Report to the Collaborative Stakeholder Group – for Agreement and Approval

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Date:	18 December 2015
To:	Collaborative Stakeholder Group
From:	Chairperson – Bill Wasley
Subject:	**Setting water body targets and limits**
Section:	**Agreement and Approval**

Disclaimer
This report has been prepared by Waikato Regional Council policy advisors for the use of Collaborative Stakeholder Group Healthy Rivers: Wai Ora Project as a reference document and as such does not constitute Council's policy.

1 Purpose

The purpose of this report is for the Collaborative Stakeholder Group to:

1. Receive a summary of the steps CSG and the Technical Leaders Group has followed to set attributes and bands for each of the modelled or monitored water bodies in the catchment (lakes, main stem of the rivers, tributaries), and;
2. Understand and then decide how this information should be used when writing water quality limits[1] and targets in the Waikato Regional Plan Change 1: Waikato and Waipa River Catchment (the Plan Change), so that;
    a. the Plan Change sets out what success will look like, and that
    b. the CSG is confident the Plan Change is written in accordance with the National Policy Statement for Freshwater Management and the Vision and Strategy.

Recommendation:

1. That the report [Setting water body targets and limits] (Doc #dated 18December 2015) be received, and

2. That the Collaborative Stakeholder Group agree:

    a. Attachment 1 of this report "CSG agreements to date on components of target and limit-setting process under the National Policy Statement for Freshwater Management " is an accurate reflection of the interim decisions made by CSG as they have progressed through the steps in the National Policy Statement for

[1] Limits are defined in the NPS-FM as the maximum amount of resource use that will allow a freshwater objective to be met.

Freshwater Management, and that staff will bring back the outstanding matters in Attachment 1, in an approvals report to CSG in February 2016;

b. **Long term water body limits** in Waikato Regional Plan Change 1: Waikato and Waipa River Catchment (the Plan Change) should be written as numeric limits to be achieved by 2096 which will protect the values agreed by the CSG, and;

c. **Short term water quality limits** in the Plan Change seek to achieve beneficial outcomes over the life of the Plan Change, and should include:
    i. Methods in the Plan Change that set out that WRC will continue to monitor all water quality sites in the Waikato and Waipa River catchment, assess and report on water quality trends and review technical information, and
    ii. Other statements agreed by CSG that relate actions on the land to water body outcomes, and where possible monitor and account for those actions on the land

d. The **scale** that the long term water body limits should be set for the River Freshwater Management Units (FMUs) is a single numeric limit for each attribute in each FMU. The limit will be achieved if all monitored points in the FMU that are relevant for the attribute, meet the same numeric limit, and that any individual monitored site(s) with attribute levels in 2016 that are higher than the long term FMU limit, should not be allowed to decline..
e. The scale that water body targets should be set for the Waikato and Waipa Lakes Freshwater Management Units (FMUs):
    i. should reflect the four broad categories of lakes within the FMU, and;
    ii. one long term numeric target is given for each of the four lakes categories (peat, riverine, dune and volcanic), and
    iii. any individual monitored lake(s) in each category that have higher attribute levels in 2016 than the long term FMU limit of other lakes in the same category, should not be allowed to decline.

2 Introduction

A report to CSG 9-10th December[2] noted that

> CSG has chosen to model a step-wise approach to achieve scenario 1. Before limits and targets can be confirmed and written in the Plan Change the CSG needs to continue its work on:
>
> i. Defining the long term water quality outcome and associated contaminant limits. The Plan Change template has some draft wording. It describes the waterbodies' state in 80 years. The CSG needs to set out how the Regional Plan will contribute[3] to restoring the health and wellbeing of the Waikato River over time by employing a staged approach.

[2] See page 5 of WRC 2015. Agreement and Approvals Report to CSG entitled "Principles and options for managing within limits and CSG sub-group report back from a meeting on 18th November". Doc #3625208 dated 3 December 2015.
[3] Plan Change 1 is dealing with the 4 contaminants with respect to restoration. Other actions will be required to deal with other matters.

ii. Setting targets to achieve the first stage of the water quality outcome. The CSG has had some ideas[4] about how this could be defined, both with reference to numerical attribute bands, and as a narrative.

iii. Confirm at what scale the limits and targets will be set for each attribute (FMU or sub FMU) and how these relate to actions on the land[5].

