FLAG MEETING NOTES: 18 June 2015

Purpose:	Waimea Plains Freshwater and Land Advisory Group (FLAG) – Meeting 9
Date:	18 June 2015
Time:	9.30am-3.30pm
Venue:	Fish & Game Offices - Richmond
Present:	**FLAG members:** Philip Woollaston (Chair) Nick Patterson Matt Hippolite (iwi representative on FLAG) (Deputy Chair) Gavin O'Donnell Lawson Davey Dean Rainham Pierre Garguilo Dennis Cassidy Zane Mirfin (arrived midday) **Staff:** Mary-Anne Baker (Senior Environmental Policy Planner) Lisa McGlinchey (Environmental Policy Planner) Joseph Thomas (Resource Scientist – Water) Glenn Stevens (Resource Scientist - Water & Land) Trevor James (Resource Scientist – Environmental Quality) **Guest presenters:** Andrew Fenemor (Landcare Research) Steve Green (Plant and Food Research) Chris Keenan (via phone conference link at approx 11am)
Apologies:	Heather Arnold, Mirka Langford, Martin Rutledge
Notes taken by:	Lisa McGlinchey (supplemented by other staff)
Definitions and Abbreviations	FLAG=Freshwater and Land Advisory Group WWMC= Waimea Water Management Catchment TTIFAK = Te Tau Ihu Freshwater Advisory Komiti (interim name for group until finalised) NPSFM= National Policy Statement for Freshwater Management 2014 NOF= National Objectives Framework TRMP = Tasman Resource Management Plan SOE = State of the Environment **Unconfined aquifer** = are those where permeable strata are open to the ground surface. Surface water (rainfall and/or river flow) is able to seep from the ground surface directly to the aquifer. **Confined aquifer** = are those where permeable groundwater bearing strata are separated from the land's surface by an impermeable layer (such as silt or clay) that prevents surface water from directly seeping into the aquifer. Groundwater migrates to confined aquifers from an unconfined recharge area located elsewhere. AGUA= Appleby Gravel Unconfined Aquifer UCA=Upper Confined Aquifer LCA= Lower Confined Aquifer N=Nitrogen, P=Phosphorus
Note: records of discussion points have been grouped into similar topics and are not necessarily in the order discussed at the meeting.	
FLAG MEMBERS PLEASE NOTE: If you have any questions or need anything between meetings, then please contact Mary-Anne Baker by email: marya@tasman.govt.nz or by phone ddi 03 543 8486.	

Session 1 – Issues arising from previous meeting

- General introductions made.
- Meeting notes from April meeting confirmed as accurate.

Management Objectives Feedback Summary – Lisa McGlinchey

- There has been no feedback received as yet.
- Feedback period closes next week on the 26 June.
- LM outlined the webpage usage statistics for the consultation webpage which showed 120 page views from 95 unique users.

Meeting with Waimea Inlet Group – Philip Woollaston

- Waimea Inlet Group has a partnership with TDC.
- Mary-Anne and Philip met with the group and had a useful meeting.
- Discussed objectives one by one and group generally accepting.
- Issues raised include methods rather than objectives.
    - Group queried if FLAG should be looking at phosphorus – advised them P was not found to be an issue
    - Group concerned what was happening in upper catchment hills – advised them FLAG area included consideration of upper catchment
    - Concern also about septic tanks on plains – staff looking to refine data
    - Some concern about what is happening in Lower Queen street – but happy with Borck Creek restoration work that has been done
    - Some concern regarding impacts of climate change
- The Waimea Inlet Group advised they are going to write a formal response to the objectives. MAB advised the group could supply this after the feedback closing date.
- Philip advised the group that the FLAG is committed to inviting the Waimea Inlet Group to provide feedback again at a later stage of the FLAG project.

Action: Staff to circulate notes to FLAG from the meeting with the Waimea Inlet Group. [*post meeting note: The Inlet Group has provided more detailed feedback on the draft and which will also be circulated to FLAG*]

With the extension of the FLAG project to the wider catchment – will the impacts of forestry be looked at?
Yes – but the measures we look at are yet to be resolved.
What happens if forest blocks are not replanted? – concern over change in land use resulting in greater effects (other than sediment during harvest etc)

Summary of Chris Hickey's Memo – Joseph Thomas and Trevor James

- The key conclusion from Chris Hickey's (NIWA) memo is that because of the correlation between water hardness and nitrate toxicity the tolerance levels for aquatic fauna in the coastal springs increases so that current nitrate levels are not an issue from a toxicity perspective.
- However, nitrate is still an issue in the springs as it can affect periphyton and algal growth which then affects stream ecology.
- The key point is that periphyton will be a driver for setting any nitrate targets in the springs.
- Both Pearl and Neimann Creeks have filamentous green algal issues – these are related to a lot of factors, in addition to nitrate concentrations – eg bed stability, light, etc.

Action: Staff to circulate Chris Hickey's memo to FLAG.

Does that mean nitrates don't really drive periphyton growth?
No – it is one factor in growth levels, they need nitrate, phosphorus, stable flow and light.
The number of snails (grazers) is also highly correlated [to algal growth].

So nitrate is still an issue to consider in algal growth?
Yes –but it is the ratio of Nitrogen and Phosphorus that drives the growth. The current Phosphorous levels in the spring waters are low and so periphyton growth is P-limited.

[post meeting note AF/TJ: P-limited means that unless P levels increase, periphyton is unlikely to increase much with increasing nitrate, however we cannot assume that P levels are going to remain at low levels throughout the catchment. There is a large store of P in the stream sediment and this could become available for periphyton. It has been well established (including through the environment court) that you have to manage for both N and P. This is because either one can be limiting at different times or in different parts of catchments]

Is temperature an issue for periphyton growth in the springs?
No – they are mostly nice and cool below 20 degrees.

