Kaituna Freshwater Futures Community Group Workshop 6 Notes: Catchment modelling scenarios and use values

The Orchard, 20 MacLoughlin Drive, Te Puke
Wednesday 27 September 2017 commencing at 9.00am

Members present: Barry Roderick (Chair), Brian Thomas, Cor Verwey, Doug Hallberg, Hendrik Metz, Hohepa Maxwell, Ian Schultz, Jeff Fletcher (left early), Jessica Dean, Jon Fields, Julian Fitter, Maria Horne, Morgyn Bramley, Murray Linton, Nick Webb, and Warren Webber

Apologies: Councillor Paula Thompson, John Fenwick, Manu Wihapi, Marc Fauvel, Maria By de ley, Mary Dillon, Paul van den Berg, Peter Ellery, Richard Fowler and Vivienne Robinson

BOPRC Staff present: Kerry Gosling (Facilitator), Stephanie Macdonald (Facilitator), Pim de Monchy (Relationship Manager), Nicki Green (Water Policy), Santiago Bermeo (Water Policy), Jo Watts (Water Policy and Administrator)

Observer: Rani Dhaliwal (University of Waikato PhD student) and Clinton Birley (BOPRC)

Related documents previously circulated:

1. Workshop paper – Catchment modelling scenarios and use values.
2. Workshop presentation

Click here to access those online or go to: https://www.boprc.govt.nz/media/685574/final-workshop-6-powerpoint-kaituna.pdf and https://www.boprc.govt.nz/media/685571/final-briefing-note-for-freshwater-futures-community-groups-workshop-6.pdf.

1 Welcome /Updates/Focus of the day

Hohepa opened the workshop with a karakia.

Barry (Chair) welcomed everyone to the workshop and introduced Doug Hallberg from Affco. Clinton Birley, Land Management Officer in Pim's team asked the group if he could be an observer for the day. Clinton was warmly welcomed.

1.1 Agenda, purpose and updates

Steph introduced the agenda and purpose of the workshop. She outlined the work programme for the day.

- National Policy Statement for Freshwater Management 2017 update
- Freshwater use values
- Catchment scenarios and modelling
- Management options; and
- Next steps

The groups 'burning issues' were written up to be addressed throughout the day.

Steph recapped the work programme. We are now in 'phase 3' where we are working towards preferred objectives, working up scenarios and applying these in the catchment model. Nicki outlined the timeline we have been working to. Staff will let the group know of any timeframe extensions or changes in budget which may allow further community group workshops.

The tentative day for the next workshop, Workshop 7 is **5th December 2017**. Members were keen to lock in the date so people can plan around it.

Actions: Lisa to send an email out to members ASAP to check availability of members and lock in the date for Workshop 7.

1.2 National update

Nicki provided members with a brief national update since the last workshop. The National Policy Statement for Freshwater Management 2017 (NPSFM) changes came into effect on 6 September 2017. Key NPSFM changes include: strengthened policy for Te Mana o te Wai, suitability for swimming targets, Council to consider how to enable communities to provide for their economic well-being within limits, and monitoring plans to include microbial health, macro-invertebrates and maatauranga maori. Stock exclusion regulations have not been progressed by the government at this stage.

Refer to fact sheets on the Ministry for the Environment's web-site here or by going to this link: http://www.mfe.govt.nz/publications/fresh-water/fact-sheets-changes-freshwater-nps-2017.

Questions and comments:

Will there be another session on management options with experts as it is a big topic? Yes. This is the first part of the management options discussion, not the last.

2 Burning questions

Pristine condition: The group's preferred in-river state statement for water quality in the Waiari currently seeks a 'pristine' condition. A number of members have voiced concern to the Chair that this may be too high an aspiration. The word 'pristine' may mean different things to different people.

Staff advised that the results of the modelling will help us understand what seeking a pristine condition means and what changes would be needed to achieve this. The preferred state can be revisited in light of this if needed.

Community water supplies: There are a number of community water supplies in our catchment and there are concerns about microbes, and *E. coli*.

Staff advised that work is being undertaken about the safety and security of drinking water supplies as a result of the Havelock North inquiry into an outbreak of gastroenteritis in August 2016. Risk assessments and any mitigation actions will be taken into account in the work we are doing.

3 Freshwater use values

Nicki introduced the water use values. We are working through a process of looking at freshwater values. The group came up with descriptions of preferred in-river states at the last workshop, as a step towards numeric objectives. Staff are working on assigning the range of water quality and quantity required to support/achieve these in-river states, using the attributes introduced at previous workshops.

Today, we are working on freshwater use values which are listed in the draft regional freshwater value set (slide 14). Not all use values are relevant or significant in each catchment, e.g., there is no hydro electric power generation in Kaituna catchment.