This report covers i) –iii) above. It has been prepared by WRC policy staff in discussion with Technical Leaders Group (TLG) Chairman Bryce Cooper and WRC water quality scientist Bill Vant.

In terms of ii) above, the report proposes that CSG does not attempt to set numerical water quality targets for the first stage of the plan change. Instead, the technical advice is that it may be more appropriate for the Plan Change to set narrative short term water quality targets and also include measures of 'actions on the land' that are indicators of positive progress toward achieving scenario 1.

3 NPS-FM: Freshwater objectives, water quality limits and/or targets in Plan Change 1

A freshwater objective is an intended environmental outcome in a freshwater management unit, i.e. what you want to achieve in the water. The NPS-FM states that this should be numerical where practical, otherwise a tightly worded narrative.

A limit is the maximum amount of resource use available, which allows a freshwater objective to be met. This goes a step further than a freshwater objective, by describing the maximum use of the resource to achieve the desired state.

See Attachment 2 for a description of freshwater objectives and limits from the NPS-FM implementation guide by Ministry for the Environment.

The work that CSG has done so far has been to set freshwater objectives for the water. CSG is currently working through what the limits might be and how they could be expressed for the different contaminants.

By way of example, water quantity and nitrogen are simpler examples for the relationship between a freshwater objective and a limit:

Table 1: Example of the relationship between freshwater objectives and limits, using water quantity and nitrogen

NPS-FM terminology	Water quantity example	Water quality example Nitrogen in Lake Taupo
Freshwater objective total amount in the river	The 5-year low flow has been determined to be 148 cubic metres per second at present. The amount of water that may be abstracted from the Waikato	By 2080, the annual average concentration of nitrogen in the water in Lake Taupo must be no greater than 70 mg/m^3

[4] There has been discussion at CSG about how CSG will define 10% toward scenario 1. For instance, it was suggested that it could focus on changes made on the land, as well as changes measured in water bodies. This idea is taken a step further in Option 2 of this report.

[5] CSG work to date will be used in a "Setting Plan Change water quality limits and targets" report to CSG (in prep) for the 18-19th December CSG meeting from policy and technical staff.

	River upstream of Karapiro and allocated to consented water takes is Five percent of this amount.	
Limit maximum amount of the total that is allowed to be used	Seek to phase out exceedences of the combined primary and secondary allocable flows set in Table 3-5 of the WRP by 31 December 2030.	The manageable load of nitrogen from the Taupo catchment (as determined by Overseer) must reduce from 880 tonnes per year to 700 tonnes per year

To know whether the freshwater objectives are being achieved, WRC needs to develop a monitoring plan (NPS-FM Objective CB1)[6]. Methods could include:

- where and how water quality is monitored, and/or modelled, and what happens if new trends are detected, and
- how data about actions on the land that relate to effects on water quality will be gathered, assessed and reported.

4 Long term water quality improvement

The desired long term water quality has been established through the values-setting exercise that CSG, project partners and the wider community have been engaged in to develop the Waikato Regional Plan Change 1: Waikato and Waipa River Catchment (the Plan Change).

CSG has decided they will describe the long term outcome as the water quality improvement that must be achieved in 80 years. In order to know that the long term, broad narrative outcomes have been met, the Plan Change will set out numerical water quality objectives. This is the recommended approach in the NPS-FM (Policy CA2 e)). The draft objective[7] require that the CSG's water quality attributes must be met at certain numerical levels by 2096.

The catchment models used by the TLG start with the well-established principle that there is a link between actions on the land to reduce contaminants and the amount of contaminant that is measured in the water.

The CSG sub-group noted that in order to know that a water quality numeric outcome in a sub-catchment is met, all the property-level contaminant losses and reductions would have to be assessed and aggregated to a sub-catchment level. In addition, biophysical processes that occur between the property-level and the surface water would have to be accounted for.

Whilst technical knowledge of water quality cause and effect is well established, precise quantification is not currently feasible. Difficulties include:

1. Lag effects - timeframes for actions on land to create a water quality response
2. The amount of water quality response that can be tracked back to individual property-level mitigation actions

[6] There is guidance in NPS-FM Policy CB1 that methods are established that recognise long term trends and monitoring is at sites that are representative for each FMU.