Was the research into nitrate toxicity looking at all life stages of fauna? My understanding is that eggs are more susceptible than adults.
JT: Chris has been using the more sensitive invertebrates such as mayflies and daphnia – but we don't know if he has looked specifically at trout eggs.

Session 2: Landcare Research Modelling

Presentation: Verification of SPASMO Model- Steve Green (Plant and Food Research)

Presentation by Steve Green and Andrew Fenemor on what is behind the SPASMO calculations, and results. What is involved in the calculations and the verification of the model that has been done around the country through field investigations.

Key points:

- Steve has a modelling background and spends a lot of time understanding impacts of horticultural land use especially, irrigation and nutrients on crop production, soils and nutrient losses.
- His SPASMO model starts with a soil – water balance which uses inputs of climate and makes calculations on a daily basis
- Detailed turnover of nitrogen via the N-cycle in the soil is included in the model – a lot of lab work has been done (including 3 soils from Tasman) to determine figures for mineralisation rates
- Research in dairy pastures has also been done looking at pasture production to provide data sets for how grass grows
- Energy and nutrient budgets for animals are included in the model – these are used to calculate a milk production profile and feed requirements over the year – on-field research has been done to look at these numbers
- Tree crops information looks at leaf, flower and fruit production – the model simulates this and other inputs over the 40 year model period – this is supported by in-field measurements of water use, using sap flow sensors
- Experimental data is fed into the model to enable simulation of what crops and pastures are using.
- Plant and Food Research (PFR) has a lot of experience looking at changes of soil moisture – down to 2m depth – there have been apple, kiwifruit and pasture in-field investigations – this enables validation of the model for the dynamics of soil moisture.
- The model uses real grower data to verify the calculation procedures
- PFR has confidence in the SPASMO calculations to simulate the soil moisture dynamics
- PFR has also looked at leaching and drainage – investigations using meters (vineyard experiments in Marlborough) – methods of measuring both drainage and leaching losses which are used to verity that the model behaviour is reasonable.
- Dairy farm in Taupo (low density farm, high drainage site, unirrigated over 2 years) in-field investigations looked at water and nutrient fluxes – using 50 drainage meters.
- PFR is confident that the model framework is fit for purpose.

- In the Ruataniwha project – AgResearch ran numbers through OVERSEER to compare with the SPASMO outputs – and got reasonably similar outputs - considering OVERSEER is a gross model without the daily timesteps of SPASMO – for areas where different numbers where obtained this was found to be due to differing assumptions and differing inputs used in the models.
- In the Waimea project with Landcare, the SPASMO model is used to simulate water demand and nutrient losses across four land uses – grapes, pipfruit, dairy, outdoor vege production, one virtual climate, four different soil types (including their respective soil characteristics eg water holding capacity).
- Dean Rainham's survey of local growers was used to provide data on practices for input into the model (though haven't seen detailed survey results).
- Irrigation water use modelled from the water needs for the crops being grown. Comparison with actual data show the model data seems reasonable.
- If we can reduce the level of drainage, we can reduce the nitrogen losses.
- Drainage rates in Waimea tend to be higher than Blenheim for the same crops due to higher rainfall.
- Soil types also affect drainage and leaching losses, with gravelly soils (e.g. Ranzau) losing more than heavier soils (e.g. Waimea)
- In a separate project led by Landcare Research, the economic consequences of SPASMO varied irrigation allocation scenarios have been modelled by Greg Dryden, Fruition, though not reported in this project.

Questions arising from presentation:

Can you explain the virtual climate used in the model?
This is a virtual dataset that uses the nearest actual data (since 1972) to interpolate on a daily basis within a 5km grid across the country. This is not actual data, but is a good estimate – the best we have. This data has been provided by NIWA. The site used in this modelling is in Hope, which has slightly higher interpolated rainfall than at the airport.

Regarding the wilting point – is this assumed to be consistently spread through the soil profile?
It is a physical soil characteristic – it is what water will be held within the top metre of soil – rather than what is available to the plants.

Group Discussion: Landcare Modelling Report - Andrew Fenemor (Landcare Research)

Group discussion of report outputs and conclusions - led by Andrew Fenemor. Discussion document *Nitrate-Nitrogen Losses from Waimea Plains Farm Systems: Initial Results for Discussion by Waimea FLAG* (10pp) had been pre-circulated.

Key points:
- Over the 40 years of simulations SPASMO provides average numbers – these outputs show soil type is a critical factor for how much nitrate is leaching (refer SG/AF's presentation - table on slide 25 - same as Table 2 of Discussion Document)
- Because of relatively high rainfalls in the Waimea, irrigation doesn't have much influence on nitrate losses compared to differences in soil type.
- Pipfruit and grapes have similar (low) nitrate leaching rates while outdoor market gardening is higher especially on Ranzau stony soils

Discussion on model output summary for nitrate leaching

The group discussed the outputs shown on the summary table in the draft report (refer SG/AF's presentation - slide 25, Table 2 of discussion document) and Andrew's discussion points on page 9 of the discussion document.

Questions arising:

Given grape growers are only putting on 10kg/ha N fertiliser but modelled leaching averages 18, do the results suggest there is a natural mineralisation occurring on Ranzau Soils?

Yes.

Do inter-row crops affect leaching in orchards and vineyards?

Not much – it is largely due to crop water use and soil type.

Where leaching rates are higher than inputs – do you have a feel for where this is coming from?

Natural processes in the soil will be generating nitrate.

Can we assume the excess nitrogen from natural processes also occurs across the other land uses?