We are starting to estimate actual water use to input into the catchment model and also likely future land use changes and how they may change water use and water quality.

Staff asked for the group's input to help further understand the water quality and water volume needs for various water use values and have also asked stakeholders and industry groups for the same.

Staff asked:

1. *Have we missed any key codes, standards or regulations that direct industry water quality needs? Are there are any relevant standards in the quarrying space?* No
2. *Do the animal drinking water standards apply just to dairy or to all stock?* ANZECC guidelines relate generally to stock drinking water.

Question / comments:
Rain harvesting: Where does harvesting of rain water fit in? Is that a take of water?

Staff advised capturing rainwater (e.g. from a roof) is not a take of water under the RMA. However, in some cases there would be related RMA or Building Act requirements for large structures like roofs, tanks, or dams used to catch or hold that water.

Action: Staff undertook to find out for the group about the volume and depth of damming that could be undertaken for rain harvesting and advise as follows:

Rule 46 of the Bay of Plenty Regional Water and Land Plan allows for minor damming of water that is in an ephemeral flowpath or gully, an artificial watercourse or is run-off from the surface of land (i.e. not a permanently flowing river or stream), for activities such as water harvesting so long as the permitted activity conditions are met. The volume and depth to be a permitted activity are either:

i) dam impounding < 5,000m^3 of water <2.5 metres vertical height or
ii) dam impounding <10,000m^3 of water <1.5metres vertical height.

See the rest of the rule for the complete list of permitted conditions.

If the permitted conditions cannot be met, a restricted discretionary resource consent is required under rule 46A or 48. Damming water in the bed or a river or stream is subject to rules 47 and 47B and generally requires a resource consent.

City and district councils may also control the structural integrity of dam structures under the Building Act 2004. A building consent or district council resource consent may be required for structures such as storage tanks or buildings 'catching' rain water.

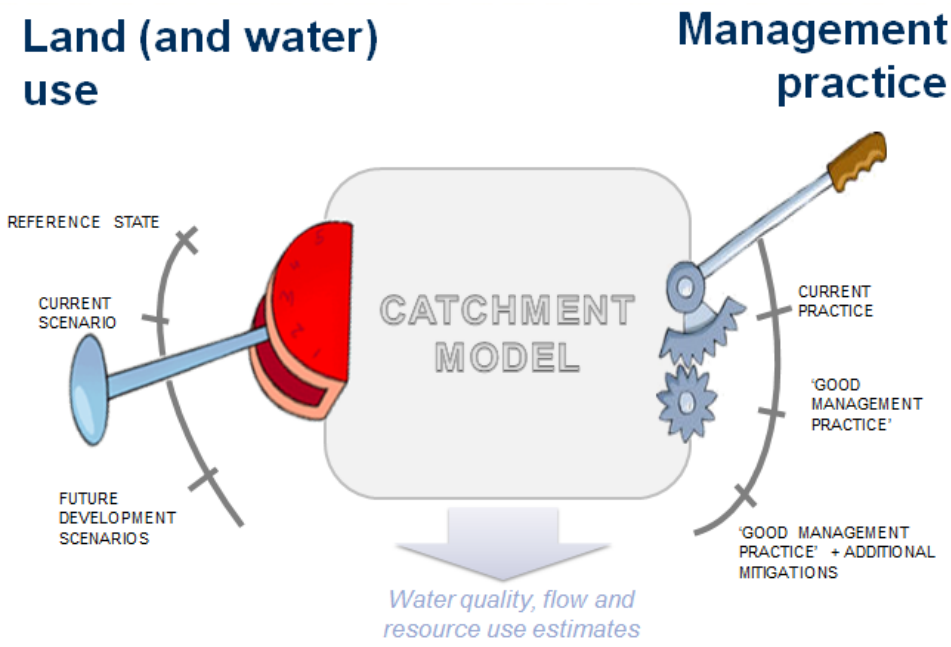
4 Catchment modelling

Nicki outlined to the group the purpose of catchment modelling which is to identify the key sources of contaminants, to estimate the amount caused by human activities, and to estimate what will happen to waterbodies in the future if land-use and management practices stay the same or change in the future. The model looks at both water quantity and water quality (in terms of nitrogen, phosphorus, sediment and *E. coli)*.

The model only looks into bio-physical aspects. Economic and social implications will be assessed separately once we narrow down potential management options.

Nicki introduced Santiago who explained the diagram below which is a conceptual description of the model, in which the two main "levers" are land use (and associated water use) and management practices in the catchment. The model outputs are estimations of water flow and quality in the river at certain points, which will enable us to assess which "lever settings" provide for use and in-river values, and which don't.