[7] See WRC 2015 Approvals and Agreement report entitled "Re-crafted: Steps to achieve the Vision and Strategy over time". Document #3572646, dated 9 October 2015. For CSG 18, 13-14 October 2015.

For the first aspect, the timing of the water quality response for some actions are delayed and although such timing can be estimated they cannot be known precisely. For instance, sub-catchment differences in nitrogen attenuation factors and lag times were covered by NIWA expert Sandy Elliott in his presentation to the CSG on 21 October[8]. The modelling was therefore conducted assuming an equilibrium 'steady-state' – that is, the water quality that would *ultimately* be achieved through a certain set of actions. Over long time frames such as 80 years, we can be confident that actions on the land in the first stage toward achieving the Vision and Strategy by 2096, will be able to be measured in the water. The scientific uncertainty in 2015 about timing and location of effect should be greatly reduced in 80 years[9].

For the second aspect, there is no simple connection between property-level actions to mitigate contaminants and the amount of contaminant measured in the water. For instance, there is no model that can reliably link numerical property-level limits to numerical water body limits. The CSG sub-group concluded that the Overseer model was a useful tool as it modelled nitrogen leached from the root zone of a property. They had reservations about using this model to set property level limits in the first phase of the plan change. Instead they concluded that it was better to concentrate on actions in property plans, which could include use of Overseer to help guide those actions

5 Short term water quality improvement

Water quality monitoring is the only way to assess whether the long-term freshwater objectives of scenario 1 have been achieved. However, in a step-wise approach to scenario 1, we shouldn't rely on water quality monitoring as a measure of success in the early stages because actions will be implemented over time and because of lagged responses between actions and water quality effect.

The TLG has reported to the CSG on the literature related to the efficacy of mitigations and how these mitigations, when incorporated into a catchment model, are predicted to improve water quality.[10] However, the TLG has also noted the limitations of this modelling and has cautioned against using it beyond its purpose. Any model is a prediction about the future, not a certainty. The CSG sub-group has discussed that we cannot precisely track water quality effects of the mitigations taken up by individual landowners. For these reasons, CSG needs a range of measures to show the effectiveness of the Plan Change.

Alternative to relying solely on water quality monitoring data as a measure of success

Data about actions on the land that relate to water quality will be gathered, assessed and reported. For instance, the amount of contaminant mitigation actions in property plans

[8] See powerpoint presentation WRC document number 3594449 on the land-water model by NIWA scientist Sandy Elliot who was one of the people commissioned by TLG to develop the model. The attenuation that occurs between the root zone and the surface water body was covered by TLG memberTony Petch when he outlined the groundwater research in mid 2015.

[9] As noted on page 5 of a CSG sub-group report back, entitled CSG subgroup: Managing nitrogen and phosphorus at a property-level 23 October 2015 workshop] (Doc #3574906 dated 16 November 2015 Bryce [Cooper] reminded the sub-group that there are two areas of uncertainty (load from land, load to come and timing and the load in the water) for nitrogen:

1. On the land, where root zone nitrogen loss is modelled by OVERSEER
2. In the water, where there may be removal before total Nitrogen is measured at a monitoring site (attenuation), as well as how long it takes to reach water (lag time).

[10] It is important that all TLG advice to the CSG can be reviewed and assessed by interested parties. The TLG have completed reports on all topics that they have advised CSG on, and had them peer reviewed. For instance, reports on scenario modelling 1 and 2 and the mitigations report are available.They are in the process of being approved and put on the CSG portal. As the Plan Change goes into the formal RMA process, submitters and appellants will want to see this information.

undertaken could be reported. A step further than this would be modelling of the estimated reductions of diffuse contaminant discharged at a sub-catchment scale.

6 Scale at which limits are set

The NPS-FM National Objectives Framework sets out different 'bands' that numerical attributes fall into. Regional communities can choose the band they set, as long as it is above the lowest water quality band (the lowest band is "D").

When deciding the future scenarios to model, the CSG discussed the desired improvement in water quality with reference to bands for each attribute, and looked at maps of each monitored point in the catchment. The CSG set the desired bands for each FMU to be modelled as part of the scenario modelling.

Looking ahead to achieving the long term water quality in 80 years, there are merits in taking a practical approach to how the improvement will be measured within each FMU.