If their carbon-nitrogen ratios are the same, then yes we can.

As these are based over 40 years and apples were not intensive historically – should the numbers would be lower?

The numbers are based on what is actually done now. It is not a measure of what has happened over the last 40 years - as practices have changed over that time – it is an average of 40 years of simulated data based on current practices and aggregated for current land use pattern.

Can you break the results into what is coming from natural processes and land use?

Yes, the model can do this, but we have not been asked to report on this aspect as the concern has been total nitrate losses.

Is it reasonable to have lumped apples and other crops with the likes of kiwifruit given it is very different (high) in its leaching risk?

We can model each crop specifically - the table is used to show what is going into the land use map used to inform the model at a plains level.

> ***Should these been looked at separately? Or put in more relevant groupings?***
>
> ***If we are using the table data for a worst case scenario, we need to ensure the data is accurate and representative of the crop types.***
>
> *AF: Agreed though we have had to aggregate similar crops to get the modelling done in time and within budget. We have developed a map of crop types and land uses (refer* SG/AF's *presentation). Accepted there will be differences between kiwifruit and apples but kiwifruit area has declined a lot so wasn't worth the cost of doing separate kiwifruit simulations*

What is considered low, medium and high nitrate leaching?

SG: I'm not sure what high means, but the real question is what is the actual impact on the receiving waters. These levels give us something to start looking at this question.
AF: We have done preliminary work on the sensitivity of receiving waters which include the separate aquifers, springs, Waimea River and Waimea Inlet. What is low, medium or high depends on whether those levels are likely to breach reasonable limits wanted for those receiving waters.

Discussion on worst case scenario modelling

- Pierre has assisted TDC in informing where market gardening might be done on the plains given climatic and soil restrictions, as shown in the mapped area of slide 21 of the presentation (Fig 1 of discussion doc).

AF: could this area be used to model a 'worst case scenario' - is this realistic?
PG: No, the volume demand in the market is not there – other areas in NZ (and overseas) would need to be out of production for this to occur in Waimea – there is also a lot of existing tree crops (grapes/apples) in this area and unless the bottom falls out of these markets they are unlikely to go.

> **GS: So you are saying no more than an additional - say 400ha of market garden?**
> *PG: This would be two thirds more than we currently have – I would be surprised if we got more than 40-50ha extra in the near future. May be up to 200ha more at most.*
> *PG: Growers are getting smarter with land use – eg farmers using GPS to improve accuracy for planting and improving recovery rates for harvest.*
> *AF: So we could assume 200ha within mapped area and assume permanent crops like grapes and apples within that area stay there, for modelling purposes.*

Are you ploughing less organic matter in?
PG: Yes – years ago margins allowed owners to plough in crops if it was not economic to harvest – now margins are much tighter and we are looking at other methods – including reducing stem numbers, but increasing stem cut outputs.

Discussion of Flow Net and spatial complexity of system

- AF: If you look at the flow tubes in Flow Net (refer SG/AF's presentation slide 31) the water in Neimann Creek coastal spring is coming from the recharge area around Hope, and Pearl Creek down from Waimea West.
- We have some measurements in wells along these flow tubes going back to the 1980's. We have record of plumes from the historic land uses.
- Question is, what does current land use imply for future nitrate concentrations coming out at these springs, and if they exceed possible limits, what can be done?

Are the levels cumulative as you go down the Flow Net?
AF: The nitrate levels are reduced much down gradient except where river water infiltration can dilute them. So the Pearl levels may be diluted but not the Neimann levels coming from Hope which is well away from the river.
We would also find higher nitrate levels in the top of the aquifer with mixing down the depth of the aquifer occurring gradually as groundwater flows along the flow tube direction.

How much of what we are seeing down further at the springs could be attributed to the historic piggery site?
It is not just the historic piggery – there is also a history of market gardening. We can calculate flow rates through the aquifers – approx 10-15 years from Hope to the coast. Mapping of the nitrate plume suggests it is moving more slowly.

GS: there is mixing as it goes through the system so the levels in the northern areas will be a mix of current and historic sources.

So if there is more irrigation in these areas will there be increased leaching?
AF/GS: more intensive land uses come when more irrigation is available, so there will be more nitrate leached even though the SPASMO modelling suggests irrigated vs unirrigated crops don't vary much in their leaching rates. With a dam we will have more area farmed and irrigated.

In terms of Pearl Creek – do we know where the nitrate for this spring is coming from?

AF/TJ: Neimann Creek is higher in nitrates than Pearl – Neimann: Median 3.65 (range 1.82-8.5mg/l, earlier data up to 13mg/l), Pearl: median 2.75 (range 2.1-3.9mg/l, Borck: median 5.4 (range 4.6-7.0).
AF: some of the areas of UCA are or have been at 30mg/L – with the drinking water standard at 11.3mg/L.

Do we have any information on Nitrate levels going down the flow tube on the western side of the river?
Yes, we have some and levels are lower in the Appleby Gravels, but these areas are also fed by river waters, not just rainfall and irrigation leaching.

MAB: Does this tell us something about the historic levels - if Pearl Creek can be separated from the historic sources affecting Neimann Creek? Can this tell us about the different land uses?
AF: Not really as we're still lacking specific information on historic land uses over time.
Flow net information is only approximate, and there isn't very good water quality data along this area.

What about the contribution from septic tanks?
JT: council had an aquifer protection zone which regulated septic systems and offal pits, but was not that effective for nutrient management from diffuse sources.

Is the land use information the best information we have? Are there trends?
AF: The redder the map (refer slide 28 of SG/AF's presentation) the more nitrate leaching – the map is our best estimate of what is leaching across the landscape – we won't know the scale of trends until we redo this land use map [for future scenarios or historic land uses].

