FURTHER SUBMISSION FORM

IN SUPPORT OF, OR IN OPPOSITION TO, SUBMISSION/S ON NOTIFIED:

PROPOSED WAIKATO REGIONAL PLAN CHANGE 1: WAIKATO AND WAIPĀ RIVER CATCHMENTS AND VARIATION 1 TO PROPOSED WAIKATO REGIONAL PLAN CHANGE 1: WAIKATO AND WAIPĀ RIVER CATCHMENTS

Waikato Regional Council
Te Kaunihera ā Rohe o Waikato

Save this PDF to your computer before answering. If you edit the original form from this webpage, your changes will not save. Please check or update your software to allow for editing. We recommend Acrobat Reader.

Council needs to receive your further submission by 5pm, Monday, 17 September 2018. Please read the notes on making a Further Submission at the end of this form before completing your submission.

IMPORTANT NOTE

A copy of your further submission must be served on the original submitter/s within 5 working days of being lodged with council. An address list of all submitters is included with the summary of decisions requested documents and is available at waikatoregion.govt.nz/healthyrivers

YOUR NAME, ADDRESS FOR SERVICE AND CONTACT DETAILS (MANDATORY INFORMATION)

Name of submitter (individual/organisation)	Horticulture New Zealand	
Contact person (if applicable)	Lucy Deverall	
Agent (if applicable)		
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	The Terrace	
	Wellington	Post code: 6143
Phone number/s	Home: 04 472 3795	Business:
	Mobile:	Fax:

IN ACCORDANCE WITH SCHEDULE 1 OF THE RESOURCE MANAGEMENT ACT:

I am:

- (●) A person representing a relevant aspect of the public interest.
  In this case, also specify the grounds for saying that you come within this category; or
- ( ) A person who has an interest in the proposal that is greater than the interest the general public has.
  In this case, also explain the grounds for saying that you come within this category; or
- ( ) The local authority for the relevant area.

My reasons are (i.e. grounds for selection above):

Industry body representing horticulture nation-wide

PLEASE INDICATE WHETHER YOU WISH TO SPEAK AT A HEARING

- ◯ Yes, I wish to speak at the hearing in support of my further submission.
- ◉ No, I do not wish to speak at the hearing in support of my further submission.

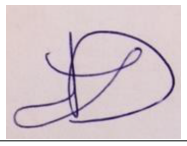
JOINT SUBMISSION

- ☑ If others make a similar submission, please tick this box if you would consider presenting a joint case with them at the hearing.

IF YOU HAVE USED EXTRA SHEETS FOR THIS SUBMISSION PLEASE ATTACH THEM TO THIS FORM AND INDICATE BELOW

◯ Yes, I have attached _____ extra sheets. ◉ No , I have not attached extra sheets.

SIGNATURE - *NOTE A SIGNATURE IS NOT REQUIRED IF YOU MAKE YOUR SUBMISSION BY ELECTRONIC MEANS*

Signed  Date 17/9/2018

Type name if submitting electronically

FURTHER SUBMISSIONS CAN BE SENT BY

Chief Executive, 401 Grey Street, Private Bag 3038, Waikato Mail Centre, Hamilton 3240

Waikato Regional Council, 401 Grey Street, Hamilton East, Hamilton

(07) 859 0998

healthyrivers@waikatoregion.govt.nz *Please note: Submissions received by email must contain full contact details.*

PLEASE CHECK that you have provided all of the information requested and if you are having trouble filling out this form, phone Waikato Regional Council on 0800 800 401 for help.

Personal information is used for the administration of the submissions process and will be made public. All information collected will be held by Waikato Regional Council, with submitters having the right to access and correct personal information.

Form 6 of Schedule 1, Resource Management Act 1991.

FURTHER SUBMISSIONS ON PROPOSED PLAN CHANGE 1 AND VARIATION 1 TO PROPOSED PLAN CHANGE 1

NAME OF ORIGINAL SUBMITTER: _____ **ORIGINAL SUBMITTER ID:** _____

ADDRESS OF ORIGINAL SUBMITTER: _____

Clearly indicate which parts of the original submission you support or oppose, together with any relevant provisions of the proposal. Also indicate the Submission Point ID.