7 Summary

Freshwater objectives need to describe an intended environmental outcome that will enable the chosen values for the FMU to be met to the desired level. The Plan Change will set a freshwater objective that must be met in 80 years. It will list the attributes that will be measured and contain numbers (for instance, concentrations of E.coli).

Limits are defined in the NPS-FM as the maximum amount of resource use that will allow a freshwater objective to be met.

The work that CSG has done so far, has been to set freshwater objectives for the water. CSG is currently working through what the limits might be and how they could be expressed for the different contaminants.

Attachment 2 sets out guidance about how freshwater objectives and limits should be developed. Attachment 3 sets out guidance from the Land and Water Forum.

Attachment 1 CSG agreements to date on components of their target and limit-setting process under the National Policy Statement for Freshwater Management

Attachment 2 Description of freshwater objectives and limits from the NPS-FM implementation guide by Ministry for the Environment.

Attachment 3 Information about the link between land and water quality, and a process for freshwater accounting. Excerpt from Fourth Report of the Land and Water Forum November 2015

Justine Young and Emma Reed
Policy development workstream
Waikato Regional Council

Bill Wasley
Independent Chairperson, Collaborative Stakeholder Group

Bryce Cooper
Technical Leaders Group

References

Elliot, S. 2015. How do the catchment models for *E. coli*, nutrients, and clarity work? Powerpoint presentation at CSG Mitigations workshop on 21 October 2015 WRC document number 3594449.

Land and Water Trust 2015. Fourth Report of Land and Water Forum November 2015. Downloaded from www.landandwater.org.nz on 8 December 2015.

Ministry for the Environment 2015. A Guide to the National Policy Statement for Freshwater Management 2014. Ministry for the Environment Manatū Mō Te Taiao, Welllington New Zealand.

Attachment 1: CSG agreements to date on components of their target and limit-setting process under the National Policy Statement for Freshwater Management

10 December 2015

Freshwater objectives (attributes and attribute states in the water)

CSG have decided on a series of attributes to be included in Plan Change 1 based on advice from the TLG (Workshop notes CSG13 and 14). These attributes are based on the National Objectives Framework (NOF) in the National Policy Statement for Freshwater Management 2014, and have been adapted for the Waikato context to create a Waikato Objectives Framework (WOF). The attributes included in Healthy Rivers Wai Ora WOF are:

Upper, Middle and Lower Waikato FMUs	**Waipa FMU**	**Peat, lowland riverine, dune and volcanic lakes FMUs**
E. coli (E. coli/100mL)	E. coli (E. coli/100mL)	E. coli (E. coli/100mL)
Clarity (metres)	Clarity (metres)	Clarity (metres)
Nitrate (mg NO_3-N/L)	Nitrate (mg NO_3-N/L)	
Ammonia (mg NH_4-N/L)	Ammonia (mg NH_4-N/L)	Ammonia (mg NH_4-N/L)
Phytoplankton (mg/m^3)		Phytoplankton (mg/m^3)
Total Nitrogen (mg/m^3)		Total Nitrogen (mg/m^3)
Total Phosphorus (mg/m^3)		Total Phosphorus (mg/m^3)
		Planktonic cyanobacteria (mm^3/L)

The way that WOF differs from NOF is as follows:

- E.coli - as per NOF
- Clarity – not in NOF, (modified A-B threshold from original TLG thinking)
- Cyanobacteria - in lakes FMU only
- Phytoplankton - as per NOF
- TN and TP - at mainstem river sites only
- Nitrate - as per NOF
- Ammonia - as per NOF
- DO - out of scope of Healthy Rivers Wai Ora so not in WOF

(CSG workshop notes 13 and 14)

There have been several reports/presentations to CSG on attributes and a final report by TLG summarising the process is in preparation.

CSG described a set of scenarios to model in Round 1. Scenario 1 described the ultimate goal for water quality, equivalent to achieving the water quality outcomes as described by the Vision and Strategy. Further refinement was made in Round 2 to model steps along the way to achieve scenario 1.

For both rounds of modelling TLG needed to translate the qualitative instructions given by the CSG into quantitative parameters to run the model. One implication of this process is that if CSG instructed an attribute to move 'up a band' then the model has aimed for the lowest possible point to be able to satisfy that band requirement i.e. the concentration of that attribute which just shifts into the band above. This means that all the scenario modelling has been undertaken to meet the bottom of the band when instructed to move up a band.

