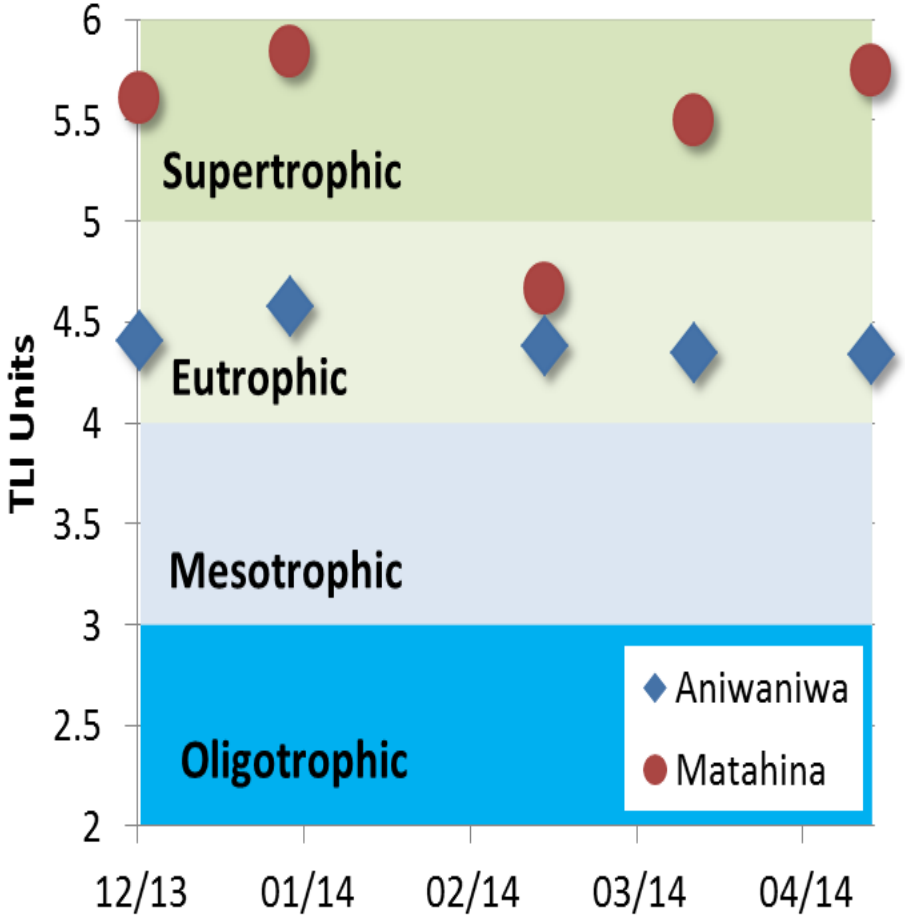
Rangitāiki at Inlet to Aniwhenua Canal				
	Nitrate	*Ammonia*	*TN*	*TP*
2014/15	A	A	C	D
2016/17	A	A	C	D
2017/18	A	A	C	D

Rangitāiki at Matahina Dam				
	Nitrate	*Ammonia*	*TN*	*TP*
2014/15	A	A	C	C
2016/17	A	A	C	D
2017/18	A	A	D	C

Current State

Trophic status and oxygen





Lake or River?

How do these impoundments function?

	River		Lake
Residence time	Seconds/minutes		Hours/days
Deposition	Transitional		Permanent
Algae	Periphyton		Phytoplankton
Stratification/ mixing	Well mixed		Vertical density changes
Light regime	Full euphotic zone		Depth limited
Energy	Poor		Poor - rich

Aniwaniwa

Matahina

Recommendation Aniwaniwa

Run of the river system – river system attributes:

- Nitrate-nitrogen – ecosystem health (toxicity).
- Ammoniacal-nitrogen – ecosystem health (toxicity).
- *Temperature.*
- *pH.*

Recommendation Matahina

Lake system – lake attributes:

- Total nitrogen – ecosystem health (lake).
- Total phosphorus – ecosystem health (lake).
- Phytoplankton (Chlorophyll-*a)* – ecosystem health (assess in changes in lake productivity).
- Water clarity (Secchi depth).
- Cyanobacteria (planktonic) – human health (lake).

Recommended draft objectives - Aniwaniwa and Matahina

Attribute	River Attributes	Lake Attributes	Objective value
	Aniwaniwa	Matahina	
Total nitrogen		C	• Ecosystem health • Indigenous species • Mahinga kai • Fishing
Nitrate	A		
Ammoniacal-nitrogen	A	A	
Total phosphorus		C	
Chlorophyll-a (Phytoplankton)		C	
Water clarity		To be established	• Ecosystem health • Human health
Macrophyte (LakeSPI)		To be established	• Fishing • Ecosystem health • Indigenous species
Cyanobacteria - planktonic		A	• Contact recreation • Customary use

Discussion Questions

1. Do you accept the objectives *to **maintain*** water quality in the C band for TN, TP and Chlorophyll *a*?
2. Do you accept the need to ***arrest*** increasing trends in nitrogen supply across the catchment as a priority?
3. What concerns/questions do you have about this?