PROVISION *(e.g. Objective 4 or Rule 3.11.5.1):* _____	**SUBMISSION POINT ID** *(e.g. PC1-1234 or V1PC1-1234)* _____
Do you support or oppose the submission? ◯ Support ◯ Oppose	
THE REASONS FOR MY SUPPORT OR OPPOSITION ARE: *Tell us why you support or oppose this submission. These reasons will help us to understand your further submission*	**I SEEK THAT THE WHOLE (OR PART [DESCRIBE PART]) OF THE SUBMISSION BE ALLOWED (OR DISALLOWED):** *Give precise details*
Please see attached documents for further submission table	

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Add another page

NOTES ON MAKING A FURTHER SUBMISSION

1. Serving a copy of your further submission

A copy of your further submission must be served on the original submitter within 5 working days after it is served on (i.e. received by) Waikato Regional Council.

2. Further submission content review

Please note that your further submission (or part of your submission) may be struck out if the authority is satisfied that at least 1 of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious
- it discloses no reasonable or relevant case
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further
- it contains offensive language
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

3. Privacy information

The Waikato Regional Council will make all submissions and further submissions including name and contact details publicly available on Council's website. Under the RMA, any further submission supporting or opposing an original submission is required to be served on the original submitter after it is served on council therefore your contact details must be made available.

Personal information will also be used for administration relating to the subject matter of the submissions, including notifying submitters of hearings and decisions. All information will be held by the Waikato Regional Council with submitters having the right to access and correct personal information.

Contact us for more information
Phone: 0800 800 401
Email: healthyrivers@waikatoregion.govt.nz

FURTHER SUBMISSION ON WAIKATO REGIONAL COUNCIL PLAN CHANGE 1: HEALTHY RIVERS

SCHEDULE ONE: Supporting technical report

Horticulture New Zealand (HortNZ) has commissioned Jacobs to provide further analysis on the key submission points outlined by HortNZ in the submission to Variation 1 of Healthy Rivers Plan Change 1 (PC1) and in the attached further submission. Particular submission points include that:

- a multiple contaminant approach to assessing effects is more likely to achieve water quality objectives than using a Nitrogen Reference Point as a proxy for intensification for commercial vegetable growing.
- new commercial vegetable production should be provided for as a restricted discretionary activity (or discretionary activity)
- a blanket natural capital approach to allocation is not appropriate for horticultural activities.

A copy of this report is in Attachment A of this further submission. The report uses a number of case studies to apply and assess main principles of PC1. Key findings of the Jacobs report include that:

- assessing a new land use based on NRP is unlikely to achieve the water quality objectives and core values outlined in PC1 and it is more effective to take a multi-contaminant approach as the effect of contaminants on the values protected by PC1 will vary depending on the sub-catchment and location of the enterprise.

- commercial vegetable production may be a mitigation that reduces a microbiological load and its associated effect on the values.

- freshwater quality values and associated targets identified in PC1 can still be achieved while allowing for sufficient and suitable land to be allocated for commercial vegetable production.

- new commercial vegetable cropping can be provided through as a restricted discretionary activity with specific criteria

- a natural capital approach to N allocation is not appropriate for horticulture and is unlikely to result in a decrease in N across the Waikato region.

In the event that a natural capital approach is applied through PC1, the Jacobs report also outlines a possible Hybrid Natural Capital approach which would be more appropriate for horticulture.

SCHEDULE TWO: FURTHER SUBMISSIONS

Submitter	Submission point ID	Support / Oppose	Reason
Aitken, David John Submitter ID: 71238	PC1-625	Support	For PC 1 to work engagement will be required at the sub- catchment level, with all landowners and users. Methods will require some amendment that directs Council to provide for engagement at the catchment and sub- catchment level.
Aldirdge, Roderick Francis David Submitter ID: 73788	PC1-7043	Support in part	Achievement of the targets is not as important as achievement of the values sought to be protected by PC 1, so this part of the submission as opposed however the rest of the submission point is aligned with the HortNZ submission.
Alexander Farming Genetics Submitter ID: 74115	PC1-10095	Support in part	Deletion of the plan change is not supported. However, the consideration of a sub-catchment approach is necessary. HortNZ also supports recognition of the versatility of land in making decisions regarding farming activities. Versatility needs to consider such matters as the activities the land can sustain, productivity of soil for specific land use activities, the attenuation rates and position of the farm within the catchment, the specific climatic factors associated with the land and the uniqueness of land features in combination with the matters described above. We also support inclusion of a method to undertake work into the effects on water quality of urban sprawl and population growth.
Aston, Penelope Submitter ID: 73811	PC1-5432	Support	This submission point aligns with the HortNZ submission points around a whole of catchment approach, as well as our submission points to enable sub- catchment processes.
Ata Rangi 2015 Limited Partnership Submitter ID: 74045	PC1-11373	Support in part	HortNZ supports clarification about the type of resource consent which must be applied for, preferring at the outset for rules to be focused on discharges as opposed to land use controls.
Auckland Council Submitter ID: 73518	PC1-9139	Oppose in part	HortNZ supports recognition of cross boundary issues within PC 1. However, it does not think that the scope provided by Auckland Council's submission is sufficient to recognise all of the appropriate cross boundary effects. Exclusion of certain subcatchments from requiring a nitrogen reference point is tacit opposition to a nitrogen reference point in general, and given HortNZ's opposition to a land use based nitrogen allocation regime elements of this