Throughout the course of this workshop, staff asked group members to help define each "notch" for both levers in more detail.



To do so, the model starts with three basic scenarios:

- Reference state - No human land or water use and land cover is only native bush or wetlands. It estimates the background levels of contaminant and flow profiles in water bodies; important to bear in mind that the water bodies would naturally contain some *E. coli*, nutrients and sediment. This is somewhat akin to the "control setting" in a science experiment.
- Current scenario - baseline - current land and water use and management practices
- Future development scenario - the likely future land and water use

These help us understand what happens to water quality and quantity under different futures. Santiago explained that staff have talked to Dairy NZ and kiwifruit industry representatives about future land use change patterns. Staff sought feedback from the group to help refine future development scenarios and, in a later activity, management practice options.

Staff expect to be able to present outputs of modelling for the reference state, current scenario and, potentially, future development scenarios at the next workshop. The group is set to discuss management practice or mitigation scenarios in more detail during workshop 7, and to consider the modelling results for those scenarios early next year.

Question / comments:
Pristine: The nature and purpose of the 'Reference state' is not a plausible future but a point of reference or background level to understand what water quality and quantity would be like in the catchment without human intervention. Its purpose is to understand what part of the issues are human caused or natural. For example, if we returned all of a catchment to native bush, there may still be some naturally-occurring contaminants affecting water quality. It is not modelling whether a 'pristine' state with no humans is viable.

Model validation: How do we validate the reference state scenario? There are sub-catchments in native bush with similar characteristics which we have some monitoring data for; these could be used to validate results for the reference state scenario. The baseline scenario is also validated against existing monitoring data.

Modelling inputs, assumptions and uncertainty: What is the level of uncertainty in the model? What is the accepted level of uncertainty? Staff noted we have to estimate what is used and

what is being discharged. Some is measured and some estimated. Then we will model changes into the future.

Staff explained that there will always be some uncertainty and that with any catchment model, parts of the model will have a large bearing on decision-making where other parts will be less important.[1] We need to get the assumptions right and understand the level of uncertainty. Pim noted that, at the moment parts are uncertain and may be too uncertain. For example: If assessing N and the uncertainty is 60kg plus or minus 60kg it would be too uncertain. To reduce uncertainty usually costs money so we will need to try and reduce unacceptable uncertainty for things that really matter.

Assumptions and levels of uncertainty are being recorded and will need to be assessed. Checking the assumptions against actual data and ground truthing is part of calibrating the model. There is more information about some sectors than others. Where at all possible we will be using published material to substantiate data. Part of this workshop is checking in with the group whether current and future land and water use assumptions are about right based on your working knowledge within the catchment.

A member advised that he has been doing his own modelling of water quantity which seems to be indicating there will be a need for more freshwater management units (FMU's). In his view, uncertainty is not acceptable to iwi. If we don't have measures of volumes right it will lead to BOPRC having to open up further freshwater management units.

Staff advised that we will discuss estimating water use later on in the workshop. In terms of 'opening up new FMU's' all freshwater bodies are mapped. All freshwater bodies already have an allocable amount and some are fully allocated and some are not. If we work out through this process that allocable amounts must change, and/or there is no water to be allocated then a range of measures will need to be considered.

Overview of models: Can we have an overview of the models that are being used? Some catchments have other sub-component models. Several models are feeding into a final output and decision. Will these additive models mean more error? Can we have a summary paper on models?

Action: Staff have provided this link to Nick Conland's modelling presentation - see slides 53 to 65 and the summary notes from the workshop 5, and will prepare a further summary of the models.

5 Current land and water use practice assumptions

Steph introduced the current land and water use practice assumptions activity. Members were asked to join the sectors they know the most about - dairy, kiwifruit, sheep & beef, forestry. Those that aren't growers or farmers attached themselves to the sector they were most interested to learn a bit about the sector.

Groups were provided with a list of assumptions for the sector they were interested in and a worksheet (A2704617) to consider. The key questions are:

1. Do the assumptions reflect what's going on in the catchment?
2. If wrong, can you point us to information / evidence to support changes?
3. Are there different practices in different parts of the catchment than others?

There will also be assumptions about urban areas, urbanisation and native forest which haven't been worked up yet.

Current water use assumptions are based on either actual metered or estimated use - refer to slide 35. This work is yet to be completed by Council.

[1] It is recommended that members consider the Ministry for the Environment's Guide to Managing Uncertainty when implementing the NPS-FM.

A member suggested a much better way to get the information needed for modelling is to ask dairy farmers for their OVERSEER file data, soil tests and to ask sheep and beef farmers for their environment plans.