Gradients of Agreement

Have we got it right?

1 = whole hearted support

2 = agreement with minor point of contention

3 = support with reservations

4 = abstain

5 = more discussion needed

6 = don’t like but will support

7 = serious disagreement

8 = veto

4.
The story so far

Issues – Rangitāiki

- Risk of increasing nutrients from more intense land use
- Dam lakes gathering too much nutrients and sediment
- Lower Rangitāiki is heavily modified impacts on water values
- Tuna and indigenous fish impacted
- Water availability constrained
- Algal blooms and *E.coli* generally not an issue

Working draft objectives

objective is met

objective not met

insufficient data

Attribute	River Attributes	Lake Attributes
	Aniwaniwa	Matahina
Total nitrogen (TN)		C
Nitrate	A	
Ammoniacal-nitrogen	A	A
Total phosphorus (TP)		C
Chlorophyll-*a* (Phytoplankton)		C
Water clarity (Secchi depth)		? To be established
Macrophyte (LakeSPI)		? To be established
Cyanobacteria - planktonic		A

Working draft objectives

objective is met | objective not met | insufficient data

FMU	Lower Rangitāiki	Mid-Upper Rangitāiki	Whirinaki/Urewera (Natural)
Attribute	*Objective*	*Objective*	*Objective*
Macro Invertebrate Community Index (MCI)	*B*	*B*	*A*
EPT	*B*	*B*	*A*
Bay of Plenty Index of Biotic Integrity (BOP-_IBI)	*B*	*B*	*A*
Periphyton	*B*	*B*	*A*
Macrophytes	*<50%*	*<50%*	*<50%*
Nitrate-nitrogen (toxicity)[5]	*A*	*A*	*A*
Ammonia-nitrogen (toxicity)	*A*	*A*	*A*
Dissolved Oxygen (below point sources)	*B*	*A*	*A*

Working Draft Objectives

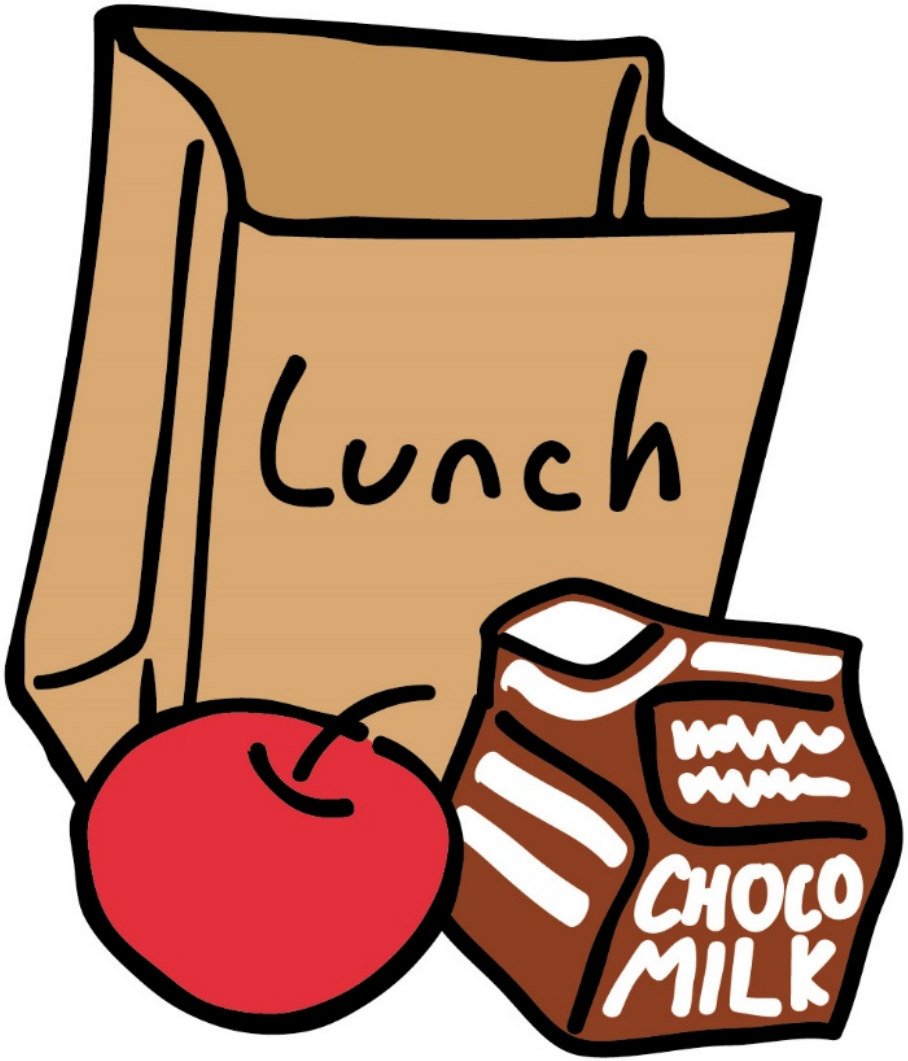
FMU	**Lower Rangitāiki**	**Mid-Upper Rangitāiki**	**Whirinaki/Urewera (Natural)**
Acidity (pH)	*B*	*A*	*A*
Temperature (summer Cox-Rutherford Index)	*B*	*A*	*A*
Habitat protection level provided by river flows for indicator species (% of habitat available at Mean Annual Low Flow)	*95% for trout angling* *90% for trout spawning and Koaro* *80% for juvenile longfin eels* *75% for adult longfin eels*	*Same as Lower Rangitāiki*	*Same as Lower Rangitāiki*
Toxicants/irritants	*>90%*	*>90%*	*99%*
E. Coli	*A*	*A*	*A*
Benthic Cyanobacteria	*A*	*A*	*A*
Cyanobacteria- planktonic (lake fed rivers)		*A*	
Deposited fine sediment			
Visual clarity			
Turbidity			

