BRIEFING NOTE

To:	Kaituna and Pongakawa-Waitahanui Freshwater Futures Community Groups	
From:	Nicki Green, Senior Planner, Water Policy; Rochelle Carter, Freshwater Scientist	**Date:** 10 September 2018
Subject:	**Workshop 8: Surface water quality** **26 September 2018, The Orchard, Te Puke**	

1 Summary – *If you don't have time to read the rest, just read this*

The briefing note and workshop 8 present and discuss surface water quality modelling results, and what they mean in our work towards setting freshwater quality objectives and limits. The key messages are:

1. Science indicates water quality is safe for contact recreation / swimming at monitored freshwater sites, but worsening in Lower Pongakawa. Modelling indicates water quality is not acceptable for contact recreation in some lower catchment water bodies. Science also indicates that Waihī and Maketū estuaries are also affected. There may be localised *E.coli* hot spots in the WMA which Council can address on a case by case basis.
2. Sediment, phosphorus and nitrogen loads from human activities (i.e., productive land uses and discharges) contribute to current poor ecological health (like loss of native plants and fauna) and affects recreational and mahinga kai values of Waihī and Maketū estuaries.
3. Current nitrate and ammonia concentrations do not pose significant risk of toxicity to aquatic life, but these nutrients can promote plant, weed or algal growth in the estuaries.
4. Algal growth in streams is generally not an issue.
5. Macro-invertebrate monitoring indicates ecological health is compromised in some lowland water bodies.

The results suggest the focus of water quality work should be on:

- sediment, nitrogen and phosphorus key source areas generated by human activities, particularly in the lower catchments.
- continuing improving trends (e.g, Ammonia in Kaituna River at Te Matai).
- addressing worsening *E. coli* trends in Pongakawa catchment and water bodies with D or C band.
- avoiding increasing in *E. coli*, nitrogen, phosphorus or sediment if land use and practices change in the estuary catchments.
- addressing sediment loss during and after forest harvesting.
- arresting increasing concentrations of Nitrate and Phosphorus, and on reducing loads of sediment, nitrogen and phosphorus entering the estuaries.
- action planning to improve ecological health in lowland water bodies.

Questions to think about:

Do these results and conclusions seem "about right"? If not, what are your concerns and suggestions?

2 Meeting Overview

2.1 Purpose

We continue to work towards maintaining and improving freshwater quality by setting measurable objectives and limits based on community values. This is key work required by National Policy Statement for Freshwater Management. The Community Group provides active feedback and advice to Council.

The main purpose of this session is to present and discuss surface water quality modelling results and what they mean. This includes *E. coli* concentrations; and Sediment, Nitrogen and Phosphorus loads and source areas.

2.2 Key outcomes sought

For contact recreation, ecological health and other in-river values, group members:

1) Understand and confirm key water quality issues;
2) Understand the science attributes used to measure water quality and ecology;
3) Understand why *E.coli.* Nitrogen, Phosphorous and Sediment are important contaminants;
4) Discuss, understand and are comfortable with modelling results;
5) Provide feedback on approach to exploring mitigations

The agenda will also cover updates on:

- national and regional changes affecting this project
- project progress and next steps
- work "on the ground" in your catchments now

An Environmental Summary Report has been sent to you. Please read it prior to the workshop.

The following sections outline the modelling results and how they relate to community values.

3 Swimming / Contact Recreation and *E. coli*

3.1 What people want

Kaituna He Taonga Tuku Iho – A Treasure Handed Down (the Kaituna River Document) says "**Ensure the water …is clean and safe for swimming in locations where people wish to swim**…" with specific locations identified and recommended by Te Maru o Kaituna[1]".

In workshop 5, you said you would like **all rivers in the Kaituna-Pongakawa-Waitahanui Water Management Area to be suitable for swimming everywhere, except after heavy rainfall**. The Kaituna Community Group noted a potential time frame of 2027 for this to be achieved in the lower Kaituna. These are spelled out in full in the attached document *Kaituna-Pongakawa-Waitahanui Water Management Area: Draft measurable objectives to support in-river values.*

[1] Te Maru O Kaituna, 2018, p.24, Outcome (a)(i) under Objective 5

3.1.1 How we measure water quality for contact recreation

There are several ways people might measure suitability for swimming. Key factors are shown in Figure 1.

E. coli concentration is an indicator for bacterial infection risk to people. Central government has set this as a compulsory attribute.

Using central government's bands, A, B and C band are suitable for contact recreation, including swimming and any other activity where a person might be immersed in the water e.g., kayaking, some cultural ceremonies, mahinga kai gathering. D and E band are not suitable.

3.1.2 Measurable objectives

Council staff suggest that the above statements about what people want could be achieved by:

- maintaining *E.coli* concentrations in Freshwater Management Units where *E. coli* concentrations are in the A or B band, including arresting any worsening trends;
- Improving *E. coli* concentration to at least the C band, but preferably to B band, in Freshwater Management Units where people swim and concentrations are currently in the C, D or E band.
- For rivers discharging to Waihī and Maketū estuaries, maintaining or reducing *E. coli* concentrations to support safe contact recreation in the estuaries. The scale of improvement required is still being estimated.

Questions to think about:

Do these measureable objectives feel "about right"?

If not, what are your concerns and suggestions?