Can you overlay the groundwater results over these flow net maps?
GS: Yes we have done this in the past [refer meeting 2] – we have hand drawn the nitrate contours to be consistent with the flow net map contours as well as NO3 data and inferred aquifer boundaries.

Action: Staff to overlay groundwater nitrate results on flow net map and send out to FLAG.

Discussion on questions listed in the draft report

1. Do the relative loss rates across different land uses make sense?
I think we now understand these better following the discussion – but how we interpret them in relation to possible limits is the next matter.

2. Variability in leaching is strongly related to soil type (stoniness, available water content) – does this make sense?
All indicated this made sense.

3. Unirrigated [land] sometimes leaches more than irrigated. Seems counter-intuitive?
PW: Yes, but this can be the case as Steve explained.
SG: An example in Hawke's Bay of a dairy farm that we modelled showed if you irrigated it, it would reduce the leaching – because under the current practice the farmer would bring in feed and not irrigate – then during winter stored soil nitrate would leach out with rainfall.
GO: A good healthy vigorous plant will take up more nitrate than a half dying plant.
AF: The models assume irrigation is efficient. If it wasn't efficient this would also cause variability of leaching rates.

4. Average leaching rates differ between SPASMO and OVERSEER
PW: the grape and vegetable differences are dramatic.
AF: when the same inputs are used in SPASMO, you get similar output results.

SG: OVERSEER has no control on water balance so this will influence the differences. They have a different crop rotation (includes onions) and therefore different fertiliser regimes.

PW: Should we believe SPASMO as it is a more sensitive model?
SG: We shouldn't compare the models until we know they are using the same input data.

MAB: The HortNZ report does not show market gardening as being risky for nitrate leaching – but SPASMO does point to this. Kiwifruit is probably not such a concern as there is only a small amount on the Waimea plains.

> **Market gardening is still using a lot of fertiliser application and at times when uptake might not be high (eg around harvest), which could suggest important industry practices to look at.**
> *PG: the last two weeks of any vegetable crop is when the most Nitrate is taken up – there is a lot of research backing this up. We are putting a lot on, but a lot is taken up by the plants.*
>
> *JT: this information is not really being made readily available.*
>
> **MAB: but the question here is why the two models are so different across market gardening and we need to get a better understanding of why this is the case. The two models prioritise the different crops differently – we need to clarify the priority of which land uses to focus on.**
> *SG: Dean has suction cup research data on this issue which will provide some input into this.*
> *PW: We need to go beyond the models and look at what we think is the real case for leaching on Ranzau soils for example.*
> *SG: ask to look at the rainfall input into OVERSEER – the rainfall differences in SPASMO could account for some of the differences between the models.*
>
> *MAB: We can provide this observation back to Chris Keenan –And request that the modellers look at the input data to see why there is a difference and whether it relates to the water balance part of the model or not, that the Hort report to reflect any findings.*

JT: If growers are putting a lot of nitrogen on and then get rain – what do we do then?
DR: That is when we talk to the growers about what type of fertiliser and regime they are using to address this.

What is unacceptable nitrate leaching?
SG/AF: You need to look at the impacts on the springs and work backwards – up the flow tubes for example – then ask if we had this much nitrate lost this is the impact (can tune to current land use) – then simulate in that zone what nitrate limits will have an impact on the spring values.

We are assuming we have a problem?
We are assuming we have a problem in some places.
Clearly some people do have a problem – such as one apple grower with high nitrate in his irrigation well.
They say they are having a problem – other growers with similar Nitrate levels are not having a problem.
Current levels could be good enough, but we might not want them to get any worse.

Does it make a difference if Nitrate is put on as fertiliser in solid vs liquid form?
Yes, it does make a difference.
The difference also depends on the crop.

SG: a farm we monitored in Hawke's Bay – in a dry area, sheep camped there and the land was oversupplied with nitrogen which resulted in groundwater levels of 120mg/L.

PW: If we can discuss what the levels in the springs should be and work up the flow tubes from there – this is something we should discuss this afternoon.

Session 3: HortNZ Modelling Report

Prior to discussion with Chris Keenan (HortNZ) via phone link, the FLAG discussed the HortNZ modelling report and aspects they wanted to specifically discuss with Chris.

Discussion and topics arising:

- Our understanding of best practice needs further development – are there areas or land users on the plains that could make improvements? We need to drill deeper on current practice questions, including looking at audited proof of practices.
- Some more refined mitigation measures (some included in the Landcare discussion paper) have not been included in the HortNZ report.
- Regarding water use and soil moisture monitoring – is the amount of water they are using the right amount at the right time?
- PG: we went through the HortNZ report at the growers meeting. No significant issues were raised. The surveys were quite comprehensive on what growers were doing.
- we may still need to do more work to understand reasons for the significant differences between the two reports we have and the implementation or preparation of recommendations to council. We may need better rules regarding best practice – how do we bridge this gap?
- SG; One way to reduce differences would be to ensure both models are using the same input data. It is likely given experience elsewhere that the main difference is in how the water balance is addressed in each model.

Having talked to the growers - what are your thoughts on this Dean?
DR: the apple growers don't use much nitrogen fertiliser – they put it on post harvest for buds the following season. The market gardeners could do better in the areas of water management and minimising drainage – ie monitoring and more efficient delivery of water to crops.

Would it be fair to say there is more opportunity to manage nitrogen losses through changing management practices, than through reducing the amount of nitrogen used?
DR: Yes - The sharper operators are looking at what has been applied in the past and what the conditions were at the time and changing their practices to match the conditions and plant needs – precision farming. The less efficient operators just put on the same amount each time without these considerations.