Management focus - water quality

- Stop any increasing nutrient trends
- Reduce sediment loss
- Improve ecological health in streams in the plains
- Understand how nutrients from the catchment and the dam affect ecosystem health in HEP dam lake Matahina
- Maintain *E. coli* levels (do no worse), and improve over time.
- Prioritise key source or ”hot spots”

Comfort level?

Others?

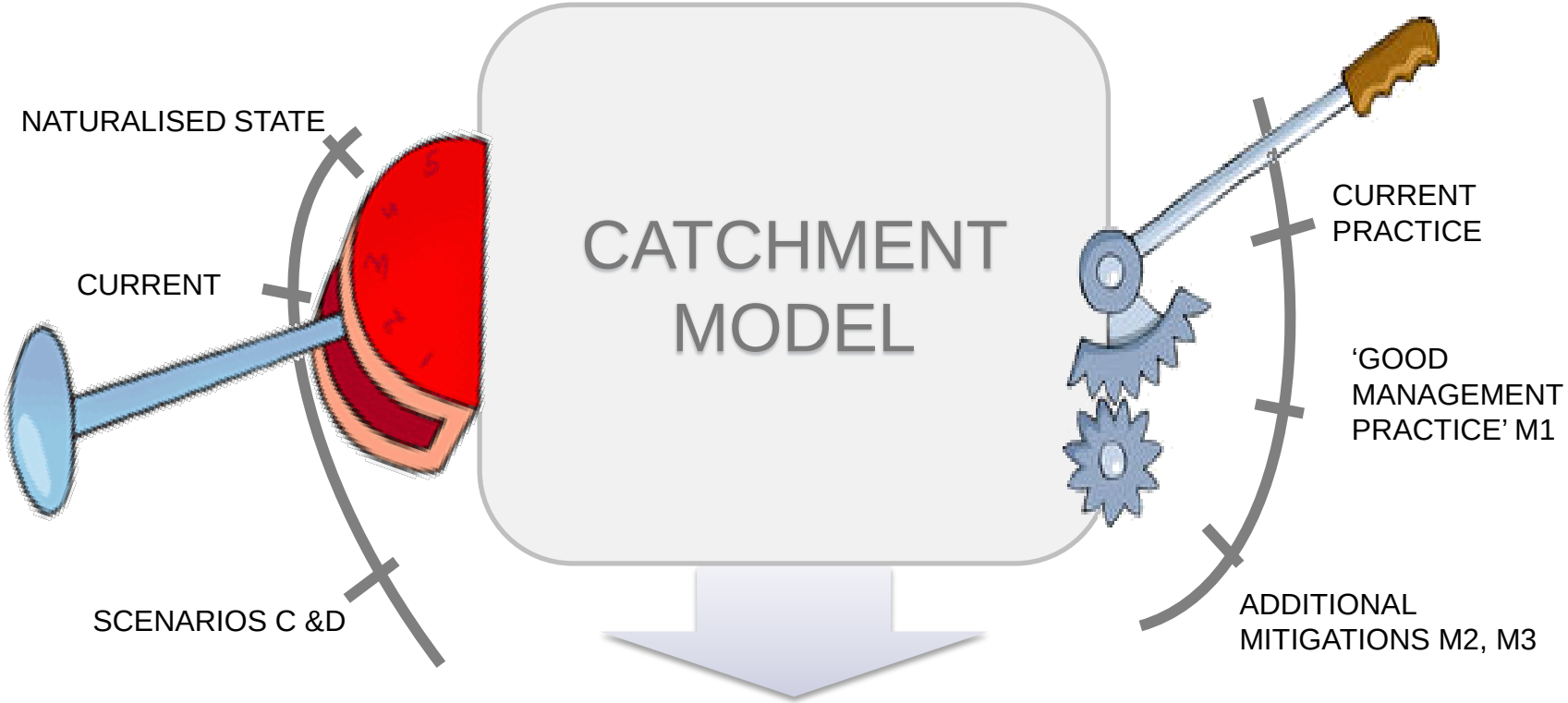

Lunch
CHOCO
MILK

5.
Scenarios

Scenarios: exploring alternative futures

Land (and water) use

Management or mitigation practices



Water quality, flow and resource use estimates

Workshop 1: Credible futures Rangitāiki

Workshop 4: Credible futures 2030

Approach to developing scenarios

Start from documented growth projections and defined GMPs/options identified, adjusted/narrowed down based on iwi and stakeholder engagement

Community groups

Tangata whenua

Co-governance fora

Territorial Local Authorities

Major resource users/ environmental NGOs/ industry groups