Submitter	Submission point ID	Support / Oppose	Reason
			are supported. However, looking at nitrogen in absence of considering the effect of other contaminants and stressors from activities such as transport, stormwater management, sewage discharge overflows, urbanisation, drainage and flood protection would have unintended consequences. The northern Waikato catchments have great pressure associated with urbanisation. Efforts by the farming sector to achieve catchment limits and targets could be completely undermined by the effects of increasing urbanisation. An appropriate form of relief to start addressing this issue could be the addition of a method requiring the formation of a committee in Council with membership including the commercial vegetable sector as well as other relevant participants to investigate cross boundary issues in relation to freshwater management, from both the quality and quantity perspectives. Inclusion of intermittent streams was opposed in the Auckland Plan process where appeals on merit were limited by the Auckland Act. It is also opposed by HortNZ in relation to PC 1. No appropriate cost benefit analysis was carried out in the inclusion of overland flow paths and streams that may be considered to be intermittent is causing significant difficulty. It is suggested that if this relief is to be accepted, it should be supported by an analysis of the costs and benefits of this approach, as it would apply to the entire Waikato catchment.
Auckland/Waikato Fish and Game Submitter ID: 74085	PC1-11007	Oppose in part	HortNZ opposes the addition of new schedule D and E within PC 1 as proposed by the submitter. Erosion and cultivation setbacks are important tools to manage discharges from land to water but are not the only tools that should be utilised; nor in many cases are they the most effective tools to use. HortNZ supports a far more targeted approach to erosion and sediment control from disturbed land under the influence of cultivation and harvest. The addition of a 30% reduction short-term target is not supported as a practical measure. Consideration needs to be made for an appropriate transition timeframe to achieve water quality objectives targets and limits. The appropriate transition timeframe needs to have a consideration of the needs of communities seeking to provide for their social, cultural and economic well-being.
Awaroa Lands Ltd Submitter ID: 73627	PC1-6629	Oppose in part	HortNZ opposes the amendment of PC 1 to treat all properties on an individual basis through farm environment plans. Horticultural properties need to be treated as enterprises operating across many properties either owned, shared or leased. The imposition of a farm planning

Submitter	Submission point ID	Support / Oppose	Reason
			regime targeted at the property level is not practical. HortNZ does not oppose the amendment of PC 1 to allow farmers and growers to decide what scale they target the farm planning regime at; and would not oppose a voluntary option that allows for a farm planning regime to be targeted at the property level.
Ballantine, Alan Maurice Submitter ID: 74094	PC1-8124	Support in part	HortNZ agrees that PC 1 needs to focus energy where it is most needed; and considers the identification and management of hotspots to be an appropriate response. This aligns with the HortNZ sub- catchment based approach. However, HortNZ does not consider that where water quality standards are being met that changes will not be required by any farmers; because there are cumulative impacts of all farming operations on water quality outcomes in the lower River. HortNZ certainly supports amendment of PC 1 to allow consideration of non-farmland point and nonpoint source discharges so that non-farmers who contribute to water pollution are held accountable also.
Balle Bros Group Submitter ID: 67834	PC1-11398	Support	The submission point aligns with the HortNZ submission, with the useful improvement of pest species management being a part of the solution to achieving outcomes sought by PC 1.
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11511	Support in part Oppose in part	HortNZ supports elements of the submission point by Beef and Lamb New Zealand. In particular: • a strengthened sub- catchment approach • deletion of part of the policies, methods and rules applying to the management of nitrogen discharges in favour of an approach that is more inclusive of all contaminants and stressors. • Incorporation of a transitional allocation regime that provides for the investment in existing activities; and transition to a more clearly defined regime in the next planning cycle. Any allocation regime for nitrogen should be defined as an allocation of discharge permits not property or land based allocation of nitrogen; and the defined land use limits should only currently be allocated at the sub- catchment level, based on the table proposed in the HortNZ submission. • Supports adding the lower catchment back into PC 1. • Opposes a nitrogen based allocation approach that is not taking into account other contaminants and stressors that affect the values for freshwater in the Waikato River system.