Staff advised that if we had access to OVERSEER data files and soil tests, assumptions would be more accurate but this relies on farmers being willing to share. The dairy farmers in the group felt most dairy farmers would be happy to share, but were aware Fonterra can't provide private information without permission. Members suggested discussing this with Darryl Jensen (BOP Federated Farmers) and perhaps approach each farmer for permission.

Action: Pim to check in with Darryl Jensen regarding support to request individual OVERSEER data files from farmers.

Question / comments:
Stock drinking water: Will estimates of water use include stock drinking water? Yes, we will be estimating the number of stock and estimate amount of water used.

Quantity of water to make milk? A member asked how much water does it take to make a litre of milk as he has heard that it takes 200 litres. Dairy farmer members estimated it is more likely to be about 10 litres of water to make a litre of milk in the Kaituna, based on 150 litres of water a day per cow (drinking and wash down). It was noted that it is always important to look at where statements like that have come from and what information they are based on.

Staff advised that stock drinking and domestic use are permitted by s 14(3)(b) of the RMA and there are also permitted activities in the Regional Water and Land Plan. Council should be able to estimate how much surface water and groundwater is used by dairy but will probably not get down to how many litres of water it takes to make a litre of milk. Plan change 9 will answer some of these questions with metering requirements.

The outputs and report back from this activity is listed in Appendix One of the workshop note.

6 Future Development scenario by area

Santiago introduced the future development scenarios for the Kaituna catchment. He explained that staff have talked to Dairy NZ and kiwifruit industry representatives to understand likely land use change patterns. Information has also been drawn from previous workshop exercises (Workshops one and five).

This activity asked the group to identify what the future land uses might be in different parts of the catchment. Staff sought members' informed view on what future land use might look like. Members were grouped by areas of the WMA (Lower Kaituna, Mid/Upper Kaituna, and the Waiari), provided with maps of current land use, land use capability (where the red represents the least capable land and green represents the most capable land, based mainly on slope and soil type but not climate) and draft future land uses.

Groups were provided with a worksheet (A2704598) to consider future development scenarios. The two key questions are:

1. Which future land uses should be changed and why?
2. Any other comments?

Members were asked to look at the maps and note any changes needed and why. Steph asked members to report back to the group. Outputs from the worksheets as well as notes from the report back are incorporated below: For the scanned completed worksheets see A2709445.

Lower Kaituna

- Increase wetlands – everything north of Kaituna Rd
- No kiwifruit north of Te Puke– wet feet/unsuitable soil. Kiwifruit need to be at least 1m above water table.
- Lack of frost and wet feet mean kiwifruit may move further up the catchment.

- Retreat of kiwifruit could perhaps be replaced with rice? Need to start thinking smarter about what is the best use for the land.
- NIWA report about climate change and effects on kiwifruit expects a shift of kiwifruit.[2] Zespri saying cultivars will change so that production can continue.
- Te Tumu urban development not as wide as shown. Around half of Te Tumu growth area will be constrained due to coastal dunes, natural hazards, archaeological sites etc. with the urban area being limited to the middle higher part.
- Dairy – still considered to be viable for some time yet with pumping, carry on with feed pads as the lower Kaituna is some of the most profitable dairy land in the country.
- Quarry closed by 2050.
- Land below sea level in much of the lower Kaituna. Peat shrinkage is dropping land level.
- Should expect groundwater intrusion more often and not expect insurance.

Mid / Upper Kaituna and Waiari

- Commercial woodlots of high value sustainable forestry, longer rotation with less loss of phosphorous and sediment. Kauri, rimu, totara, blackwoods rather than radiata
- More forestry on LUC class 7 & 8
- Horticulture in the upper catchment on higher capability land
- More manuka
- Carbon farming on steeper country.
- Further dairy conversion if nutrient limitations can be dealt with
- More lifestyle lots = driving to work not producing much.
- Some organic poultry and pigs (which may be acceptable if they banned farrowing crates)

7 Management Options

Steph introduced the management options activity. Members were provided with a list of draft management options which have been gathered from the previous workshops with all community groups.

Management options have been categorised by the contaminants (sediment, nutrients, quantity and bacteria/pathogens) they would address. In later discussions, more filtering and assessment will occur based on criteria, which community group members also provided input to during workshop 5.

Members were asked to work in groups and to consider the list of management options, and particularly whether any options should definitely be considered or definitely not be considered and whether the management option is considered to be Good Management Practice (GMP) that should be expected of all land users, or is it considered to go beyond GMP.

The thirteen worksheets have been tallied up and the results are shown in Appendix Two.

Members were asked to report back to the group a key observation each, which are listed below:

- Suggest changing to manage gorse rather than remove gorse
- There aren't any kiwifruit appropriate management options in the draft list
- If the land use is appropriate for the location then good management practice will sort the rest out. You can't easily overcome misplaced land use.
- Increased management beyond standard will be needed.