DC: Is there a difference in different grower types? Almost all the pipfruit growers are now operating at Global GAP levels – is there something similar in the vege growing industry?
Some of the Global GAP standards need to be brought into NZ GAP. Some of the smaller growers are not involved in any of these programmes and will be doing whatever they want as they are not subject to these industry standards.

PG: This has been shown in Auckland – with issues of very small growers who don't keep suitable records, etc, as they are selling at the farm gate and changing their practices to meet the larger market players would not be economic for them.

GO: We get focussed on a relatively small number of intensive uses – yet is this having the major impact at a catchment level - when there are vast areas of less intensive use, but which could cumulatively have a larger impact.

PW: What is the total area in commercial vegetable production?
PG: the three big operators would have 600ha, the next size down operators would be around 100ha, with the small operators below this.

NP: trying to drive commercial operators to reduce nitrogen levels to a point which starts impacting their economic viability is not sensible – we need to look at best practice to reduce leaching.

PG: If we look at catchment level the intensive uses combined with the non-intensive area - this might show that at a catchment level there is no issue.
AF: there are risks with averaging – but the [Waimea Plains nitrate issue] is a spatial problem – there are some areas at risk and some not – we need to understand the pattern of connectivity of water bodies to understand the land use impacts.

It comes down to land use change also – eg. if all the area that could have market garden crops, does change.

Are we getting to a point where we are saying some land blocks can and cannot have certain activities on it? If we did we would have a court case on our hands.
AF: this brings us to Dean's comment of what changes to best practice are available to reducing leaching - so that we don't need to consider land use controls.

NP: How can we ensure landowners are doing best practice – how do we monitor them?
MAB: there are several ways to do this – it could be very prescriptive: "you will grow your crops like this"; or we could go down the road of "these are the kinds of best practice we know work that we then require". We could also set higher performance standards in riskier areas.

PW: Could we say that as a condition of undertaking a certain land use you must undertake these types of best practice / accepted industry standards – or alternatively identify practices that shouldn't be used as we know they cause problems?
MAB: Possibly – but we need data on the effectiveness of certain practices and their cost. We also need to know how much room there is to move in terms of what growers are doing now – we may already be at best practice and if so, we need to know this.

PG: The technologies are always changing and each year is different.

ZM: What about a rewards based system – if you are better than average you get something?
PW: This is something we could consider – people like to be recognised for what they do.
JT: if there is any kind of monitoring and reporting back – council needs to be mindful of the costs and resources for this.
PW: a reward system could involve reduced compliance requirements and costs for the growers.
PG: The market tends to drive a lot of improvements such as the GAP programmes.
PW: There will always be some growers who don't do the best practice – but these are getting so much smaller that they are having a lesser impact relatively at the catchment level.

Chris Keenan (HortNZ) in attendance via phone conference link

Key points from Chris Keenan:

- HortNZ has undertaken the research and OVERSEER modelling and also undertaken the financial modelling.
- They have checked results with the reference group who did the questionnaires and made adjustments based on their feedback.
- HortNZ sent the draft report to TDC for feedback.
- HortNZ also want feedback from the FLAG group before they finalise the report and put it on the HortNZ web page.

Questions arising from FLAG:

We need to bridge the gap between HortNZ's findings and what areas we need to look at in developing methods for recommendation to council – in particular defining best practices – as putting limits on nitrate use in the plains is going to be hard.
CK:

- *Yes – we are heading towards a place where limits may be required, but we need to look at the variability of model results – irrigation is not driving the nitrate leaching and soil is the greater driver.*
- *The modelling for the fruit sector is more accurate as it is a simpler system to model, however there is a lot of work underway on vegetable cropping with direct measurements.*
- *In the mean time there is no reason why we can't look at what good management practice is – you have had the presentation that Dean Rainham provided at a previous meeting [meeting 7] on current practice – the survey can't tell us if these practices are undertaken across the plains.*
- *There is a requirement to keep records for nutrient management – this involves:*
    - *Research around what is good management practice*
    - *Incorporating these into a code of practice*
    - *From this, users select the bundle of practices that will suit their property and this is formulated into a farm environment plan with input from experts.*
    - *HortNZ looking at how NZ GAP can provide support in this and provide auditing (for vege industry) have yet to talk to Global GAP.*
    - *Training around implementation on farm for implementing best practice.*
- *We have summaries of this going around nationally at a high level in other forums – we are seeking good consistency nationally.*
- *We need to look at what is being done and measuring effectiveness of practices over time by redoing benchmarking in future.*

For vege cropping the whole-of-farm outputs from the OVERSEER model seem quite low compared to other crop types- can you explain this given their shallower roots and the amount of fertiliser put on?
CK: The modelling predicts it is low for a number of reasons: 1. soil type, 2. The amount of nutrient removed by crops.
We have sought to model realistic rotations for vegetable cropping (eg pg 10 of report). Appendix 4 of the report gives greater detail of the numbers used – which came from the grower survey results.

CK: We were surprised about the kiwifruit results – but recent data on the new varieties are that they are more demanding, but yet to get confirmation of these.

Does the OVERSEER model, being a long term annual model – is it less sensitive to shorter time frame practices of when fertilisers are applied – would it be better to go to shorter time frames?

CK: We have checked the fertiliser regimes, soils and how much water is applied, and the yield which comes off. These affect the model outputs. But I can't say much more than we are surprised by the results. SPASMO might give a more accurate result for kiwifruit.

If you reduce the irrigation the yield drops, but the leaching remains the same.
CK: Stuart Ford's take on this is that irrigation does not impact much on leaching rates.