3.2 Current situation

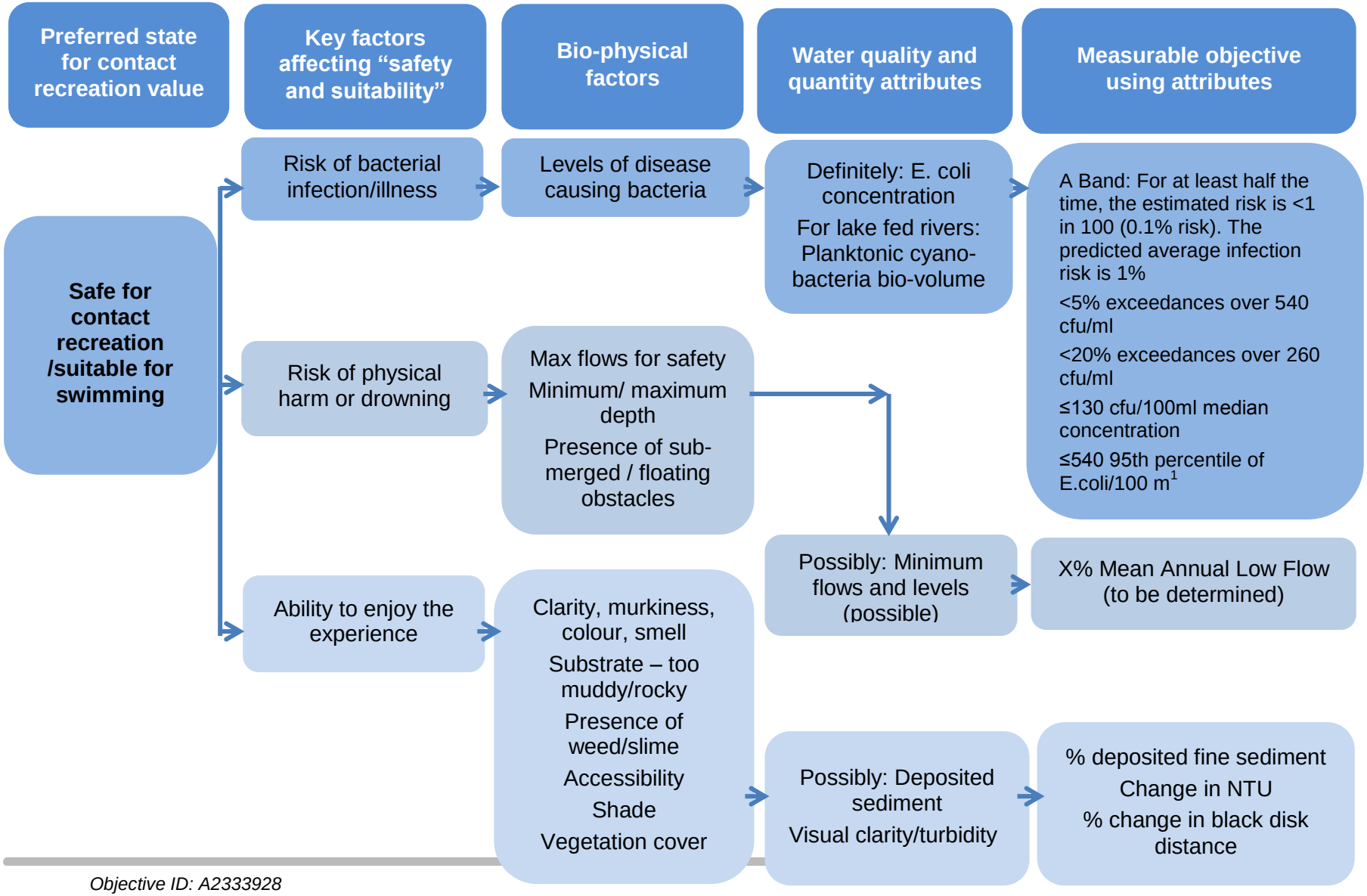
Based on central government's *E. coli* bands, water quality is safe for swimming at monitored sites (Table 1). It is good in the Kaituna River, but can be elevated in the Pongakawa and Waitahanui rivers. The trend is worsening at the Pongakawa Old Coach Road monitoring site. The improving trend in Kaituna River at Te Matai is likely due to improvements made in the Affco point source discharge.

Kaituna Pongakawa Waitahanui WMA	***E. coli***	
Site	**State**	**Long term trend**
Kaituna at Rotoiti outlet	A	👎
Kaituna at Maungarangi	A	👉
Kaituna at Te Matai	A	👍
Waitahanui	C	👉
Pongakawa at Forest	A	
Pongakawa Old Coach	B	👉
Pongakawa at SH2	A	👎

Table 1 *E. coli* concentration state bands and long term trends at monitored sites.

'A' (Very good) to 'E' (Very poor). Trends: 👉 = indeterminate; 👍 = improving, 👎 = degrading

Figure 1: Example illustrating that many factors contribute to each in-river value (in this case swimming/primary contact) and only some of those are measurable indicators that may be used for managing water quality and quantity.



This is only part of the story though. Council will soon publish some water quality monitoring data showing lowland drainage canals have poorer results, and faecal contaminants are rising in Waihī estuary.

We can't monitor everywhere and modelling helps us to estimate *E. coli* concentrations throughout all of the rivers in the WMA. Information sheets outlining the catchment model have been provided previously. A detailed technical report will be available soon. Surface water catchment modelling indicates that water quality might be in the C and D band in several lowland rivers as shown in Figure 2.

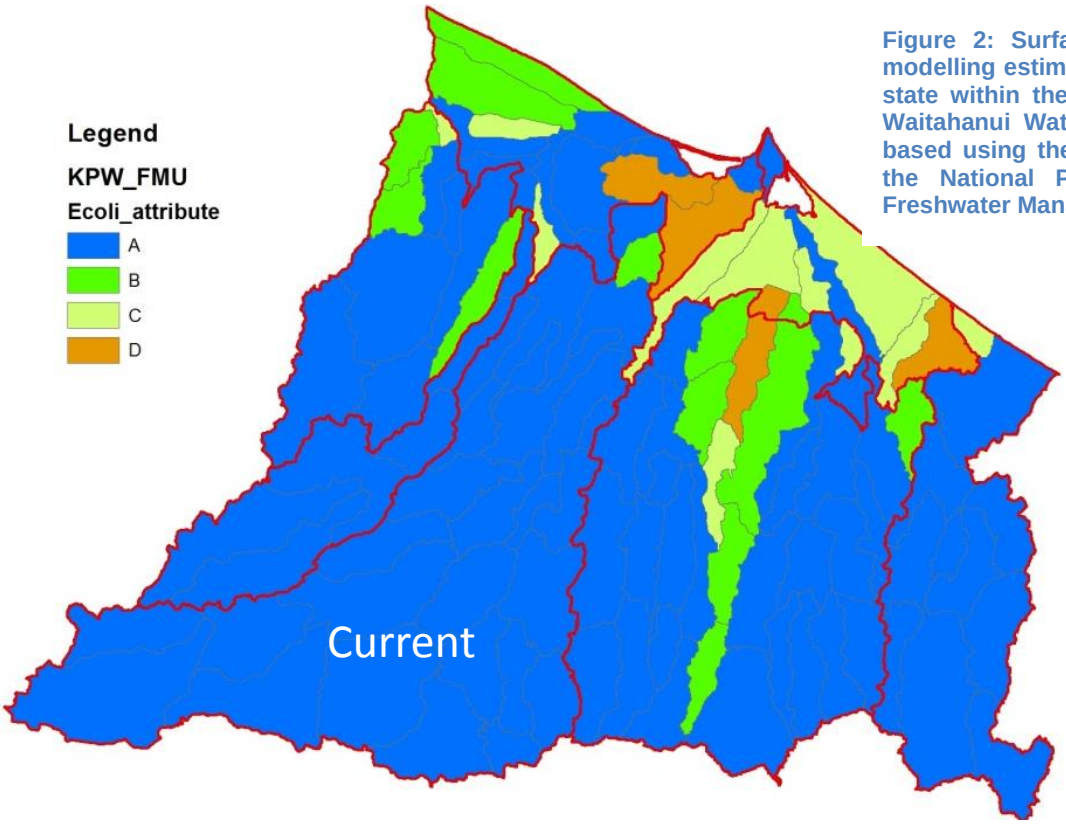


Figure 2: Surface water catchment modelling estimates of current *E. coli* state within the Kaituna-Pongakawa-Waitahanui Water Management Area based using the bands expressed in the National Policy Statement for Freshwater Management 2014

Question to think about:

Do these results seem "about right"?

If not, what are your concerns?