[2] https://www.stuff.co.nz/business/farming/96869852/niwa-study-finds-green-kiwifruit-under-threat-from-climate-change-in-main-bay-of-plenty-growing-area
http://www.tandfonline.com/doi/full/10.1080/01140671.2017.1368672

- All management options should be considered but all dependent on location / specifics. Context is important.
- Very circumstantial and should look at all options.
- Best practice rather than rules preferred.
- Best practice needs to be relevant to the industry. Parallels with industries commitment to good practice.
- A lot can be achieved without rules. The most will be achieved by liaison and working with farmers. Education and advocacy.
- 'Tūhoe's 'Te Kawa o Te Urewera' was highlighted. Their management plan is based on principles, with no rules, but no wriggle room about how people will conduct themselves. A principle-based rather than a rules-based approach could be applied to the whole region.
- Dredging will have positive and negative effects on the estuary depending on who you talk to.
- The management options on the worksheet need further explanation to understand. (Action)
- Most good management practices are ethical or moral obligations. Likely to need management guidance as rules would be very hard to write up.
- Some members felt there wasn't enough time to complete the activity with many only managing to do some, not all, of the sheets. (Action)

Action: Staff to email out the worksheet for people to complete or consider whether the management options could be provided in a digital survey form. Before doing so, reduce jargon within the draft management options and provide fuller explanation where necessary.

Staff are cognisant of the importance of this topic and the limited time to consider all sections and will explore ways of allowing members to provide further input ahead of the next workshop to get more feedback from community group members.

Santiago highlighted the list of proposed assessment criteria shown on slide 50. The catchment model will help with the first criteria. Effectiveness - environmental outcomes. The other nine won't be answered by the model but will be used to assess and weigh up the various management options.

Question / comments:
Proposed assessment criteria 10 Administrative / staff resourcing costs: A member commented that we will need a thorough analysis of these to be able to weigh up different options against this criterion.

Quantification of the issues: When are we going to qualify and quantify the actual issues? There is concern we are coming up with management options without a clear indication of what the problem is so we don't really know what we are trying to fix.

Staff noted that the group has been presented with the current water quality in parts of the catchment but not what water quality is needed for some of the values, e.g., the preferred states for in-river values. We know we have a doubling of N, issues with nitrification in the receiving environment, that bacteria has been improving considerably since 1980 but is still affecting swimming, shellfish. Our science team are working on assigning measurable ranges/numbers for each attribute that will support preferred states for in-river values. We are anticipating being able to bring this work as well as the first round of the modelling to you at the next workshop.

APSIM vs OVERSEER: A member advised that OVERSEER has been widely used in other catchments and asked about the difference between this and APSIM, which is used in this catchment model. Staff noted that OVERSEER provides a long term annual average of nutrient loss. APSIM estimates this on a daily basis, reflecting climate variation throughout the year. APSIM results have been validated against available OVERSEER outputs and the results are within 10% of each other.

8 Consenting update

Pim provided an update about resource consent applications in the catchment:

1. Pukepine has applied for resource consent to discharge stormwater from their site at 274-290 Jellicoe Street, Te Puke, to factory drain. It is a notified application and has closed. There are 4 submissions - Tapuika and 3 private ones. Pukepine have installed a stormwater trap to mitigate effects. The hearing will be in January allowing 6 months of data to be gathered about the effect the stormwater trap is having.
2. Affco have applied to renew their two resource consents. Council has requested further information about ecological effects of the proposal under s92 of the RMA which Affco are currently working on.
3. Te Puke Wastewater Treatment Plant application. Expecting hearings in the new year, if in fact a hearing is required.

How to find information about consents in the catchment:

All BOPRC resource consents can be seen by using Bay Explorer . Click on 'Layers' and check 'consents'. Workshop 2 provided information about types of consents within the catchment and workshop 5 also provided the location of consents.

9 Next Steps

Nicki outlined the next steps:

- initial catchment model outputs for reference state, current land use, and future development scenario
- assess what these outputs mean for in-river and use values; and
- develop mitigation scenarios.

Staff expect to present initial catchment model outputs (reference state, baseline and, potentially, future development scenarios) at the next workshop. The modelling outputs for mitigation scenarios are expected to be available early next year.

The next meeting is proposed for 5th December. This date will be confirmed as soon as possible.

Steph checked back on the group's 'burning questions'. We have answered some but will be able to answer those about what striving for a 'pristine Waiari' means more fully once we have some modelling outputs.