Submitter	Submission point ID	Support / Oppose	Reason
			• Support the provision of objectives policies and methods that recognise and provide for activities that have a low discharge risk for one or more contaminants. • Supports the submission points in relation to the nitrogen reference point. • Supports any land use consent being provided for a term of 35 years.
Bilby, Lorraine Submitter ID: 74090	PC1-7596	Support	HortNZ recognises that the entire Waikato community has benefited from agricultural production and that the costs should be borne by the whole community. There may be benefit in enforcing this in a method that requires the Council to consider this when undertaking development of charging regimes in relation to water quality and quantity. HortNZ has also asked for water quality outcomes to be the measure rather than targets, given the uncertainty of the science that has been provided to date. It also supports a significant investment in science, particularly in catchment and sub- catchment accounting frameworks that manage all contaminants and provide the opportunities for assessment of the effects of an activity at the property level.
Bodley, Jefferis William Submitter ID: 73429	PC1-2194	Support	HortNZ supports the bringing of pest species into the management regime for water quality, and supports the effects of other activities such as hydro dams being regulated alongside farming activities.
Briggs, Robin John Submitter ID: 73920	PC1-4956	Oppose	An allocation regime of 30 KGs of nitrogen per hectare per year does not provide for existing commercial vegetable cropping and is not science based in terms of achieving the targets and objectives within PC 1.
Bull, Gerald Submitter ID: 74125	PC1-4865	Support in part	HortNZ supports the amendment of PC 1 to ensure that it does not restrict land use to what it has been historically, but recognises that in transition that existing investment must be recognised and provided for to a degree.
Chandler, Peter and Libby Submitter ID: 74203	PC1-8949	Oppose	Notification of affected parties should not be provided for in the case of controlled or restricted discretionary activity applications.
Department of Conservation	PC1-8090	Support in part	HortNZ recognises that natural character values are important under the National Policy Statement for Freshwater Management 2017. It does not automatically follow that section 6

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 71759		Oppose in part	a) matters are conflated with the natural character values. HortNZ supports the recognition of natural character but wishes to be involved in the development of objectives, policies and methods in PC 1 to ensure that other values are recognised appropriately alongside natural character values. HortNZ also supports reinstating the notified version of the provisions for the Whangamarino Wetland and is aware of the importance of the Whangamarino Wetland as a natural habitat. However, HortNZ does not support the inclusion of reinstated objectives in the absence of the reinstatement of other objectives, policies, rules and methods for the area withdrawn from PC 1 is a result of the judicial review by Hauraki Iwi. So HortNZ has an interest in the submission points and wishes to be involved in the process to resolve the relief sought. HortNZ supports a review of all the consents that relate to the Lower Waikato flood control scheme, to identify optimal approaches to addressing water quality issues in the lower part of the Waikato River that are a result of the scheme. However, HortNZ does support recognition of the existing investment that relies on the operation of the flood protection network. HortNZ opposes amendments to PC 1 to implement greater changes to the management of contaminant discharges in the short term, without the provision of a rigorous cost benefit analysis that can demonstrate the impact on communities. HortNZ is not of the view that an allocation regime is likely to fix water quality issues; it is more the actions of people managing land and activities that will achieve positive results. It is agreed that there has to be an allocation of responsibility for contaminant discharges in order to achieve freshwater objectives for the Waikato River. HortNZ opposes amendment of PC 1 to provide for an allocation regime that only permits the discharge of contaminants up to a level that ensures the limits and objectives for the freshwater management unit can be achieved. This amendment is opposed for the following reasons: • no limits have currently been set. And a dynamic catchment accounting framework does not exist that could accurately measure the contribution of activities at a