Surface Water Catchment Modelling Scenarios

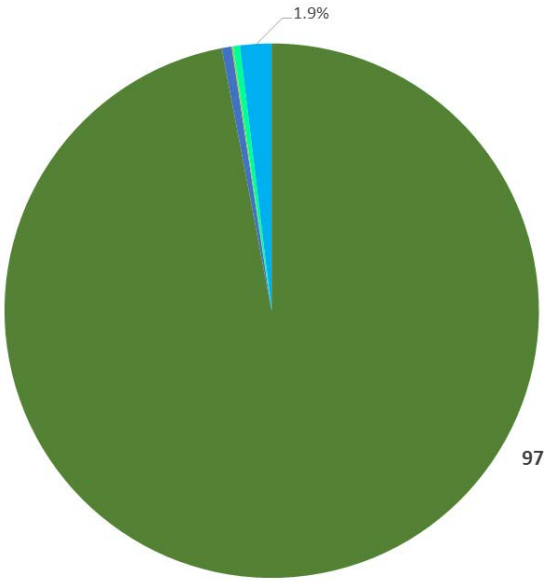
	Scenario	Description
A	Reference 'Natural' State	Natural land cover. No productive/developed land use. No water takes or discharges. HEP scheme not operating. Existing major structural modifications remain in place (e.g., dams, channel straightened and cut to sea).
B	Current/ Baseline	Current land use, estimated current takes, discharges, and land use practice.

Surface Water Catchment Modelling Scenarios

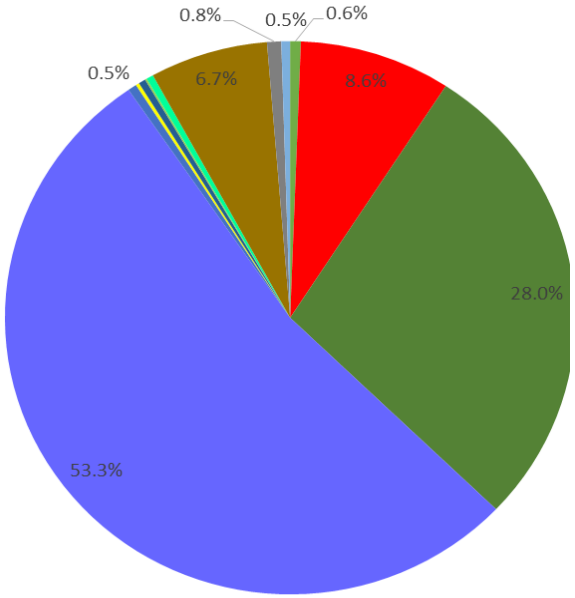
	Scenario	Description	
C	Development	Estimated future credible land use change. Estimated takes, discharges, and land use practice based on the current scenario assumptions, except for known/consented changes like the initiation of the Waiari water supply take.	Horticulture and mānuka expansion, wetlands extend over to full extent of estimated ~2050 sea level rise.
D	Development		Dairy expansion, wetlands extend over part of extent of estimated ~2050 sea level rise.