So changes of land use – such as vineyards going to kiwifruit would have an impact on leaching rates, but increasing irrigation on kiwifruit would not?

DR: OVERSEER is just looking at yield and determining leaching from yield – but this doesn't necessarily mean the nitrate is leaching – for some crops with lower yield, the nitrate is going into structural growth of leaves and canes, etc.

CK: the modelling doesn't represent some systems as well as others – but we can't prove this one way or another without rerunning the system over several years and potentially over other models with time. The only thing that will improve our modelling is data from lysimeters and monitoring under crops.

The importance of soil type has not been specifically reported in the HortNZ report, but from the SPASMO work this has highlighted in particular the Ranzau soils as a high risk – have you got any comment on how we address this or progress work on this?
CK: You could progress this by finding out the limitations of current systems and how they might establish on the plains to identify the risk in these areas – take the results from these particular land use types and apply these to the land areas they are likely to occupy and determine the likely impact of these changes on water quality.
I understand you are doing some work on this with Landcare. When you work on the scenarios to be modelled I suggest you work with FLAG members and landowners to determine what land uses might go where.

MAB: Yes we are doing this with Pierre G.

PW: Staff can compile the responses from FLAG to the HortNZ report and send them to Chris Keenan.
CK: when can this feedback be provided? It is important to finalise the HortNZ report as soon as possible so it can inform the rest of the FLAG process.

Action: Staff to come back to Chris Keenan asap with a compilation of questions and comments from the FLAG on the HortNZ work.

Do we have an understanding of what the total nitrogen is going into the system? It seems we are going about this the wrong way around – if we knew a total for the catchment we could then work backwards to limits.
PW: I think this comes back to Andrew Fenemor's comment that the nitrate issue on the plains is a spatial issue with some hotspot areas with issues and others that are fine.

DR: We have some world leading growers in Waimea and they know how much nitrate is required for their crops and they don't want to waste anything as it costs money. I'm visiting a grower tomorrow and the goals we are seeking at a paddock level are very detailed in terms of coming up with a nutrient management plan. I think setting limits is a dangerous path to go down – where we can improve is having performance standards and for many they will already have systems in place to meet these.

I don't think our problem will be these well-managed farms - the management requirements and regulations will need to focus on those that do not do this standard of management (the smaller growers).

We could require that growers are complying with an industry standard – eg one of the GAP programmes or a minimum in the TRMP if not. We may also need to consider limits in a spatial sense to address the spatial issues.

I don't see a dam causing major leaching issues. The results are showing irrigation is not a driver of nitrate leaching. A lot of the worst sites are unirrigated – rainfall is driving leaching amounts – those putting on solid fertiliser will be using rainfall to take it into the soil - fertigation can be a better practice to control this.

However the dam may allow land uses to move into areas not previously used and we need to understand what impacts this might have.

AF: What we are saying from the leaching results – which are on a per ha basis – with a dam we are saying that there will be more hectares in intensive use and may be greater aggregated effects.

But if these areas are using high tech systems – does this mean there will be more leaching?
Not necessarily
But we need to make sure that those that do increase are using these best practice systems.

Are we reinventing the wheel – Hawke's Bay, Manawatu, Canterbury have already done this - can we just look at what their best practices are and their systems and apply this to our soils and the practices we think will work here? What did you find out in Canterbury Nick?
NP: There are advantages in grouping together to look at the issues – as it is the whole that is the important thing, not just looking at individual farm level. If we look at a future best guess of what might change.

MAB: each council is facing the same technical challenges – for the water resource we are working with we will need to do different things in each area depending on soils etc. Each council has used different processes- eg having a total load and dividing it up according to historic or potential future use, using land use classifications to assign leaching amounts, grand parenting existing uses etc. The approach taken will depend on whether water quality must be improved or where further development can be provided for.

SG: There are things we can do with a dynamic model that we can't do with static models.

Session 4: Modelling of Good Management Practices

Discussion on modelling of management practices led by Andrew Fenemor and Steve Green

What we have done so far is to represent the losses from current land use – what we could do is look at future losses from future scenarios for changes in land use – or we could look at mitigations in practice to reduce nitrate leaching.

PW: It seems to me there are two questions:

1. **To what extent are current growers not using good or best practice?**
2. **How much can we expect practices to improve?**

NP: what are we going to get out of the modelling?

AF: the modelling will help answer if nitrate issues can be managed through best management practices alone - or is it going to require something more – such as land use controls - we need to know this too.

DC: Given some of the land uses are similar – is it really going to make a difference?
NP: Possibly if more of the plains are used with further water available – and there is a potential difference depending on what land uses these are.

JT: there are 1000 – 1500 more hectares possible in a with-dam scenario [within the dam service area and including Redwood Valley]

Even generous increases might result in 800ha more over a variety of crop types – perhaps just more of the same?

SG - what if kiwifruit gold takes off?
Current proportion of kiwi fruit is quite low.

The dam is both about better security for existing users as well as providing for more irrigation.

From a quality perspective we need to ask the question what is the potential for expansion with more water?

- *AF: in previous work we just scaled up the current land use percentages over the currently unirrigated land area.*
- *Market forces will have an impact – falling dollar etc – it is dangerous to assume that if we have more water availability, that this will result in expansion.*
- *There are quite a chunk of water rights held for land that has an uneconomic size etc for productive land uses.*
    - *But getting a larger water bill will force landowners to be more productive*
    - *But this is not the case as they now have a choice to not be involved, so not have the associated costs – this will promote those who want to be lifestyles blocks to remain so.*
- *We will have some historic details for allocation and the resultant production to inform the future scenarios*
    - *Yes but some land use has had irrigation rationed, which has put a stop on the productivity growth.*

What might be a more reasonable scenario than the market garden potential expansion area identified?