Also, some instructions were 'maintain when at A and raise the rest to B'. Due to the different current state the monitor points were starting from, and the different bands some were aiming for down the river, there are some monitoring points whose attribute state differs within an FMU for the same contaminant for scenario 1.

The lakes are not included in the scenario modelling - CSG have discussed broad qualitative descriptions of what outcomes they are seeking to achieve in the water, and have had technical input about possible bands. A further report on lakes will be received at CSG21 see 'Lakes policy options and water quality outcomes' document #3603451.

So far in the plan change template CSG have a set of placeholder tables to insert freshwater objectives into (Waikato Regional Council, 2015). This is the concentration in the water of eight freshwater management units, for the different attributes. CSG need to agree on a concentration number for the different attributes for each FMU, which will be inserted into Plan Change 1 and form the freshwater objectives. In the scenario modelling, the TLG used a 'no decline' approach when within an attribute band and a 'just met' approach when the requirement was to move to a higher attribute band. CSG needs to consider if the 'bottom of the band' approach is appropriate.

Load reductions from the land

At CSG's request, TLG produced, from the scenario modelling, a spreadsheet of contaminant load reductions required from each of the 74 sub-catchments to achieve each of the steps towards scenario 1. The TLG also produced 'heat maps' for the 25% step scenario (indicating which sub-catchments with the greatest gap between current and desired loads at 25% stage). This showed considerable spatial variability, with some sub-catchments required to reduce more per hectare than others in order to achieve the in-stream water quality attribute concentrations. This is unsurprising, given the spatial variation in factors affecting contaminant loss (land use, land use intensity, soil types, climate, slope, attenuation processes) and the spatial variation across FMUs in the in-stream attribute limits trying to be achieved.

Again, as lakes were not included in the modelling, numeric reductions of loads needed to meet any lake attribute limits are not able to be included.

Currently there is no place holder in the plan change template to indicate load reductions per FMU or per sub-catchment. This information could be incorporated into a policy or a rule in a variety of ways, as a way of achieving the objectives described above, which are the concentrations of contaminants in the water.

References for Attachment 1

Attributes agreed at CSG13:
Workshop notes CSG13, 2-3 July 2015. Follow up on attributes (DM#3458965).
Day 2. Document #3439320.

DO agreed to be out of scope at CSG14:
Workshop notes CSG14, 10-11 August 2015. TLG recommendation on the use of dissolved oxygen (DM#3471897). Day 1, Section 3, Approvals and updates session. Document #3471459.

Lakes FMUs agreed at:
Workshop notes CSG14, 10-11 August 2015. TLG recommendation on lakes FMU (DM#
3465537). Day 1, Section 3, Approvals and updates session. Document #3471459.

Plan change template:
Waikato Regional Council 2015. TEMPLATE: Waikato Regional Plan Change No. 1 - Waikato and Waipa Catchments (Proposed). Document #3287412.

Attachment 2: National guidance on setting objectives, limits and targets

Excerpt from A Guide to the National Policy Statement for Freshwater Management 2014. Establishing freshwater objectives and setting freshwater limits

Ministry for the Environment 2015. A Guide to the National Policy Statement for Freshwater Management 2014. Ministry for the Environment Manatū Mō Te Taiao, Welllington New Zealand. Pages 34 - 36.

Establishing freshwater objectives

Establishing freshwater objectives and setting limits go hand in hand. Establishing freshwater objectives is likely to involve an iterative process of considering options both for freshwater objectives, and for the limits necessary to achieve them, before making final decisions. Ultimately though, it is necessary to decide on the freshwater objectives to justify the level at which limits are then set.

Freshwater objectives need to describe an intended environmental outcome that will enable the chosen values for the FMU to be met to the desired level. Thus, the locally held values associated with each FMU, identified through engagement with local iwi and hapū, water users, and the community, will be important in objective-setting. Part CA of the NPS-FM directs the process for formulating freshwater objectives. A freshwater objective should be set for each attribute associated with the chosen values for each FMU. Freshwater objectives can reflect the current water quality state or be aspirational (better than the current water quality).