What is your general reaction/response to these findings?

3.3 Where does the E.coli come from?

E. coli comes from human, farm animal and wild animal faeces. Modelling indicates that if there was no farmed land, and all of the Water Management Area was covered in natural land cover, most rivers would be in the A band, and just a few would be in the B band (caused by wild animals/birds).

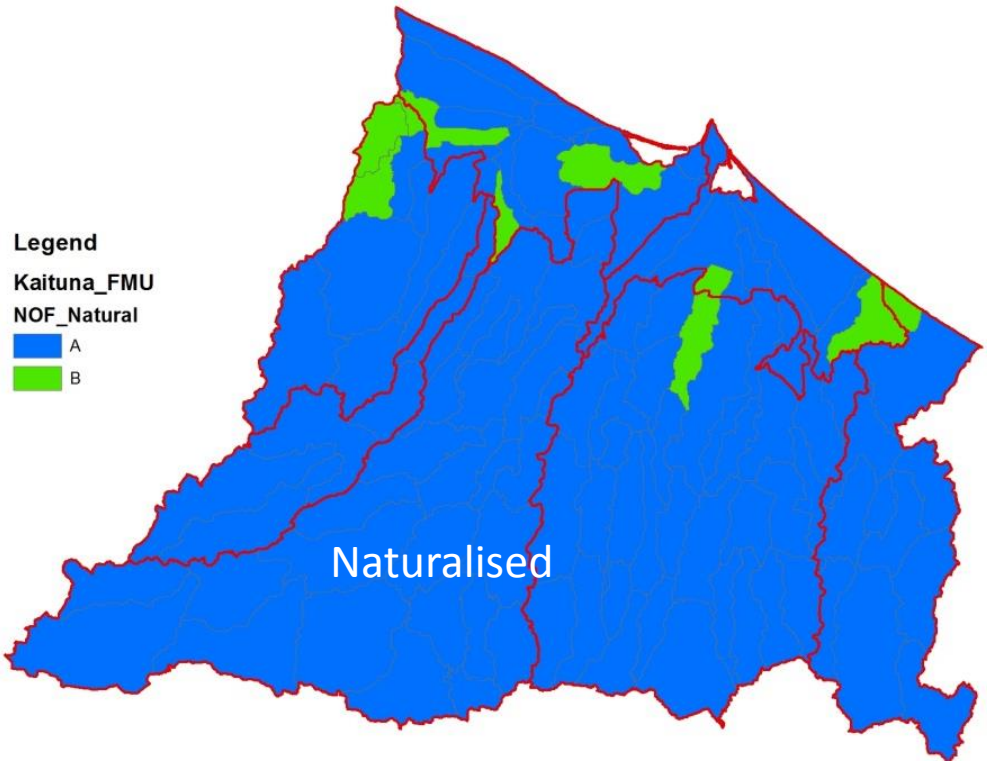


Figure 3: Surface water catchment modelling estimates of *E. coli* state within the Kaituna-Pongakawa-Waitahanui Water Management Area under natural land cover (and no water use), using the bands expressed in the National Policy Statement for Freshwater Management 2014

3.4 Possible future situation

Remember at workshop 6 we talked about possible credible future land use change?

Staff asked the model "what if land use changes as outlined in Table 2?"

"What if land use changes in the future?	
Land and water use *practice* stay about the same as now, except for consented changes like the initiation of the Waiari water supply take.	
Development Scenario C • New wetlands in coastal areas replace mainly dairy farming • Kiwifruit expands in to suitable areas, mainly from pasture • Urban area expands to current urban limits in lower Kaituna. • New forestry and scrub (mānuka) in low capability land in the mid-upper parts of catchments	**Development Scenario D** • New wetlands in coastal areas, but less than in scenario C • New dairy on suitable land • Urban area expands to current urban limits in lower Kaituna. • New forestry and scrub in low capability land in the mid-upper parts of catchments

Table 2: Brief description of future development scenarios used in SOURCE modelling for Kaituna-Pongakawa-Waitahanui Water Management Area.

The modelling indicates that:

- Development C: If urban, kiwifruit, and wetlands increase in the lowlands (i.e., dairying reduces), and forestry increases in the mid and upper catchments, water quality for primary contact would improve in the lowland streams and Puanene stream, as a result of reducing faecal contaminant inputs (See Figure 4).
- Development D: If urban and dairying expand a bit in the lowlands, with new forestry in the mid-upper catchments, suitability for contact recreation would improve in some places and worsen in others. We might see some improvement in the mid-upper Pongakawa River, and some improvement in some lowland streams. The main stem of Kaituna River would remain 'A' band. Water bodies in Pāpāmoa East may move from B band to a mixture of A and D.