Summary:
Land use change scenarios

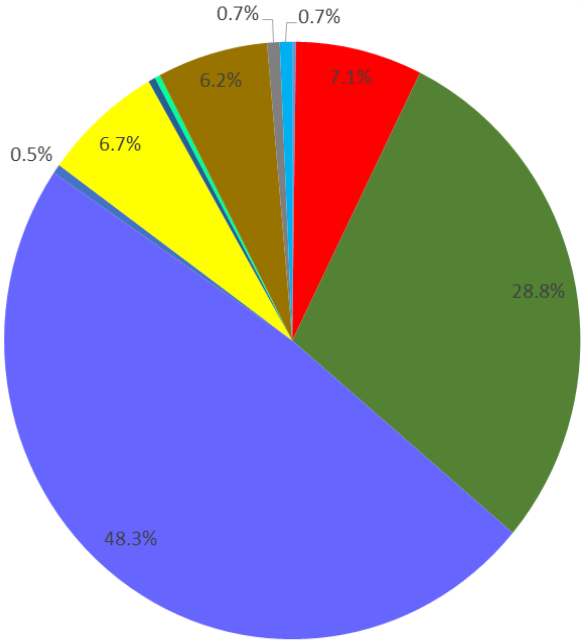
Reference ‘natural’ state



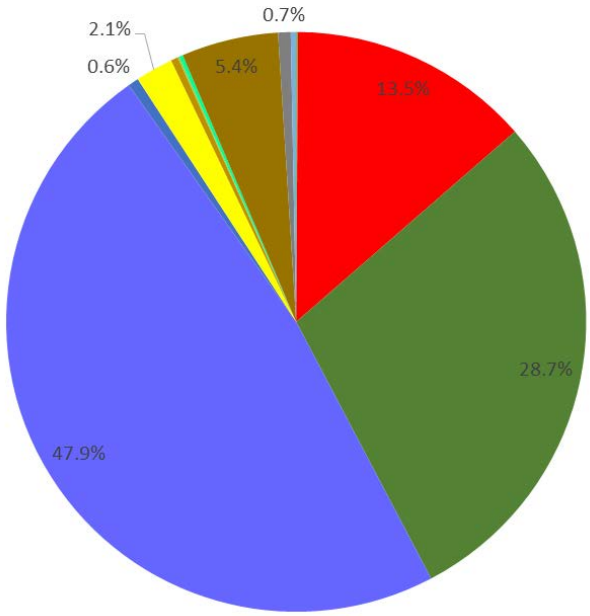
Current state



Development “C”



Development “D”



Arable
Dairy
Native Forest
Plantation Forest
Hydro
Kiwifruit & Orchards
Lifestyle
Parks & Reserves
Scrub
Sheep & Beef
Urban_Road_Rail_unknown
Vegetables
Wetlands

Development scenarios (C and D)

Used to test ….

what will happen to contaminant loads, yields

and water quality in the future if "likely/credible"

future land and water use change?

Good practice mitigation scenario (M1)

Used to test ….

what will happen to contaminant loads, yields and water quality now and in the future if good management practice is applied to all land uses?