Freshwater objectives can be set at different scales and levels of detail. In giving effect to the NPS-FM, a regional policy statement may include broad narrative objectives based on the desired values, but for regional plans, freshwater objectives must be set using the process contained in Policy CA2. Freshwater objectives in regional plans should be numeric where practicable, and use the attributes and attribute states supplied in Appendix 2 where available. Any other attributes considered appropriate to achieve a value should also be used to set freshwater objectives to achieve the value. Numeric attributes can be supported with a narrative. Where it is not possible to set a numeric freshwater objective, the regional plan should contain a tightly defined narrative freshwater objective. A narrative objective may outline an acceptable amount of change, an outcome or parameters sought.

The setting of freshwater objectives must be made in the context of environmental, social, cultural and economic considerations. Regional councils must consider the social, cultural and economic implications for resource users when setting freshwater objectives (Policy CA2(f)), as well as ensuring the environmental outcomes in Objectives A1 and A2 are met. Objective setting will be an iterative process. Final decisions about freshwater objectives should only be made after analysis of options, and should be fully informed by an understanding of their costs and achievability. Councils are expected to engage with tāngata whenua and communities about the way their water bodies are valued to set freshwater objectives and achieve those objectives through setting limits (both for water quality and water quantity) in their regional plans.

Setting freshwater quality limits

Limits are defined in the NPS-FM as the maximum amount of resource use that will allow a freshwater objective to be met. Limits relate to people's use of freshwater resources; therefore while a freshwater objective describes the desired state of the water in relation to a particular characteristic, a limit should go a step further by describing the maximum use of the resource to achieve the desired state.

For water quality, the resource being limited would generally be the assimilative capacity of the fresh water (its capacity to absorb contaminants). Setting a limit for water quality would involve determining the maximum use of that capacity (through discharging into the water) that will enable a chosen freshwater objective to be met.

In most cases, setting a water quality limit involves identifying the quantifiable total of a contaminant entering the FMU from all sources. The background component (the amount of contaminant that comes from natural processes or sources, or from historic activity rather than from current resource use) will also need to be established but is not part of the limit itself (not part of the total amount that could be allocated to users). However, not all contaminants can be measured in a way that allows them to be expressed as a quantifiable total load which can then be allocated. Other types of limits to resource use (eg, limits on stock access) may be appropriate for meeting some freshwater objectives.

A limit should, where practicable, specify an actual amount that can be measured or modelled with statistical confidence. The NPS-FM is not prescriptive about how a limit is expressed; (eg, whether as a source load, catchment load, loading rate, loss rate, or concentration). However, the intent of the policy is that a limit will be allocable (that is, an allocation to a particular user, activity or sector can be determined within the total for the FMU) where practicable.

A limit is not simply the maximum resource use an FMU can withstand; it is the maximum use of a resource that will allow the relevant freshwater objective to be achieved. Therefore, limits on resource use should ensure specific freshwater objectives can be met, rather than reflect more generic aspirations. If time shows that the freshwater objective can be met within more relaxed limits, the limit and objective combination will need to be reviewed during the next plan change, to decide whether to aim for a more aspirational objective or to increase the limit to allow more use of the resource.

To define the limit, regional councils will need to identify:
• the current state of water quality
• the quantity of water available and how it fluctuates seasonally and over time (as concentrations of contaminants will be influenced by the quantity of water present)
• the attribute(s) and objective(s) that the setting of a limit is intended to manage
• inputs and outputs (freshwater accounting). In the case of water quality, that includes identifying the sources of relevant contaminants (eg, sediment, nitrogen, phosphorus)
• the limit for each relevant contaminant, taking into account any possible interactions between contaminants and possible lag effects
• the timeframes over which the limit can be achieved, and targets that may be required to reach the limit (discussed further in the section on Policy A2)
• the scale at which the limit is to be applied (eg, to the input into a lake itself, the streams feeding into the lake, or by managing nutrient inputs to the land in the catchment). Some limits may not be allocable at anything smaller than a catchment scale.

In many cases limits for both water quantity (eg, environmental flows/levels) and water quality will be necessary to meet freshwater objectives. Other methods (eg, riparian management in the case of rivers) may also interact with limits and influence achievement of freshwater objectives, and would need to be considered at the same time as setting limits.
Limits can be set at a range of scales to fit regional circumstances, but the collective set of limits must be sufficient to address every freshwater objective for every FMU in the region. One limit may contribute to achieving more than one freshwater objective, while in other

cases a whole set of limits might be needed to address a single freshwater objective. Limits can be water body specific, or land-use specific.