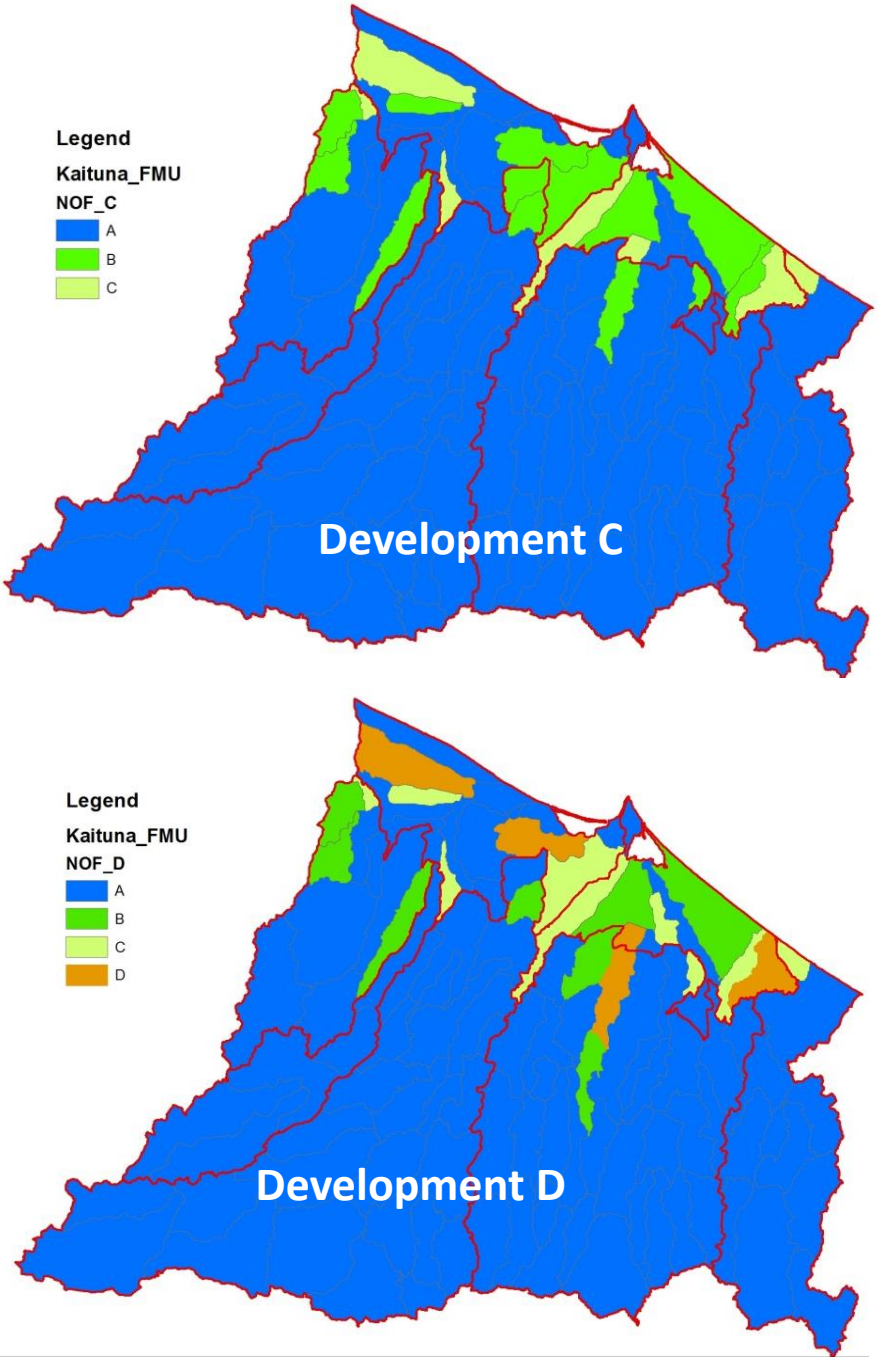


Figure 4: Surface water catchment modelling estimates of *E. coli* state within the Kaituna-Pongakawa-Waitahanui Water Management Area for future development scenario C (top) and D (bottom), using the bands expressed in the National Policy Statement for Freshwater Management 2014

Questions to think about:

Do these results seem "about right"?

If not, what are your concerns and suggestions?

What is your general reaction/response to these findings?

4 Ecosystem Health and Sediment, Phosphorus and Nitrogen

4.1 What people want and how we measure water quality for ecosystem health

The attached information sheet[2] outlines (in Table 1) what Kaituna *He Taonga Tuku Iho – A Treasure Handed Down* and Kaituna and Pongakawa-Waitahanui Community Groups have said they want to achieve in relation to ecological health.

There are several ways people might measure ecosystem health. The key science attributes are outlined in the information sheet, along with draft measurable water quality objectives to support these.

Questions to think about:

Do these measureable objectives seem "about right"?

If not, what are your concerns and suggestions?

4.2 Why Nitrogen, Phosphorus and Sediment are important

Nitrogen and **phosphorus** are essential for growth of plants. Too much nitrogen and phosphorus can cause excessive growth of slime, algae and aquatic plants, which can reduce ecological and aesthetic values.

Nitrate and ammonia are the dissolved component of nitrogen and, if present in strong enough concentrations, can be toxic to aquatic life. **Phosphorus** is not toxic at higher concentrations.

Too much **suspended sediment** can smother beds of lakes, rivers and estuaries, which can diminish shellfish, native plant and fish life and recreational values. It can also clog up waterways and increase the risk of flooding.

4.3 Current and possible future situation

The modelling results for sediment, phosphorus and nitrogen source areas and loads are in Appendix 1.

4.3.1 Nitrogen – key messages

- Nitrogen levels start off relatively low at the top of the catchment, with the smallest difference between natural and current state, due to the moderating impacts of the lakes acting as a "nitrogen sponge".
- Nitrogen load increases downstream as flow also increases. There is also a larger change between the estimated natural and current loads downstream reflecting the increase in human made load from more intensive land use.
- Modelling indicates the human-made contribution to nitrogen loads range from <1% in small headwater catchments dominated by native forest, to ~99% in catchments draining into some lowland drainage canals.

[2] A2863296

- Nitrate and ammonia toxicity does not appear to be a current issue in our rivers and streams (see Table 3), but we need to focus on arresting increasing nitrate trends and on the health of the estuaries.
- Ammonia concentrations have improved in the lower Kaituna, related to improvements in the Affco discharge.
- Modelling indicates that Development C would generally reduce the human-made total nitrogen load. This would ultimately reduce the load going into receiving environments and help reduce nutrient enrichment in our estuaries.
- Under Development D, it is likely improved nitrogen mitigation measures would be needed to maintain current water quality (although results are mixed across the WMA).

Site	**Nitrate (toxicity)**		**Ammonia (toxicity)**	
Kaituna Pongakawa Waitahanui WMA	State 2017	LT Trend	State 2017	LT Trend
Kaituna at Rotoiti outlet	**A**	☞	**A**	☞
Kaituna at Maungarangi	**A**	☞	**A**	☞
Kaituna at Te Matai	**A**	👎	**A**	👍
Waitahanui	**A**	👎	**A**	☞
Pongakawa at Forest	**A**		**A**	
Pongakawa Old Coach	**B**	👎	**A**	👍
Pongakawa at SH2	**B**	👎	**A**	☞

Table 3 Nitrate and Ammonia toxicity state bands and long term trends at monitored sites.
'A' (Very good) to 'D' (Poor). Trends: ☞ = indeterminate; 👍= improving, 👎= degrading

4.3.2 Phosphorus – key messages

- Phosphorus starts off relatively low at the top of the catchment, with the smallest difference between natural and current state, due to the moderating impacts of the lakes acting as a nutrient "sponge". This has also been moderated by treatment of alum in Lake Rotorua.
- Load increases downstream as flow also increases.
- There is a change between the natural and current loads downstream reflecting the increase in human made load due to more intensive land use.
- Modelling indicates that human-made contribution to phosphorus loads range from <1% in small headwater catchments dominated by native forest, to ~95% in catchments draining into some lowland drainage canals.
- A focus on arresting increasing concentrations will be needed.

- Modelling indicates that Development C will generally reduce the human-made total phosphorus load. This will ultimately reduce the load going into the estuaries and help reduce nutrient enrichment.
- Note that under Development D, it is likely that better mitigation measures (e.g., on farm actions) would be needed to maintain current water quality in some areas.

4.3.3 Sediment – key messages

- Sediment starts off relatively low at the top of the catchment with the smallest difference between natural and current state, due to the moderating impacts of the lakes acting as a "sponge".
- Load increases downstream as flow also increases.
- There is larger change between the natural load and current downstream reflecting the increase in human made load due to more intensive land use.
- Modelling is telling us that human-made contribution to sediment loads range from <1% in small headwater catchments dominated by native forest, to ~95% in some lowland catchments draining into some drainage canals.
- A focus on reducing sediment load into lakes and estuaries is needed.
- Modelling indicates that both Development C and D would generally increase the human-made total suspended sediment loads. This would ultimately increase the load going into the estuaries and additional mitigation measures would be required to maintain current water quality or improve it.