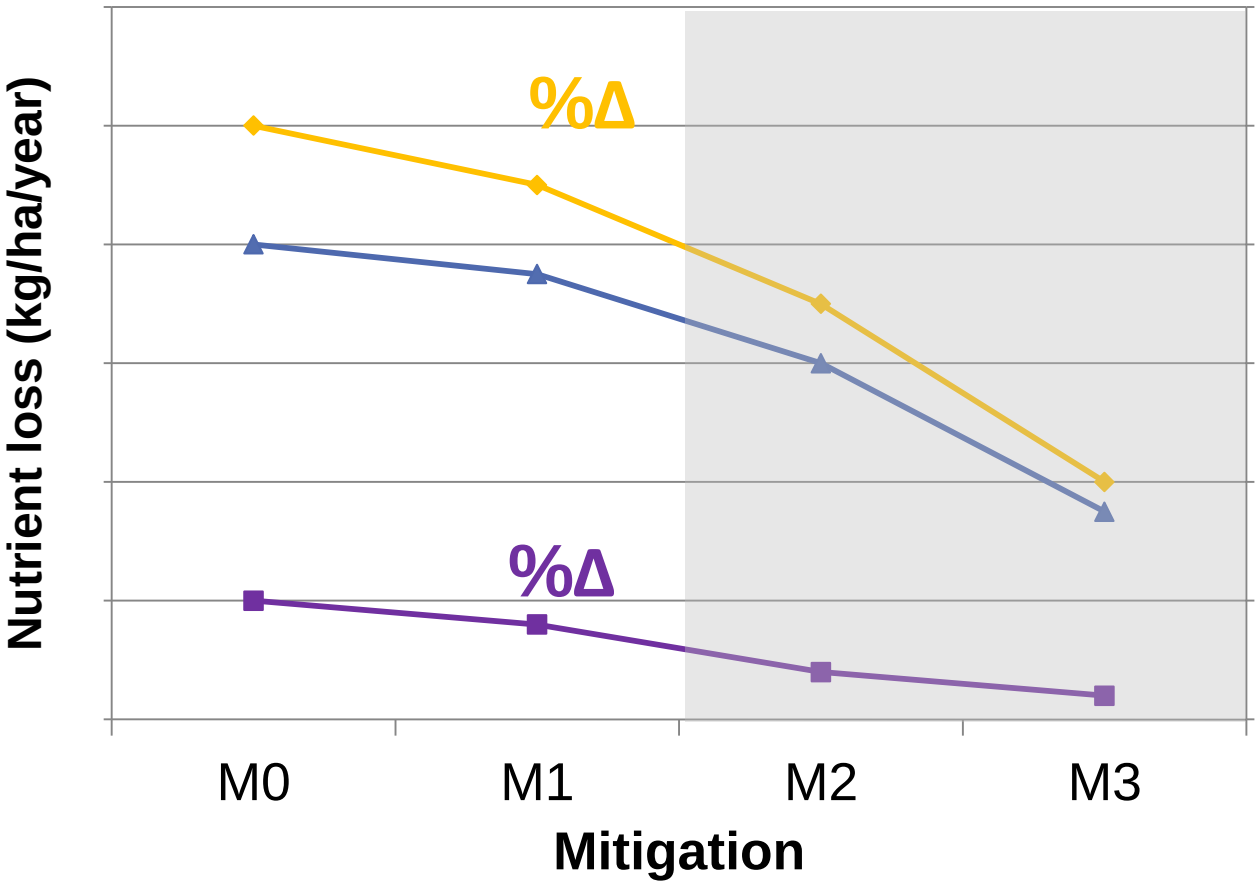
Mitigation bundles

Cost (% reduction in profit)	Effectiveness (reduction in contaminant loss)			
	Nil	Low	Med	High
High				M3
Med			M2	
Low		M1		
Nil				

- Based on previous studies and literature
- Group helped to bundle mitigation actions in to M1-M3
- Practices with prohibitive cost and nil or highly uncertain effectiveness not included

Mitigation costs and effectiveness

PerrinAg & LCR assessment for different land uses



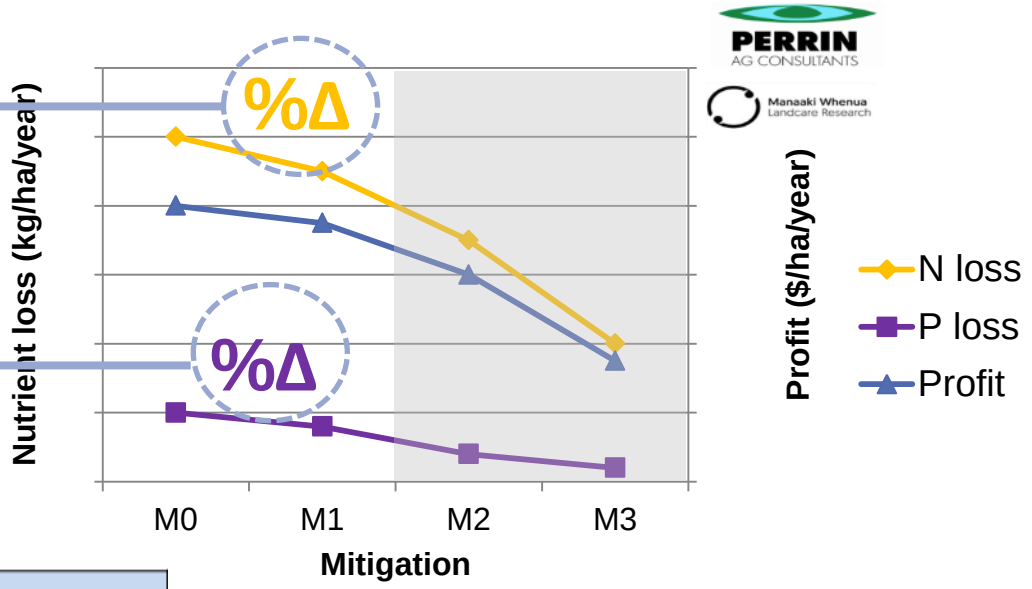
Analysis based on:

Overseer

Conceptual only, not to scale

Mitigation effectiveness informs modelling scenarios

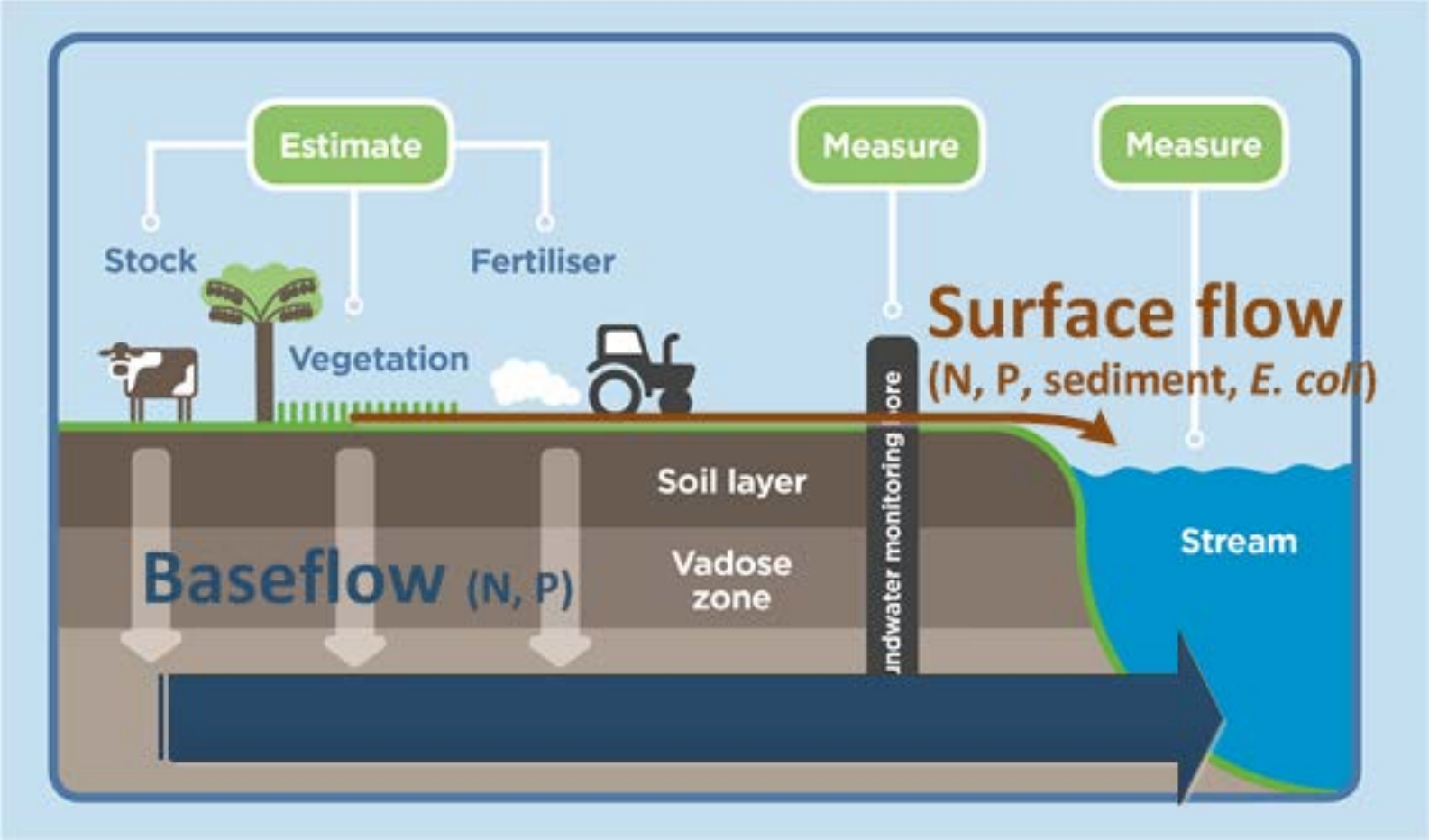
Base flow mitigation effectiveness for N and P losses



		Mitigation		
A. Reference land use	✓			
	Current practice (M0)	M1	M2	M3
B. Current land use	✓	☼	?	?
C. Future land use	✓	☼	?	?
D. Future land use	✓	☼	?	?

Surface flow mitigation effectiveness for N, P, sediment and *E. coli* losses - literature and expert advice

Base flow and surface flow



Modelling M1 scenario

Contaminant losses applied in Current (B) and development (C and D) scenarios are adjusted based on:

- Assumptions about current good practice mitigations in place
- Area where new individual practices apply (e.g. slope)
- Effectiveness of the practices

*as estimated by APSIM and other methods for use in SOURCE

Based on analysis using:

WWLA

eWater Source

APSIM

Modelling Scenarios applied

Land (and water) use	Mitigation and Management	
A. Naturalised State		
	Current practice	Good Management Practice (M1)
B. Current State	✓	M1 Current
C. Future Scenario C	✓	M1 + Scenario C
D. Future Scenario D	✓	M1 + Scenario D

6.
Modelling results

Activity:

a) *Break into 3 groups*

- ***Red* you start at Nitrogen,**
- ***Blue* - Phosphorous,**
- ***Green* - E.Coli**

b) *You will have approx. 8 mins at each station*

c) *Staff member to talk through the maps*

d) *General discussion/questions*

- ***do the results and conclusions seem about right to you?***
- ***Would you draw other conclusions***

7.
Management options

Potential management options:

1. Control land use intensification
2. Farm/Orchard Environment Plans – good practice
    a) Estimate nutrient losses and hotspots
    b) Set specific actions and standards e.g., stock exclusion
    c) Set a cap or good/practice range of nutrient losses
3. Controls on discharges
4. Action plans to improve stream ecological health in the plains
5. Prioritising action - focus catchments