Submitter	Submission point ID	Support / Oppose	Reason
			property scale. HortNZ has suggested a discharge load limit table as a precursor to a future plan change that may consider property level load limits. • Because no accounting framework exists, it is not practical to set up a transfer regime that provides for land use flexibility within limits in the manner that the submission envisages. The adoption of an approach that is not based on sound science and natural resource accounting will have significant adverse economic effects. • HortNZ proposes as an alternative that load limits or targets are set at the sub-catchment level in the 1st instance and has proposed a table of subcatchments load limits and targets. • Approaches to managing down over allocation will require a range of options for landowners and land users, that cannot adequately be achieved by instating an ad hoc allocation regime without careful thought as to how the system will work. This is why HortNZ has proposed an alternative approach allowing for cooperation between enterprises that the sub- catchment level that encourage catchment scale works that improve water quality outcomes alongside edge of field measures. • It is not accepted that any individual activity will cause the maximum catchment load to be exceeded, rather it is the combination of all activities cumulatively that is the issue. HortNZ opposes an activity based regime that excludes certain uses based on exceedances of the catchment load, unless all facets of discharge are taken into account; recognising all stressors on; and contributors to declining, water quality. HortNZ recognises that the macroinvertebrate community index is an important measure of ecosystem health but suggests it will only be applicable in relation to the appropriate habitats the measure is designed for; in particular for wade-able streams; and only if the appropriate protocol is used for soft bottom and hard bottom streams. For similar reasons HortNZ considers that any attributes, limits and methods for sediment, temperature and dissolved oxygen require more work than has been done at this stage and would be more practically set in most cases at the sub- catchment level.
Corlett, Peter Valentine Submitter ID: 73467	PC1-8200	Support	The submission point aligns with the HortNZ submission

Submitter	Submission point ID	Support / Oppose	Reason
Fertiliser Association of New Zealand Submitter ID: 73305	PC1-11168	Support	The submission appropriately recognises that the link between discharges below the root zone of crops, over and through land is not the quanta that enters water. For farming activities, the difference can be extreme and to ensure that PC 1 is effects-based, recognition should be provided for proved attenuation of discharges leaving the root zone.
Fletcher Trust Submitter ID: 73848	PC1-9132	Support in part	HortNZ recognises the OVERSEER model as a legitimate tool to model pastoral N discharges and a useful stopgap for crudely estimating some arable and vegetable operations, but supports the use of alternative scientific methods that have been approved by an appropriate body or person. Commercial vegetable cropping in particular would benefit from a range of other possible methods; in particular the APSIM model currently being assessed by Plant and Food shows greater promise given the flexibility of the model to provide: • accounting for mitigations not currently within the OVERSEER model • information on leaching informed by a more sensible daily, weekly or monthly time step; the time step being critical particularly with shorter rotation crops. At the very least HortNZ wishes to see the flexibility to use other models to estimate nitrogen discharges or other discharges retained within the plan.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10451	Support in part Oppose in part	HortNZ supports the clarification of objectives, limits and targets in the plan however, seeks clarification for why the 80 year objectives are referred to as water states as opposed to objectives.
Fulton Hogan Limited Submitter ID: 74048	PC1-10737	Support	HortNZ supports the submission in order to decrease any confusion that may occur as a result of regulatory crossover in the meaning of terms and definitions. This is particularly important in relation to terms used within the NPS Freshwater 2017.
Goddard, Allan and Mary-Anne Submitter ID: 73061	PC1-2344	Support	HortNZ supports a clear definition of how enterprises and properties that are across regional boundaries will be managed within the PC 1 regime.
Gordon, Bruce Arrol Submitter ID: 73388	PC1-4332	Support	A sub- catchment approach has been proposed in the HortNZ submission. Amendments may be required to the definition of nitrogen reference point.

Submitter	Submission point ID	Support / Oppose	Reason
Hamilton, Malibu Submitter ID: 74083	PC1-9854	Oppose	The healthy rivers plan for change as a response to the Treaty legislation for the Waikato River. The Treaty legislation has a higher statutory weight than the NPS 2017. That is why targets and freshwater objectives in PC 1 are more stringent than they would be under the NPS 2017. Given that the targets are more stringent it is appropriate that investment certainty is provided to businesses operating within the catchment of the Waikato River. If discretion is provided to Waikato Regional Council to change timeframes for adjustments required in land use and discharge of contaminants, businesses will not have the certainty to invest in long-term solutions to water quality issues. Water quality adjustments take longer than 5 years to register and waterbodies impacted by land use so a 5 year interval is not appropriate. PC 1 is a transitional plan recognising that resolution of water quality issues for the Waikato River is an intergenerational task. HortNZ is not opposed to Waikato Regional Council reporting every 2 years on progress, but would prefer that valuable monitoring and reporting money be spent on producing an accounting framework that works to understand the influence of individual activities on outcomes for natural resources within the catchment. While outstanding natural character is important, PC 1 is not the most appropriate tool to recognise outstanding natural character. Outstanding natural character is already preserved in other parts of the plan. The best management practice of any particular time is the good management practice of a future time. Requiring Best Environmental Practices has economic consequences that penalise smaller farmers and growers and discourages young farmers with high debt levels from investing in rural production activities. It is preferable to set bottom lines and focus on the overall impact of an enterprise compared to other enterprises. The recent decision on the freshwater plan for the Gisborne district has showed that maintenance of freshwater objectives occurs within bands. Water quality should be maintained to ensure that values are met, not absolute numbers identified within attribute