Steph let members know that "Hands on Water" is occurring on Thursday 9 November, Redwood Valley, near Paengaroa. Members to email Stephanie.Macdonald@boprc.govt.nz if you would like to attend as an observer. Please RSVP by Wednesday 1 November 2017.

Barry thanked everyone for their attendance.

Hohepa closed the workshop with a karakia at 2.30pm.

10 Actions

1. Staff (Lisa) to send an email out to members ASAP to check availability of members and lock in the date for Workshop 7.
2. Staff to provide a written summary of the models.
3. Staff to email out the management options worksheet for people to complete or consider whether it could be provided in a digital survey form. Before doing so, reduce jargon and provide fuller explanation where necessary. Members to provide feedback to staff.
4. Staff (Pim) to check in with Darryl Jensen regarding support to request individual OVERSEER data files from farmers

5. Warren to share presentation from Peter Beets Scion about forestry nutrient cycles.
6. Members to email Stephanie.Macdonald@boprc.govt.nz if they would like to attend the “Hands on Water” Expo as an observer on Thursday 9 November near Paengaroa. Please RSVP by Wednesday 1 November.

Appendix One – Current land and water use practice assumptions

A2711404

The group discussed current land and water use assumptions in small groups. Sectors groups included: dairy, kiwifruit and sheep & beef and Warren provided forestry input.

Dairy

- Typically, dairy farm system 3 in the catchment.
- Lowland flat areas: harvest 20 tonne/ha of dry matter, pprox. 3.5 stock/ha, Kiwicross stock. Feed 5kg maize and palm kernel in winter (save pasture silage for milkers and use maize for the dries). Feed a lot of protein silage. Usually winter off about 50% of cows (50% in the catchment and 50% leave the catchment). Increasing number of feed pads (no roof) but not the norm yet.
- Higher country: harvest 12 tonne/ha of dry matter, approx 2.5 stock/ha, Jersey or Kiwicross (Jersey crossed with Friesian). Pasture based in winter. No feed pads.
- Since lower pay outs farmers are focussing on profit, not just high production which has driven a change of practice.
- Main grass is ryegrass-tetraploids.
- System 3: 20-30% imported feed
- Cropping on flats – no fodder beet grown. Maize silage and swede/turnips (plant in Oct to graze Jan/Feb feed over dry season).
- 10% new pasture per year. The reason for doing this is the grass gets tired.Weeds (kikuyu and paspalum a real problem), pests and better cultivars. The older pastures run out after about 5yrs. Round up spray and drill a day later.
- Leaching 35 - 36kg N/ha, some same leaching rate but with much higher stocking rate.
- Pim asked whether the figures are from an OVERSEER or Fonterra file – A: Fonterra – Pim: Is it fair to say these are at the lower end? A: Yes
- Fertiliser companies recommend non-P, low N fertilisers on effluent irrigated areas.

Sheep and beef

- Big variation in systems. Not always dependent on where they are, e.g., intensive for dairy stock raising, dairy wintering and also for intensive rearing of bulls.
- Are urine patches of dairy cows being treated differently from bulls? They have vastly different N loss.
- Benchmarked against dairying. Stocking rate is quite variable between farmers. Ranges between 25 – 45% from sheep to intensive beef grazing so is fair.
- Kg N loss per ha using Overseer: Intensive beef mid 20's. Less intensive 8 – 25 range. Dairy / or intensive higher. Sheep lower. Lifestyle blocks can go up to 25 with short term dairy grazing.
- Timing and location of fertiliser applications: Application of fertiliser has way less impact on farm over on farm management.
- Fencing of waterways: Physically difficult with long rhyolite catchments. Practicality of fencing is very difficult. Result is some ephemeral water courses have been put back into natives rather than fencing out. Makes economic sense to fence out marginal areas.

Intensive beef cattle based systems

- Stocking rate wintered – will drop to 50% - 60% of peak stocking rate.
- Significant in terms of where on the land you are putting them.
- No intensive beef finishing systems spreading effluent like dairying.

Traditional sheep and beef

- Not many sheep farms left in the catchment and generally less intense and lower urine patch issues. Same for deer and younger beef.
- 50% less P and K than dairy farm. Relative to amount of feed grown.
- Significantly lower for N – less than 50% could be as low as 10-20% for some.
- None irrigating in BOP or this catchment.
- Supplementary N application for sheep: Is it economic? Yes where you can earn good money from growing silage 10-20%.
- Need to consider hotspot management. There is opportunity for hotspots with hill country sheep and beef which have relatively low outputs but if concentrated in small area, e.g., densely grazing a winter crop before rainfall / crops can greatly affect N effects in terms of hotspots. On the other hand N loading is normally spread widely for more extensive traditional grazing.