Think beyond ….
- yourself
- your group or
- organisation

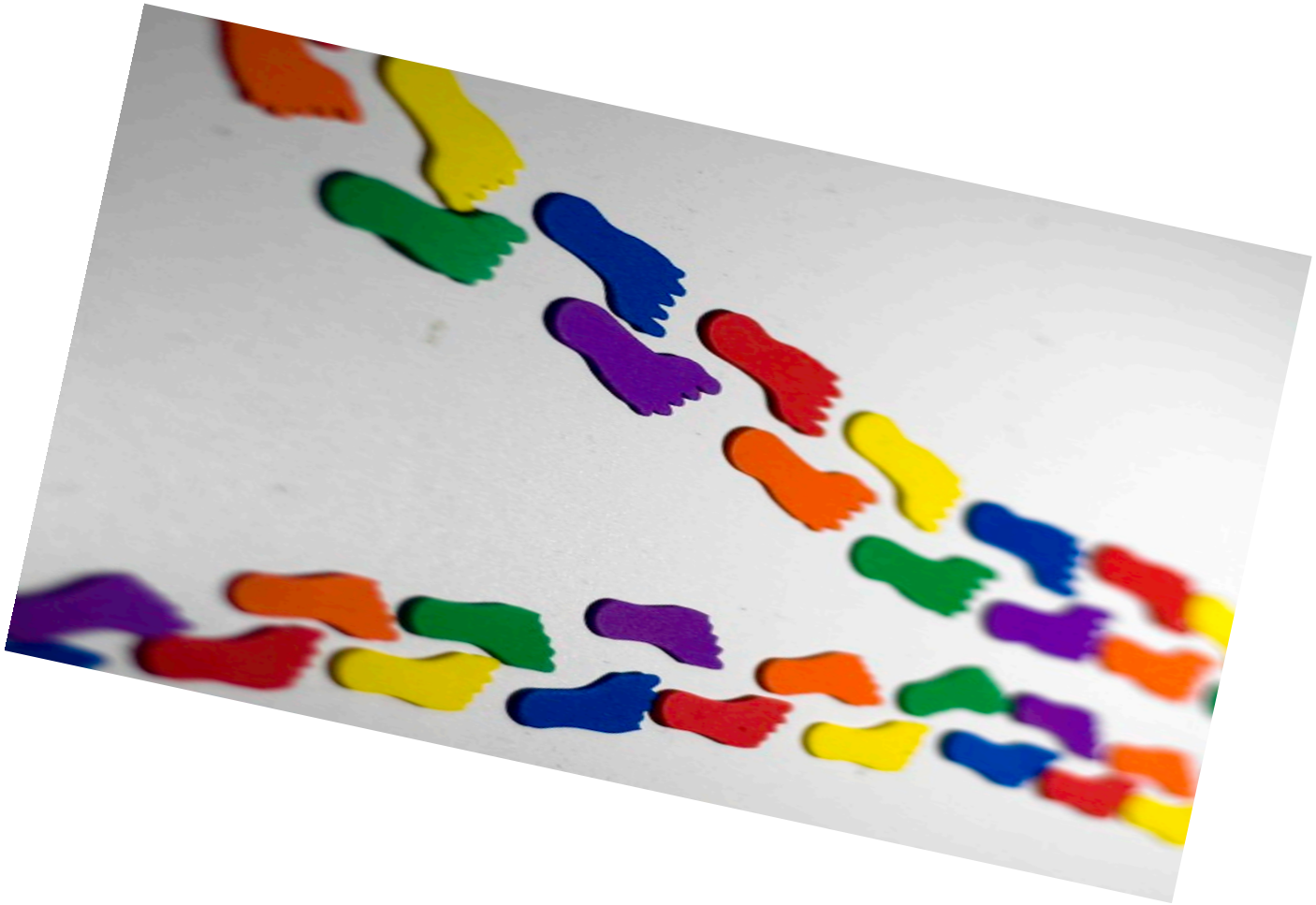
1. Break into four groups
2. On each table is one of the four management options
3. Have a quiet think yourself –post-it per thought
4. Group discussion as post your thoughts

(Pro, Con, Big ?'s, Options)

When you rotate to a new table – tick any comments you agree with then add your own thoughts on new post-its

8.
Summary and next steps

Where we've been today



Next steps

- Engagement with the public about groundwater (and other topics) after June onwards
- Surface water quantity- August
- Plan drafting

Engagement

- Discussion document
- Continue Iwi and Hapū engagement
- Community/public engagement – after Central Government consultation
- Plan drafting

Thanks once again

- In closing…
  - Any feedback to us on this session?
- Next session August
- Talk to others ……