Submitter	Submission point ID	Support / Oppose	Reason
			data monitoring. It is the full combination of attributes that protects the value, not adherents to any particular number for 1 of the attributes of the value. Adding intermittent streams to the ambit of PC 1 requires further cost benefit analysis under section 32 and if intermittent streams are to be added the submitter should provide the evidence to support the cost benefit analysis. Adding a new category of water body is a significant water body and requiring protection is not required as the Vision for the Waikato River requires protection of all connected water. If 1.6 m visual clarity is the minimum water clarity limit required at all times there will be significant economic consequences and the submitter should be asked to assess the effect of the proposal for a minimum water clarity limit of 1.6 m on the costs and benefits under section 32 RMA.
Hauraki District Council Submitter ID: 73536	PC1-8204	Support	The Hauraki District Council submission aligns with many of the key points in the HortNZ submission.
King Country Energy Limited Submitter ID: 60693	PC1-8251	Support	HortNZ considers that not only the proportionality of an individual should be considered, but also the contribution across all of the 4 contaminants that are targeted in PC 1. There also has to be time provided to ensure that technology and practice can evolve to meet the challenges of achieving water quality objectives.
Lord, David Graeme Submitter ID: 71258	PC1-1507	Support	It is appropriate to add a method that ensures the cost of implementing PC 1 to the Waikato Regional Council is measured and monitored.
McCaughan, Lance Submitter ID: 73457	PC1-6486	Oppose in part	To require crop dusting only by land-based means is not an effects-based solution to water quality issues.
Mercury NZ Limited Submitter ID: 73182	PC1-9474	Oppose in part	PC 1 should ensure that all sectors and contributors to water quality issues absorb the costs of those effects internally.
Osborne, John and Margaret	PC1-7041	Support	HortNZ considers that the approach to managing bacterial contaminants is not as strong as it could be within the plan; particularly given the significant effect of bacterial contaminants on

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 74190			core River values such as human health for primary contact recreation, fishing and mahinga kai. HortNZ considers that the risk posed by avian microbiological contamination is low compared to the risk posed by human and ungulate sourced bacterial contaminants, and supports a more targeted focus on the sources of bacterial contamination with high public safety risks. HortNZ notes that bacteriological contamination of surface water can also render surface water unfit for the irrigation of leafy green vegetables and other paddock to plate food options, because of the increased risk of food safety issues.
Otorohanga District Council Submitter ID: 74055	PC1-8167	Support in part	While HortNZ recognises it may be impractical to put on hold the implementation of PC 1; it does agree that any system of reference points that leads to a land-based allocation of discharges should be delayed until far more accurate models and accounting frameworks have been developed. HortNZ also supports a far stronger commitment to training. ODC also makes the valid point that there is not enough consideration of domestic food production issues; that are somewhat different in nature to export production issues because of the extra effect on local communities impacted by higher food prices for leafy green and other staple vegetables.
Petre, John Lowrey Submitter ID: 73707	PC1-4565	Oppose	HortNZ does not support the amendment of PC 1 so that provisions apply to all land, irrespective of ownership. HortNZ considers that uncontrolled discharges are the important matters to manage.
Pinnell, Graham Submitter ID: 74007	PC1-4322	Support in part	HortNZ supports the concept of a net benefit or a net effect measured across all 4 contaminants being provided for within PC 1.
Plainview Farms (2007) Limited Submitter ID: 74079	PC1-8203	Oppose in part	HortNZ does not support blanket caps on nitrogen and phosphorus, and does not support a focus that only targets 2 of the contaminants that are creating adverse effects on water quality. The approach unfairly benefits some sectors over others. If a blanket cap on nitrogen and phosphorus was to be considered, the cap must be practical for commercial vegetable cropping systems.