4.3.4 Conclusions

- Nitrogen, phosphorus and sediment loads from human activities are influencing the health of Waihī and Maketū estuaries.
- Algal growth in streams is generally not an issue in the KPW WMA.
- There are nitrogen, phosphorus and sediment high source areas caused by human activities, or 'hotspots', in the WMA. These are the areas effort could be focussed to reduce loads.
- Focus needs to be on arresting increasing concentrations of *E.coli,* Nitrate and Phosphorus, and on reducing loads of *E. coli*, sediment, nitrogen and phosphorus entering the estuaries.

Questions to think about:

Do these results and conclusions seem "about right"?

If not, what are your concerns and suggestions?

What is your general reaction/response to these findings?

5 What shall we do with the modelling results?

5.1 Limit setting

A big next step is to estimate just how much we need to reduce nitrogen, phosphorus, sediment, and *E. coli* by in each river catchment, Freshwater Management Unit, or possibly even sub-catchment. This will be driven firstly by the needs of the most sensitive parts of catchment; that is Waihī and Maketū estuaries.

Both Waihī and Maketū estuary are degraded as a result of contaminants coming from the land and freshwater bodies. The Kaituna River rediversion will not fully resolve this for Maketū estuary.

Staff are still progressing work to estimate the sediment, phosphorus, nitrogen and *E. coli* load reductions needed to support ecological health, mahinga kai and other values in Waihī and Maketū estuaries.

5.2 Exploring options to reduce contaminants

Council's land management officers are already discussing possible land use practice improvements with some land owners in "hot spots" and an update can be given at the workshop.

Remember at workshop 7 we talked about possible mitigation bundles to address *E. coli*, sediment, nitrogen and phosphorus from land use? A separate workshop paper is being circulated to provide you with an analysis of cost effectiveness of these mitigations. Staff intend to use the SOURCE model to ask:

1. Firstly, "what if everybody improved their practice to include basic good practice? (the M1 bundle);

   and then, if that is not enough to get the results we are looking for ….

2. "What if more advanced mitigation actions were also applied in key areas?" (such as the M2 and M3 bundles)

The big question is, "will these mitigations be enough to achieve our measurable water quality objectives in section 2 above".

Staff will also use the SOURCE model to ask what would happen if rainfall and temperature changes as predicted by a few of central government's climate change scenarios.

Question: What do you think of this approach to testing mitigation options?

Appendix 1: Surface water catchment modelling results for sediment, nitrogen and phosphorus

The graphs and maps below show:

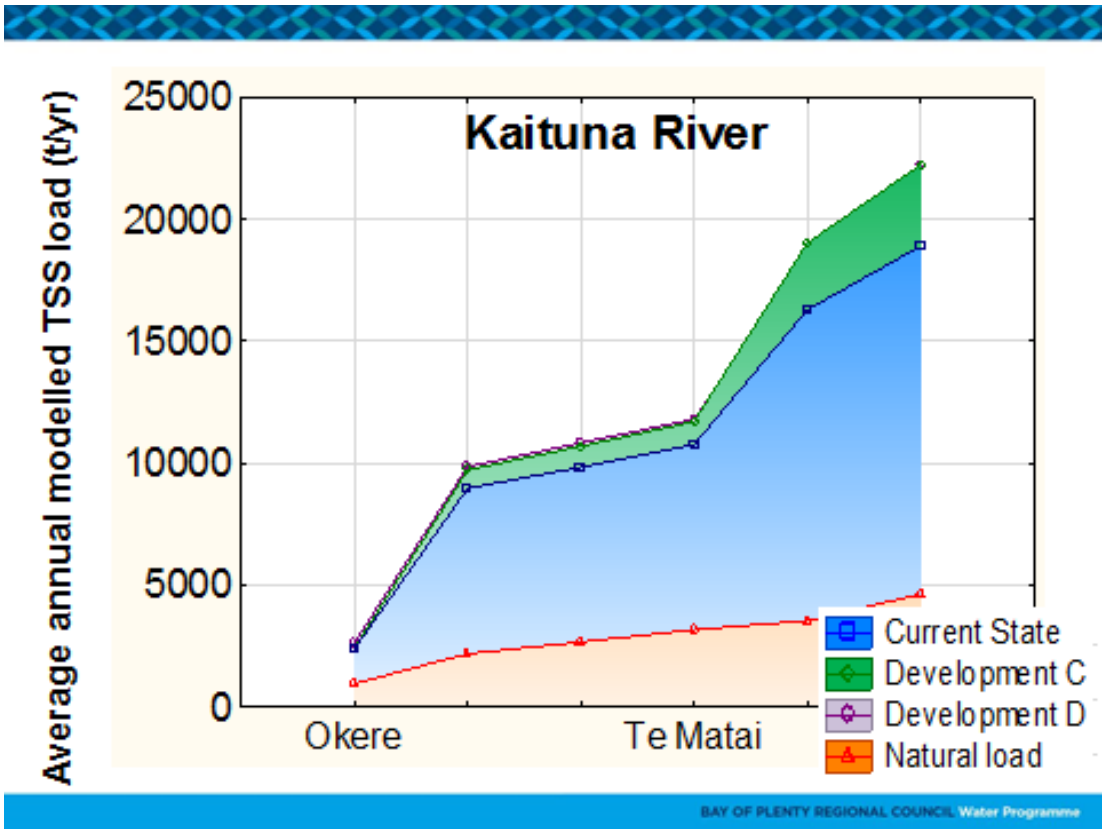
a) cumulative load, i.e., the quantity of contaminant (in tonnes) reaching certain points in the river each year from all of the sources upstream; and

b) total yield from each sub-catchment, i.e., the amount of contaminant (in kg) coming from a sub-catchment, per hectare, each year - excluding any influences from upstream sub-catchments.

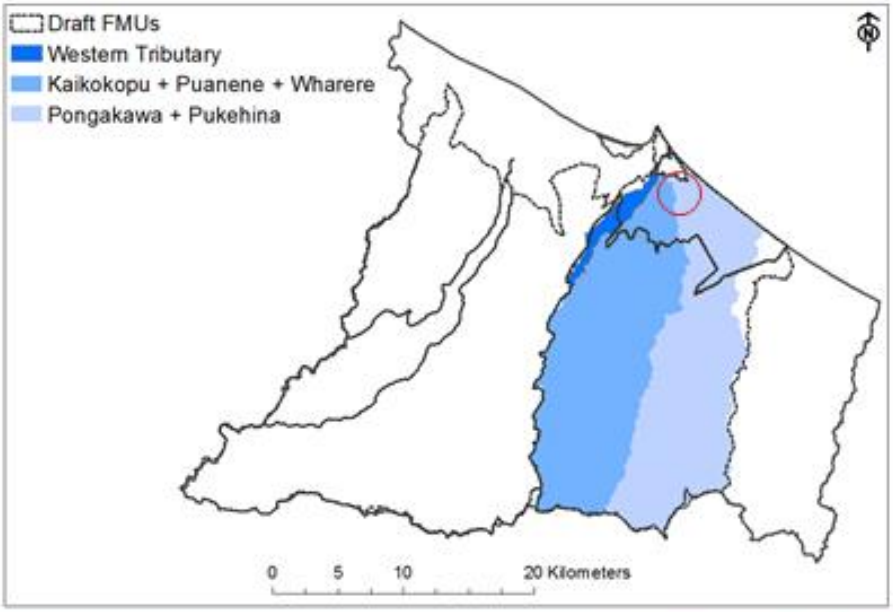
They include graphs and maps for sediment (Total Suspended Solids), nitrogen (Total Nitrogen), and phosphorus (Total Phosphorus) for the naturalised, current, and development C and D scenarios.