- *PG: Remove any block smaller than 4ha as we wouldn't use it for market gardening - you can expand onto smaller blocks that adjoin your existing land, but not onto standalone smaller blocks.*
- *Should also exclude all those currently in permanent root stock*
- *Not all land has full water entitlement (relative to their land area)*
- *Remove urban and planned urbanising areas*

What room for improvement in management practices is there?

Those industries that are involved in GAP programmes tend to drive best practice - eg most apple and grape growers will be well down the track for undertaking best practice.

What do the GAP programmes involve?
Total nutrient programmes – based on soil tests and crop need.
Most of the practices listed in the Landcare report would be required in GAP programmes – you also have to do monitoring and reporting.

Dean are these the kind of things you are monitoring in your consultancy work?
DR: Yes we provide growers with our credentials to include with the GAP reporting.

Is use of best practice driving to reduce leaching or efficient production?
It is seeking sustainability - it may not go far enough in the leaching aspect, but it is a very good step towards this. Those not involved in these programmes are following an unknown programme.

The question is how can we improve best practice in dairy and vegetable production?
I think those already doing best practice will be focussing on those practices that improve economics.

How many people are really out there that are smaller 'mum and dad' growers? – about 30 people will dominate 80% of growing on the Waimea Plains.
This might be true for apple or grapes, but I don't think this is so true for the pastoral sector.

Is it worth looking at what area/growers/landuse is covered by GAP programmes?

- *Yes this could be helpful.*
- *Yes - what is covered by NZ GAP, Global GAP, supermarket programmes, etc*
- *Anyone exporting apples out of NZ are part of a Global GAP programme*
  - *Are they all exporters?*
  - *Yes – there aren't any little producers*
  - *I think there are smaller ones that do supply domestic markets.*

How does all this fit with our aspirational goal of improving water quality?
PW: We have two goals – one being to not get worse, the second to get better.

DC: Are there hotspot areas that would improve or protect water quality if we stopped certain land uses/ practices?
AF: groundwater results do show that nitrate levels are improving, as some growing practices have improved already – the modelling is seeking to find out if this will continue with future land use change.

Best practice in horticultural land uses

***PG: in terms of horticultural options for improving practice – a lot of it is already done. It is being driven by economics**:*

- *Limit fertiliser application – everyone already below 80kgN/ha*
- *Reduction of nitrate applied – everyone looking to do this*
- *Boom irrigators more efficient*
- *Side dressing fertiliser*
- *Winter crop fallowing*
- *Soil and leaf testing*
- *Soil water testing*

Because we use granular fertiliser our biggest issue is the rain – but we don't go on the soils when it is raining.

AF: one of the things that came out of modelling is winter lettuces leach a lot of nitrogen. Is that realistic?
PG: we are using lettuce varieties to heart up naturally in cold environments. Market gardening is now more scientific and technical.

Does SPASMO including side dressing?
SG: Yes – it assumes the nitrate stays on the ground and goes in with next rainfall.

What about banding vs broadcasting?
SG: No.

Is there a difference with organic vineyards from others?
PW: Yes, We use a bit more water, and a bit less fertiliser. Prunings are also composted so there is a delay in the return of nitrate to the soils. But the differences are subtle as the nitrate loss numbers are low anyway.

So the modelling doesn't need to take this into account?
Probably not.

Does the SPASMO model pick up these differences?
It could as it accounts for the differences in how fertiliser dissolves and interacts with rainfall.

Best practice in pastoral land uses

GO: Could we go through the pastoral list of best practice?

- Application of fertiliser easier on flat land than on hill slopes – affected by timing if using planes
- Farmers are looking to reduce nitrate use due to cost
- Livestock improvements (including both genetics and grazing methods)
- Riparian buffer plantings are well covered for this in dairy scene, but not so much with sheep/beef unless they are incorporating dairy support in their regime.
- Dairy/standoff pads – probably unlikely to be used locally due to economics and desire to keep grass-fed product for marketing benefits
- Use of nitrate inhibitors – increasingly becoming an acceptable tool
- Wetlands for intercepting runoff – knowledge improving and people beginning to understand non-economic benefits of wetlands
- Wintering off on less sensitive land - need to be careful we are not just shifting the problem eg not just nitrate, but erosion and sediment issues
- Improved irrigation efficiency – most farmers are moving in this direction driven by cost and profitability

MAB: If there is no comparable GAP programme for the pastoral industry – other than Fonterra's programme – is it then really down to farm plans?
GO: The GAP programmes have been driven by the customer marketing end which has encouraged uptake – however the GAP principles are applicable to the pastoral sector. Irrigation and nutrient management seem to me to be two things people should be doing anyway from an economic perspective – let alone from an environment perspective.

Is there anything that could be put into the model on the change of forestry to pastoral land uses?
This is unlikely to be an issue as most areas in forestry that were not replanted are likely to go back into native scrub or lifestyle blocks.

Whatever policy we come up with needs to be made on a justified basis.

Is there opportunity for improved timing of pastoral applications of fertiliser? Would after rain be better than before rainfall? Would this have a positive effect for all crops?
Potentially yes – there is some concern in capacity to get the volumes on in the timeframes involved.

In the context of the plains, if 2 growers get it wrong then it is not a huge impact in the scheme of things.

We need to look at what is an acceptable amount of nitrate lost and work back from there.

Discussion on planning responses

FLAG have a consensus to look at the outcomes we want – in terms of the springs and drinking water. Let's look at these and work backwards.

What are we aiming for in the springs for nitrate levels?
TJ: less than 30% cover in filamentous algae – to achieve this there are a lot of variables not just nitrate. It would be difficult to give you a figure.