Kiwifruit

- Figures in assumptions aren't right for kiwifruit for example shouldn't be saying 'stems' but vines for kiwifruit. Nicki explained initial modelling assumptions use some published research and module for Australian vines not kiwifruit.
- Growth: Oct – April for gold and future varieties likely to be earlier. Red varieties early Sept – May.
- Prune vines through winter and also summer with material being recycled
- N – taken up Oct to Jan when growing or earlier for some varieties
- 110 – 120 kg fertiliser per ha but big variation could be as much as 20 – 200kg /ha. Some putting on much more. Organic much less. If using 1 figure for the model then those stated are about right.
- Is there a map of organic vs traditional? Total crop of organic vs conventional is known and apply pro rata for Te Puke would be right.
- Knowing split between green and gold important and also between organic and conventional. Use Zespri figures and pro rata but would be more relevant to know numbers of green vs gold in Te Puke. Should be able to access info from Zespri.
- Suspect quite a bit of room to reduce N and not effect production. Growers are required to report fertiliser application to Zespri but no audit or verification.
- Trials known of are all based on yield response, .usually on relatively young vines and a long time ago. There have been trials in mature orchards with 50kg /ha N getting good yields which suggests either you don't need the levels of N or the vines are mining N from depth.
- A lot are maintaining irrigations systems in case there is dry summer.

Forestry

- Peter Beets, Scion gave an excellent presentation about nutrient cycles in forestry. Relatively closed but there is variation.
- What was on the land before the forest? High/low rainfall, What stage of growth? Is gorse present? All of these factors have a bearing on nutrient losses.
- Recommend contacting Peter Beets directly. Looking at Rotorua forestry N contributions.
- Looking at OVERSEER assumptions which are not particularly refined. N 3-4kg /ha out of forestry.
- Warren will make Peters paper available. Nicki advised that Colin Maunder was at Rangitāiki group and provided good links to forestry information.

Appendix Two – Feedback on Management Options

The tables below show the 'frequency of responses to each management option' i.e. 6 responses support B1 being considered as a management option, with nobody considering it shouldn't be considered. Please note that these responses are indicative only. Some groups responded collectively on a single response sheet and others responded individually.

Management Options - Bacteria / Pathogens		*√one per row*		*√one per row*	
		BE considered	**NOT BE considered**	**GMP**	**GMP +**
B1	***Land use change***	6	-	3	3
B2	***Waterfowl*** and pest control for bacterial reduction only	3	4	4	2
B3	***Manage hydrology*** - pumped drains, water quantity (dilution), changing drainage network.	6	1	1	6
B4	***Land management practices*** o Riparian fencing and planting buffers: drains - Fence with 2-wire fences. Plant verges. Grass, fencing, stock exclusion, increase in winter/spring. o Stocking numbers/rates – herd/paddock management (especially on peaty soils)	6	-	4	3
B5	Wetlands	6	-	2	6
B6	Buffer zones Non-high (or low) intensity pasture around sensitive environments (relates to LUC/natural capital)	7	-	2	5
B7	Upgrade point source discharges (e.g. wastewater, on-site effluent, etc	7	-	4	3
B8	WWTPs lined effluent ponds for dairy. Wastewater management at point of discharge. On-site treatment capability.	7	-	1	6
B9	More holding capacity of effluent, , more precise application based on soil moisture, and better timing of effluent irrigation (e.g. not during or immediately after rainfall)	5	1	3	3
B10	Gate and trough location and feeding	6	-	3	3
B11	Managed stock crossings, bridges – put mats out for stock to cross over on, low walls on drain bridges	5	-	3	4
B12	Dung beetles	5	-	4	2
B14	Slope access tracks inwards from drains	6	1	3	4
B15	Break fed from inside out	5	-	2	2

Management Options - Sediment			√one per row		√one per row	
			BE considered	**NOT BE considered**	**GMP**	**GMP +**
S1	***Land use change -*** appropriate land use for soil/slope/LUC. e.g. change to forestry, native or wetland		9	1	3	7
S2	***Land management practices***		9	1	4	3
	○ Swales, soak holes and sediment traps					
	○ Sediment ponds/detention bunds/dams/storage		9	-	4	3
	○ Pole/bush/riparian planting and buffers		9	-	3	4
	○ Restrict cultivation cropping and grazing practices around sensitive areas		9	1	4	2
S3	***Mechanical*** - remove sediment before reaching estuary.		7	1	3	2
S4	***Land management practices***		6	-	4	2
	○ Stock rotation and grazing management					
	○ Stock access crossings, bridges, culverts		6	2	4	2
	○ Seal roads, track and road maintenance, races		7	-	5	3
S5	***Urban storm water management*** (overlap with district council functions)		6	1	4	3
	○ Impervious site coverage					
	○ Subdivision earthworks management (including permitted activity rules). Swales, wetlands, rain gardens		7	-	3	5
S6	***River engineering:***		5	-	1	2
	○ [Review] HEP peak flows, ramping rate frequency					
	○ Manage morphology: Stabilise susceptible stream banks		7	1	1	3
	○ Extraction of sand, gravel in navigation channel and on pipi beds in Maketū Estuary		7	2	2	2
S7	**Forestry practices** [*most, if not all, will be covered by the NES for Plantation Forestry]*		8	-	2	2
	○ No desiccation ○ Harvest planning ○ Agree rotational harvesting ○ Forestry further planting setbacks from waterways	○ Keep off steeper more erodible areas (certain soil types) ○ Constrain timing of forest felling? ○ Slash control for waterways.				
S8	**Transferable land development rights**		3	2	1	1