These will be explained fully at the workshop.

Cumulative Total Suspended Solids load



Waihī estuary total suspended solids load



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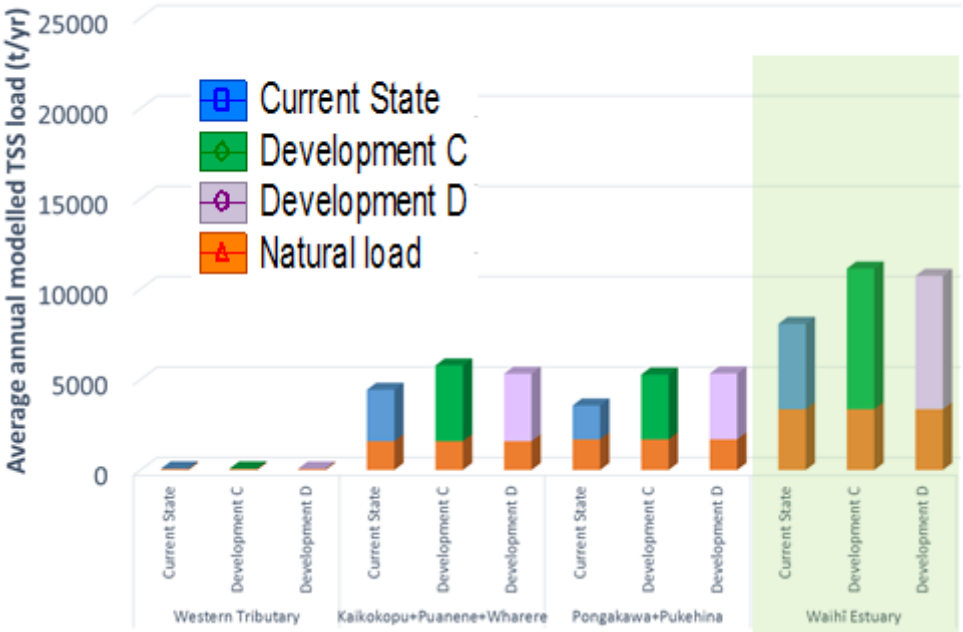
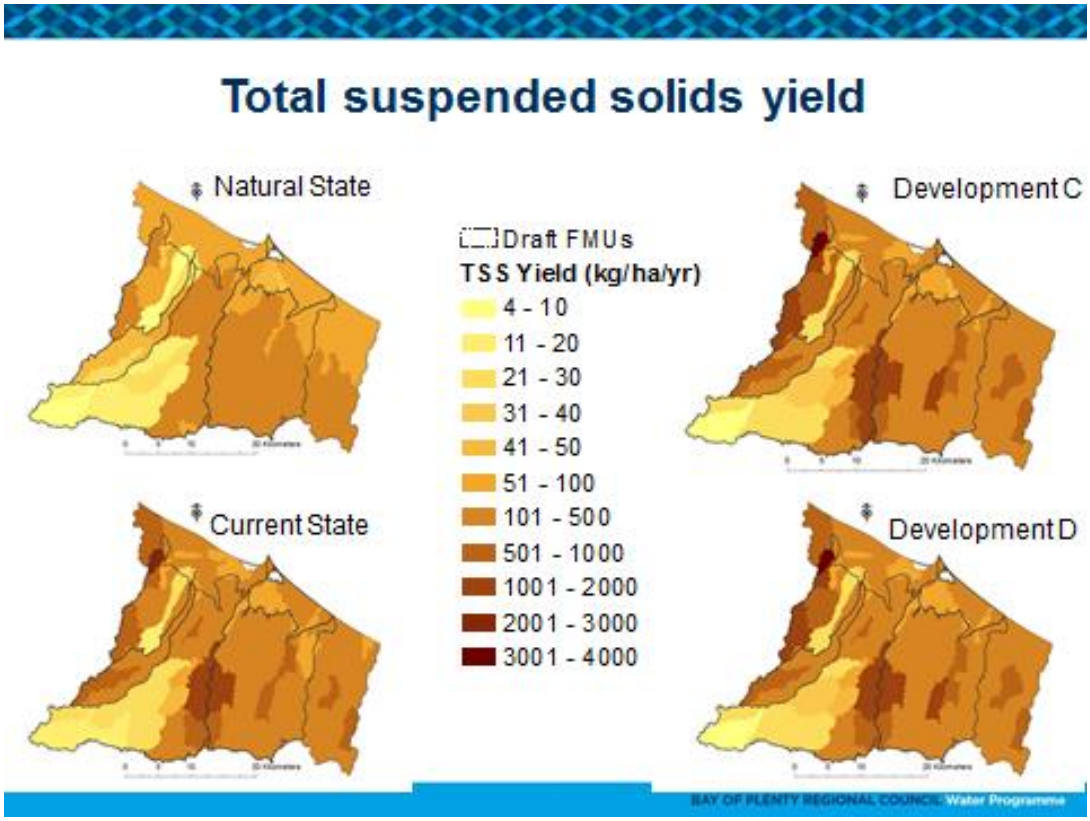
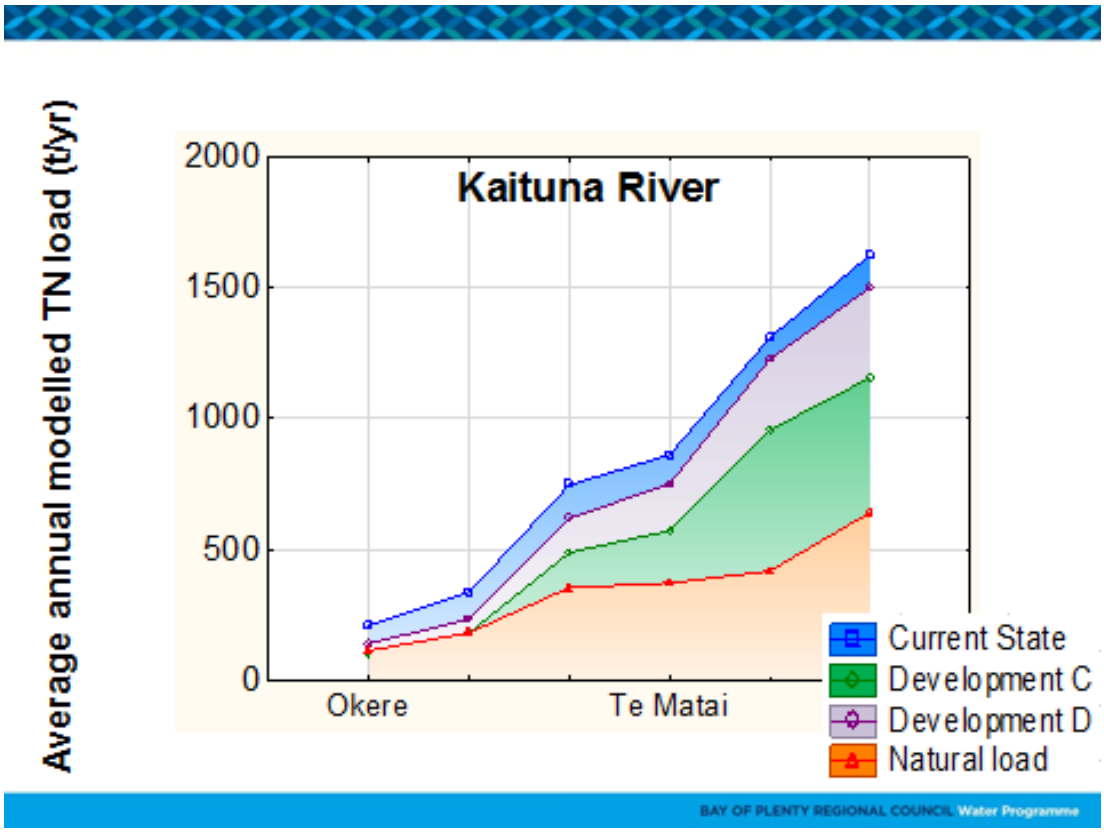
Waihī estuary total suspended solids load