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Limits set under Policy A1 must give effect to all the objectives of the NPS-FM. This means that when setting water quality limits, regional councils should also consider water quantity (Objectives B1-B7), integrated management (Objective C1), and tāngata whenua values and interests (Objective D1).

Accurate limit-setting can be technically difficult, time-consuming, and expensive. Regional councils could prioritise FMUs that would benefit most from early setting of limits (that is, those FMUs that are under the greatest pressure). For lower priority FMUs it may be appropriate for a council to set general region-wide discharge allocations (eg, per hectare) until specific limits for individual FMUs are set, as a precaution against over-allocation occurring in the interim.

Limit setting, particularly for water quality, is an iterative process that may take a succession of plan changes to get right. When freshwater objectives are first set, regional councils are required under Policy CA2(f)(v) to consider (among other things) the effects that the associated limits will have on resource users and communities. If further refinement of limits is required in later plan changes (either to better reflect what's needed to achieve the objective, or because the objective itself is changed), it will be important for regional councils to carry out thorough analysis of how the changes will affect resource users.

A limit must be given effect to through policies and rules that consider all activities contributing to the limit, and through establishing appropriate methods (both regulatory and non-regulatory) to manage compliance with the limit and to ensure it can be met.

Attachment 3: Land and water quality links and Freshwater accounting
Excerpts from Fourth Report of Land and Water Forum

The following text is taken from the Fourth Report of Land and Water Forum dated November 2015

Downloaded from www.landandwater.org.nz on 8 December 2015.

Page 25

Water quality
Understanding the links between land use and water quality outcomes
108. A key issue when considering the tools for managing diffuse discharges is understanding the links between land use and water quality outcomes. Communities and land users need to be able to identify how they can most efficiently manage within limits. This means understanding with some degree of granularity the relationship between land use practices and discharges to the waterbody, including contaminant changes that occur along the transport pathway. This relationship is variable and complex. For example, the same amount of nitrogen applied to different pieces of land within a catchment or even within a farm does not necessarily result in the same amount of nitrogen being discharged into the waterbody in a given period of time.

109. Both natural characteristics (i.e. the *assimilative capacity* of the land/water system) and mitigations can affect the relationship between land use and practices and discharges to the waterbody. There are existing tools and science (e.g. models) to help communities and land users factor this into their decision making, but their continued development will be important to enabling management approaches to be improved over time to more efficiently achieve water quality outcomes and grow the water economy.

Modelling and accounting
118. A key difference between the regulation of water quantity and the regulation of water quality is that water metering allows water quantity (i.e. takes) to be more easily measured. Direct measurement of water takes allows them to be more easily managed through resource consents. By contrast, as we move toward managing water quality, we will need to rely more on models.

119. Modelled numbers are used frequently in regulation, but they do provide some additional challenges. Firstly, modelled data is usually less accurate than direct measurement, and models need to be properly ground-truthed. Secondly, the accuracy of modelled data depends on whether land and water users' practices accord with the assumptions of the model. The only way of verifying this is by monitoring the behaviour of land and water users. This can add administration costs for the councils responsible for monitoring and compliance costs for land and water users. If monitoring is lax, there will also be opportunities for 'gaming' the system – i.e. land and water users may say they will undertake a suite of mitigation practices, but then avoid doing them.

120. Water quality accounting requires the use of a range of models that work together to take into account the effects across: a range of contaminants; a range of land use types; and the various components of assimilative capacity. This will have to occur at an activity-scale and then be reconciled with catchment-scale modelling or measurement. A diagram illustrating this type of accounting is provided below.