Management Options - Nutrients		√one per row		√one per row	
		BE considered	**NOT BE considered**	**GMP**	**GMP +**
N1	***Land use change*** (appropriate for natural soil moisture/rainfall/climate, avoid consenting activities in areas where the land is incapable of carrying the land use without significant volumes of water being available (assumes adding water will release nutrients?), coordinated catchment approach.	6	-	1	2
N2	***Land management practices*** ○ Land use/cropping restrictions (e.g. buffers around sensitive environments, restrict high leaching crops like maize)	7	-	2	4
	○ Remove large/old gorse (nitrogen) [Is there a lot of gorse in the catchment?]	7	1	3	3
	○ Riparian management: fencing and planting buffers	7	-	5	2
	○ Stocking rate restrictions/reduction	5	1	3	4
	○ Manage/monitor fertiliser loading rates – application of irrigation/fertiliser- and cultivation	7	1	4	4
	○ Pasture/fodder crop management, including new low N pasture/fodder crop varieties	6	1	5	1
	○ Use low N breeds of cow	6	1	5	1
	○ Feed pads or cow housing, particularly during high rainfall and winter	6	-	3	4
N3	Create/manage wetlands	7	1	4	2
N4	***Urban -*** Waste Water Treatment Plant (WWTP) standards and load controls; Storm water best practice, LIDs (low impact design)	7	-	2	4
N5	**Sub-catchment level (or other grouping) nitrogen discharge allowances** and limits e.g. Catchment or sub-catchment user groups - can manage a common attribute e.g. Lake Rerewhakaaitu	7	-	5	1
N6	Better effluent treatment, disposal or reuse	8	-	4	2
N7	Property-level nitrogen discharge allowances/farm nutrient budgeting	6	-	4	3
N8	Remedial work in lakes (only addressing symptom): Alum dosing, weed harvesting, aeration	4	2	5	3
N10	Farm discharge quality requirements	7	-	5	3
N11	Improve basic soil health/biology	5	2	4	3
N12	Calve later in Spring	3	4	4	2

Management Options – Water Quantity		*√one per row*		*√one per row*	
		BE considered	**NOT BE considered**	**GMP**	**GMP +**
Q1	In-stream minimum flows - change allocation limits.	10	-	6	1
Q2	Secondary allocation – high flow allocation for storage.	9	1	7	3
Q3	Variable flow restrictions: Less than 100% reliability	8	-	3	4
Q4	Seasonal limits	5	-	4	2
Q5	Storage systems, capture rainwater, recycle water	5	-	4	1
Q6	Claw back on existing consented use - amend consent conditions to align with limits/clawbacks	6	-	-	3
Q7	Base on usage [or estimated reasonable use] not allocations	5	2	2	2
Q8	Prohibit new water takes – no consents in over allocated systems	4	2	2	3
Q9	Municipal water supply demand management (water meters) [and cost-recovery]	4	-	3	3
Q10	Off-stream dams – store winter/peak flow; Storage in upper catchment	3	3	1	3
Q11	Bring water from other catchments	2	2	-	3
Q12	Damming small rivers vs. no more on-line dams	1	2	-	2
Q13	Managed (artificial) aquifer recharge	2	2	2	3
Q14	Scheduled use within catchment - rostered consents [happening now] OR water user groups	3	2	1	3
Q15	Transfer/sharing/trading takes [proposed to be provided under PC9]	3	2	-	3
Q16	Water user groups (e.g., Twyford) [already provided for under PC9]	2	3	-	4
Q17	Reduction in water use: demand management, conservation strategies, promote efficiency and innovation e.g. soil moisture monitoring	4	1	3	4
Q18	Preferential allocation policies/plans	2	2	2	2
Q19	Increase cost-recovery charges make it volume-based (note this is different to water pricing)	3	1	2	3
Q20	Real-time monitoring by telemetry	6	1	2	4