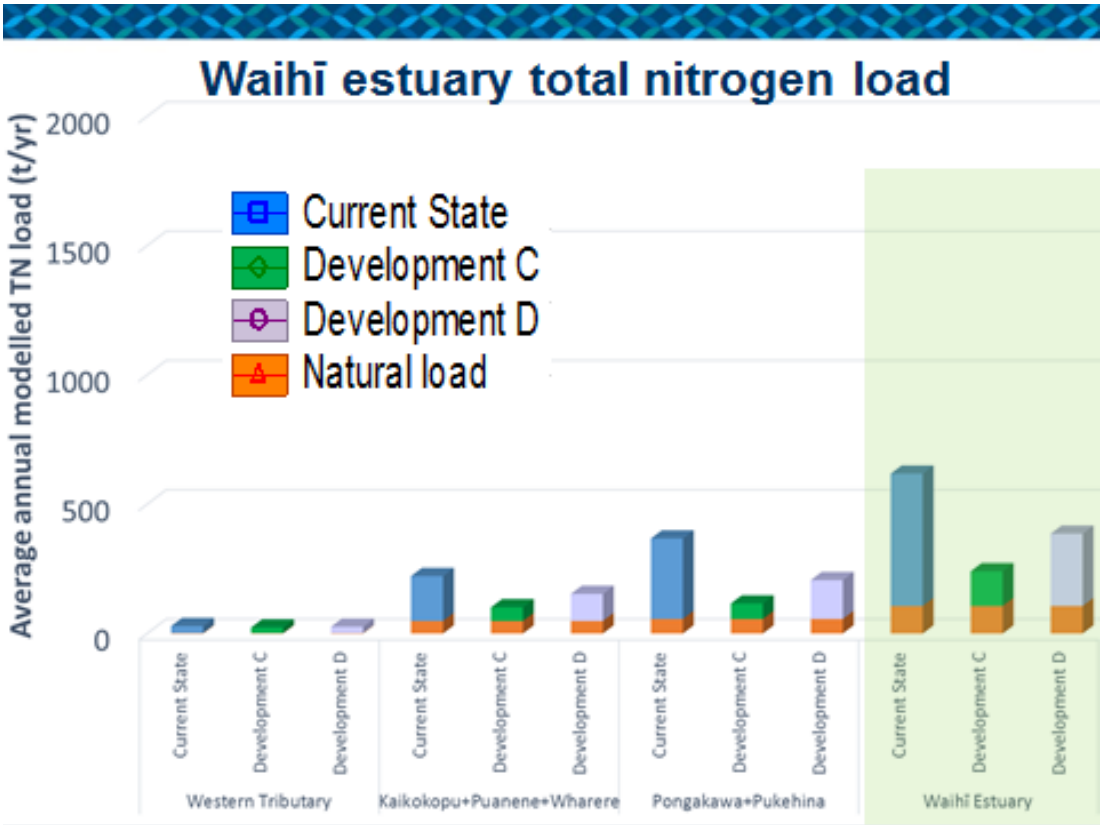


Total Suspended Solids yield from each sub-catchment

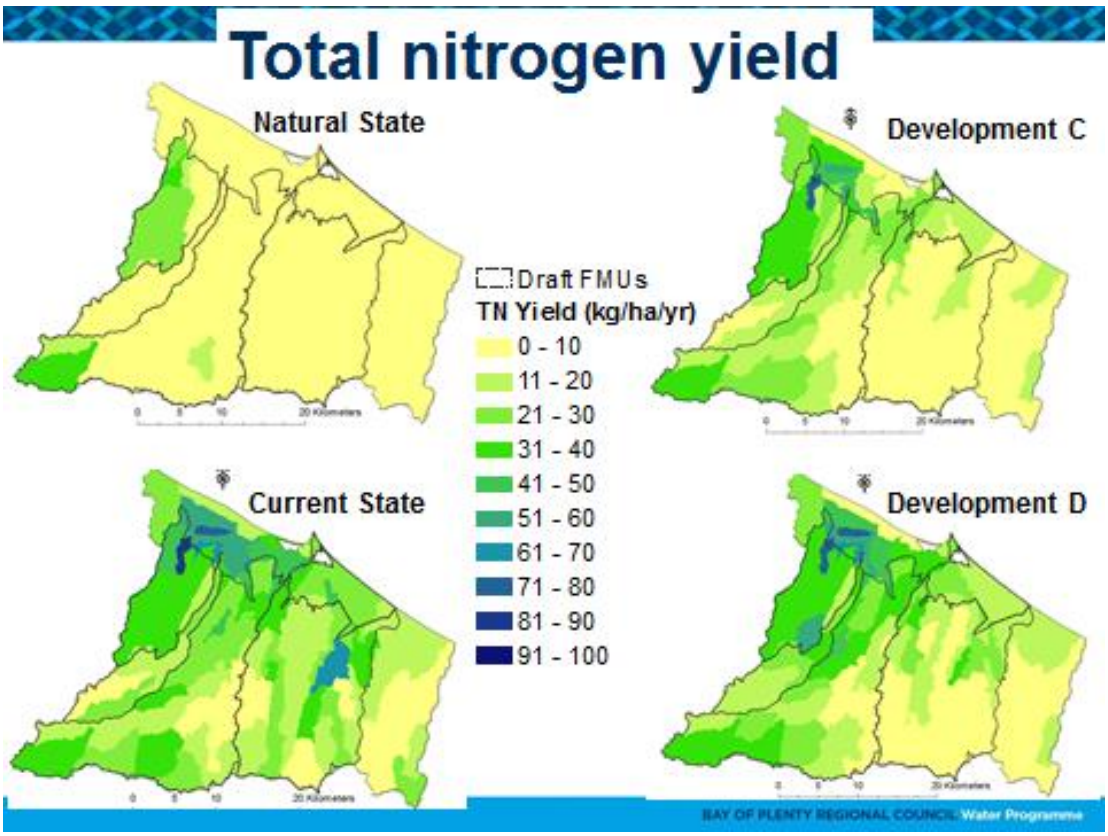


Cumulative Total Nitrogen load

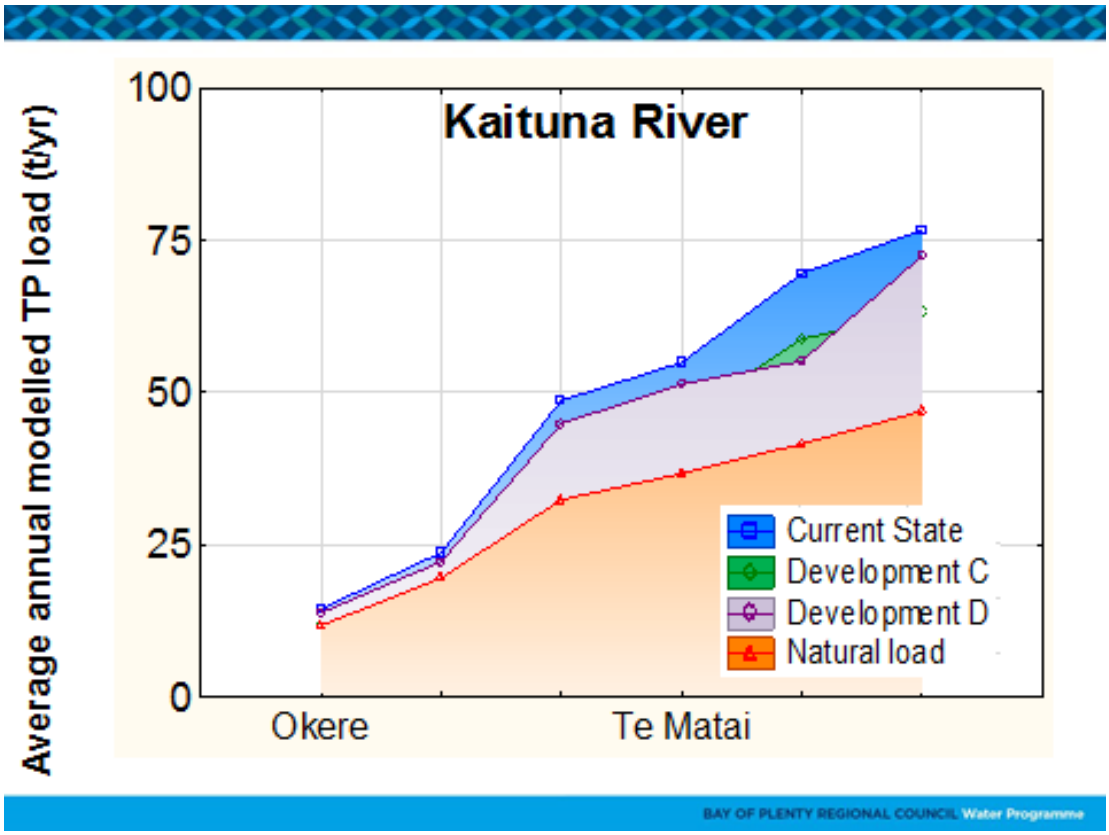