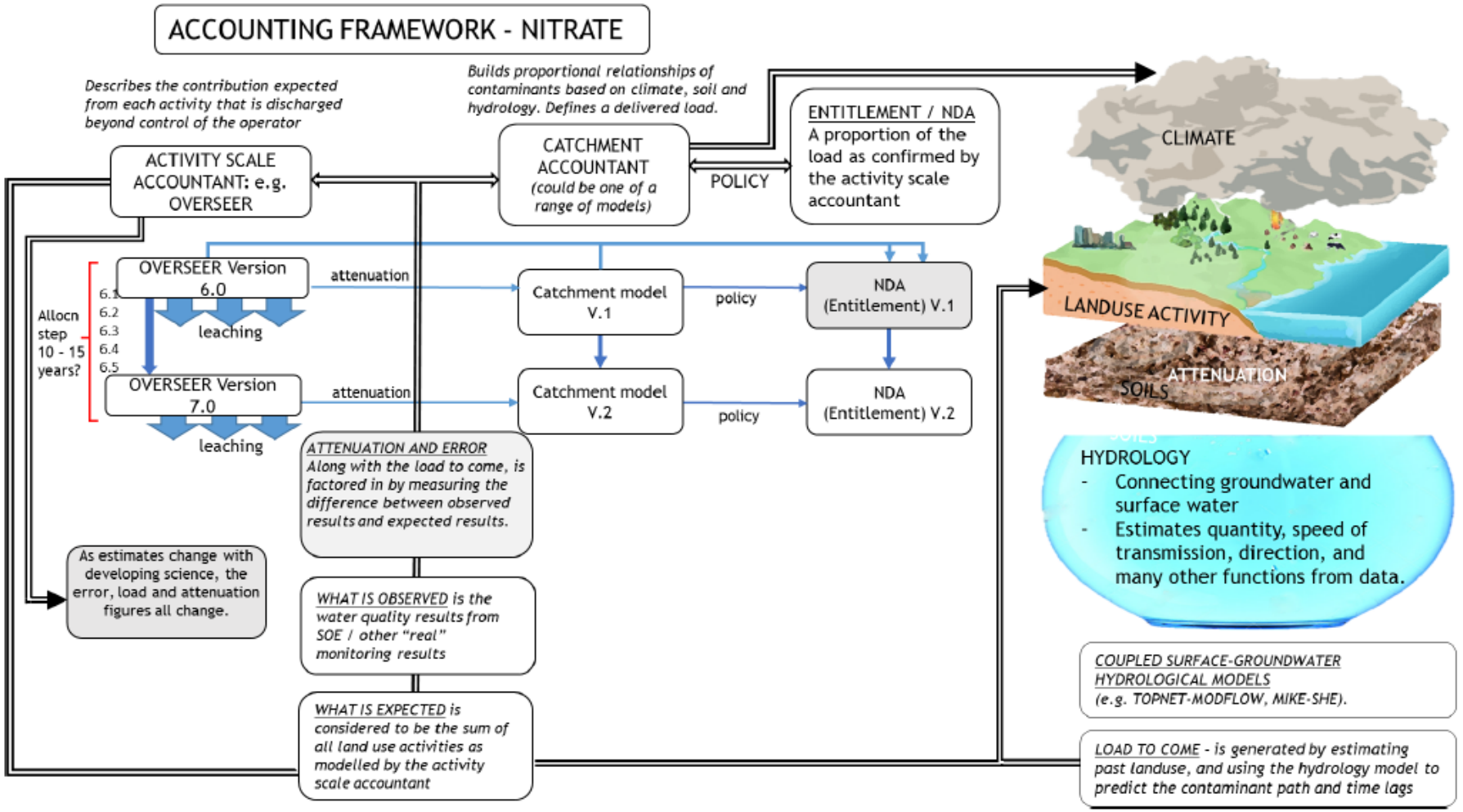
121. Modelling should be based on the best available information and will inevitably include a range of assumptions. It will be improved iteratively over time as the underlying science and information base improves. The development of a national information framework as proposed in recommendation 5 of this report is important in this regard.

122. To help communities identify a robust package of tools and interventions for achieving their desired objectives, councils (with input from the primary sector and others) will need to model catchment discharges based on current and potentially achievable management practices. This information will help communities understand the impact of proposed objectives and limits, including helping identify appropriate timeframes (and targets) for meeting limits in catchments where desired objectives and limits are not currently being met. Monitoring is needed to check whether expected results are being achieved within desired timeframes and catchments will need to be managed adaptively.

Recommendation 13: For the purpose of managing within limits, councils should model and quantify the impact of the range of currently and potentially achievable management practices (including GMP) and mitigations for the contaminants of concern (e.g. nutrient losses) in each catchment.

Councils should adjust requirements on land and water users, including considering additional mitigations, if monitoring and modelling of the impact of the interventions used shows that the objectives, limits and targets set under the NPS-FM will not be met.

Figure 1:Accounting Framework – Nitrates



(Diagram provided by Chris Keenan, Horticulture NZ)