What is a realistic goal?

JT: The ANZECC figures are for rivers, not spring fed systems.

We need to be careful – if what we are proposing won't have a demonstrable effect then we shouldn't go near it.

TJ: Agree it is not just about nitrate – these streams could do with improvement of food fall for aquatic fauna and they are habitat limited. Dissolved oxygen is a problem also.

If drinking water is one of our key goals – shouldn't we set our upper limit at this level (11.3mg/l)?
Yes – this is an international standard.
For those hotspots where we have nitrates above drinking water standard what can we do?

If we were to meet the nitrate drinking water standard in hotspot areas that are currently above the standard – would this improve the levels in the springs?
AF: Yes it would improve the springs levels.

Should we go to others who are further ahead and look at their mitigation?
MAB: I think you will find they are at the same place – feedback from HortNZ and others is there is still a lot of work to do to understand the effectiveness and cost of practices.

It depends on how we write the policy - GAP is looking at a lot of this and changing with each year – we probably won't get it completely right first time.

Isn't water quality getting better?
There are places where water is getting better, but we can't say this for the whole plains – the areas that were very high are getting better, but at the ones that were moderate the trend is less clear.

AF: Looking at the various leaching rates – if you take current dry land and change the land use to any of the modelled irrigated land uses, there will be an increase in nitrate leaching.

MAB: we don't know if we have head room for these increases.

AF: In Canterbury – there are some issues in lower areas – their solution is dilution – putting in clean water into these areas (managed aquifer recharge) while capping nitrogen losses.

Potential to look at policy options done in Canterbury – they include OVERSEER limits – if they want to change land use – they will need a consent and farm plan to prove it.

PW: Could we have a brief paper on planning approaches used around the country including Canterbury and Manawatu?
MAB: There is a lot of the choice depending on if you have room to move – if you are at where you want to be or are over allocated. At the moment there seems to be a hope that we are at an ok level, but we don't want to add any more.

Action: staff to provide summary of other regional policy approaches to FLAG.

Are you saying that if we are at nitrate levels where we want to be now [and no more] – do you mean we are talking no more water and no more expansion?
It could have that implication, but the devil is in the detail.
If we put in more glass houses we could have expansion without any leaching effects [as they are closed systems]

JT: what are council going to do for land uses that don't irrigate, but still produce high nitrates?
That implies land use controls may be needed, not just water use controls

If we aspire to 11.3mg/l as a nitrate limit we will have some of the most contaminated groundwater in the country – this can't be our limit.

What is a sustainable limit for our catchment?

- *No worse than it is now and lower than 11.3mg/L*
- *We have some areas at 14-15mg/l which is already above 11.3 – spatially it is very variable.*
- *We are not aiming to make things worse anywhere – if we increase the area under intensive farming on the plains this needs to be done in a way that doesn't make this worse.*
- *It is not enough to look at the area irrigated – we need to look at what they are irrigating – eg change of land use to less leaching uses.*

Have other regions looked at a catchment nutrient budget?
Yes, one example is Taupo and they divvy it up and trade the nutrient loads amongst themselves. Others in Canterbury. But we need to consider by spatial area and by aquifer due to our hotspots.

We may need to consider policy based on soil type and where groundwater flows are going to.

AF: We have assumed in developing the nitrate leaching map that the large area of lifestyle blocks would leach nitrate at a similar rate overall as extensive sheep and beef land use – is this representative?
GO: I can't think of a better assumption to make.
JT: In a non-intensive scenario there is less dilution as there is less water drained though the soil, so higher nitrate levels.
May need to account for more septic tanks in a smaller area.

Can we build a model to look at water quality flows?
JT: SPASMO just looks at recharge, not flow through. We do want to understand this.
AF: we had a look at this in work for WWAC which needs to be refined now.
AF and SG can look at modelling work for next meeting - AF is not available to meet. It sounds like SPASMO modelling of mitigations isn't useful at this stage without knowing what they are. AF or SG could look more into nitrate losses down flow tubes. SG is about to do some similar work in Marlborough.

Session 5: Project Management

Gantt Chart

LM gave out an updated Gantt chart for the project timeline – the key changes were correcting the timeline due to the cancelled FLAG meetings – this pushes the timeline out.

Action: LM to amend Gantt chart under meeting10 – change term "preferred" to "possible" management options.

Subsequent meeting dates

Next meeting dates agreed:

- Monday 20 July 2015 (Zane put in his apologies for this meeting)
- Wednesday 19 August 2015
- Wednesday 30 September 2015

<end of meeting>

Action Points – Council Staff

No.	What	Who
1.	Staff to circulate notes to FLAG from the meeting with the Waimea Inlet Group	MAB
2.	Staff to circulate Chris Hickey's memo to FLAG.	JT
3.	Staff to overlie groundwater results on flow net map and send out to FLAG.	GS/JT
4.	Staff to come back to Chris Keenan asap with a compilation of questions and comments from the FLAG on the HortNZ work.	MAB
5.	Staff to provide summary of other regional policy approaches to FLAG.	MAB
6.	LM to amend Gantt chart under meeting10 – change term "preferred" to "possible" management options.	LM

Action Points – FLAG members

No.	What	Who
7.	None	

Next meeting

Date	19 August 2015 (Meeting 11)
Time	9.30-3.30pm
Venue	TDC Council Chambers
Chair	Philip Woollaston

Subsequent meetings

Date	30 September 2015 (Meeting 12)
Time	9.30-3.30pm
Venue	TDC Council Chambers
Chair	Philip Woollaston

Date	tbc
Time	9.30-3.30pm
Venue	TDC Council Chambers
Chair	Philip Woollaston