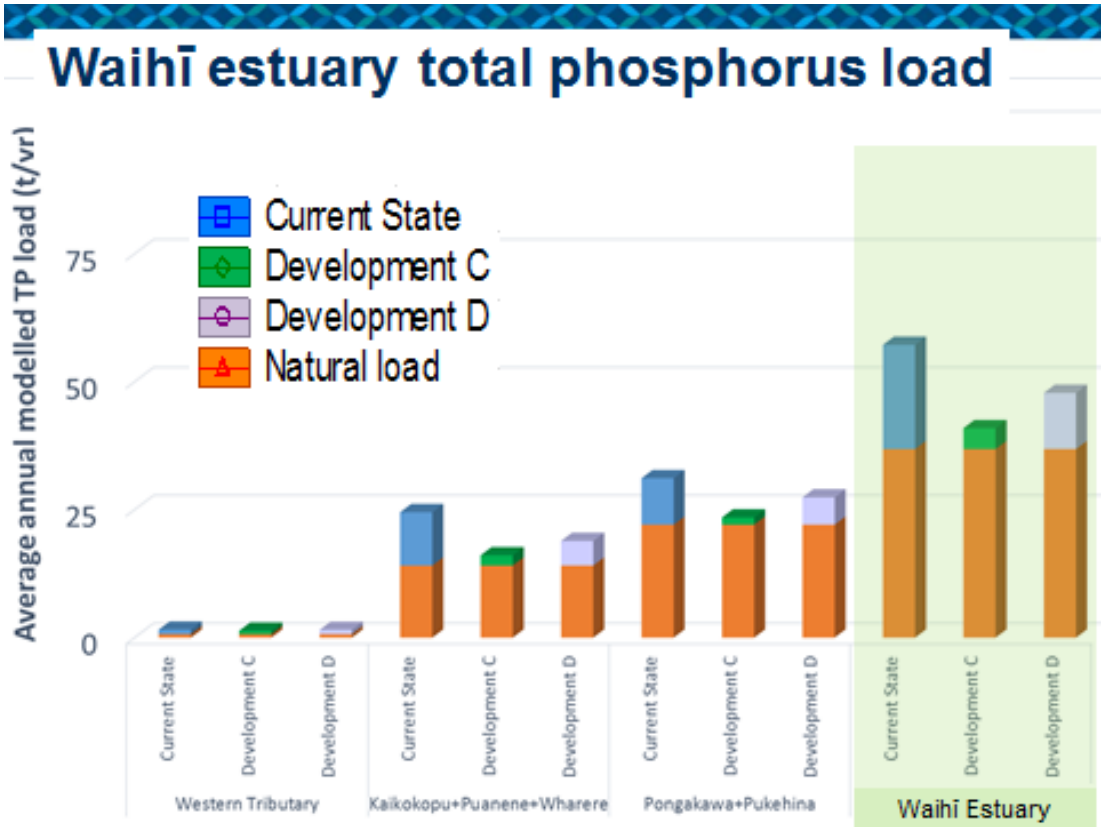


Total Nitrogen yield from each sub-catchment



Cumulative Total Phosphorus load





Total Phosphorus yield from each sub-catchment