Submitter	Submission point ID	Support / Oppose	Reason
Purdie, Stephen Submitter ID: 72217	PC1-10953	Support in part Oppose in part	HortNZ supports giving effect to the Waikato Regional Policy Statement, in particular the provisions that relate to “provisioning” ecosystem services such as food supply; and providing for the needs of regionally significant industry. While HortNZ recognises that landowners have rights and interests; others have rights and interests as well. For example, when landowners contract to lease land for vegetable cropping; they should not expect to retain a nutrient discharge allocation that relates to the enterprise operating the land.
Reeves and Taylor, James Gordon Livingston and Amy Louise Submitter ID: 71614	PC1-8688	Support in part	HortNZ supports the amendment of PC 1 to clearly define load limits and targets for each of the 4 contaminants at the sub- catchment level. These should be expressed not only as the 80 year load limits and targets but also the 10 year load limits and targets. HortNZ also supports further analysis of the costs of mitigations to ensure the mitigations that achieve the most benefit at the least cost are identified; while ensuring that the “polluter pays” and “beneficiary pays” concepts are implemented. HortNZ also agrees that more certainty should be provided within the transitional plan change about the future allocation system beyond 2026.
South Waikato District Council Submitter ID: 72892	PC1-3759	Support	The submission aligns with relief sought in the HortNZ submission in relation to effects-based rules and alternative approaches being provided for at the sub- catchment level.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8188	Support in part Oppose in part	HortNZ does support further clarification in relation to the 75th percentile of dairy farmers; and would support the inclusion of a method in the plan related to how the 75th percentile is selected; and whether that be done on a water management unit basis or across the whole catchment. HortNZ opposes reductions and timeframes for achieving ecosystem health and amendment of the water quality objectives as proposed by Forest and Bird. It also opposes deletion of all references to certified industry schemes; and deletion of non-notification clauses.
Tuaropaki Trust	PC1-3007	Support	All elements of this submission point are supported by HortNZ.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 73769			
Tylee, Brian William Submitter ID: 73530	PC1-7437	Oppose in part	HortNZ does not support blanket input controls as they are not effects based.
Waikato Regional Council Submitter ID: 72890	PC1-2970	Support in part	HortNZ supports clarification of the wording regarding the management of discharges and wishes to be involved in the clarification process. HortNZ would seek the outcome specified in its submission of managing discharges not land use activities unless a land use activity control is specifically required.
Waikato River Authority Submitter ID: 74033	PC1-11566	Support in part	HortNZ supports a clear definition of wetlands, and wishes to ensure that the definition of wetlands is consistent with definitions provided in other regional planning documents for other regions. HortNZ supports the submission point regarding the point source policy rules and methods, but seeks that amendment not be simply restricted to a review of the policy, rules and methods.
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11406	Support in part	HortNZ supports many aspects of the submission; particularly in relation to the use of decision support tools and sub- catchment management plans; but is very aware of the cumulative effects of nitrogen and other discharges throughout the catchment as a whole, and considers that the cumulative effects need to be considered alongside localised effects. HortNZ is supportive of the inclusion of a sub catchment management approach and the extent of our support as outlined in our submission on Variation 1 to PC 1.
Oil Companies Submitter ID: 73716	PC1-2586	Oppose	The submitter seeks application of the discharge provisions to rural and farming activities only. This is contrary to the many submissions seeking that there is equity in the way that discharge provisions apply; is not effects based; and will not achieve the Vision and Strategy for the Waikato River.
Wairarapa Moana Incorporation Submitter ID: 72480	PC1-2073	Support	The submission aligns with HortNZ submissions seeking to defer establishment of an allocation regime.
A S Wilcox & Sons Ltd Submitter ID: 73142	PC1-4300	Support	The submission aligns with the submissions of HortNZ

Submitter	Submission point ID	Support / Oppose	Reason
Chapman, Brenhan J Submitter ID: 72776	PC1-10203	Support	The submission aligns with the submissions of HortNZ
Chapman, John K Submitter ID: 73086	PC1-10673	Support	The submission aligns with the submissions of HortNZ
Chhagn Bros Co Ltd Submitter ID: 73762	PC1-5494	Support	The submission aligns with the submissions of HortNZ
Garland, Suzanne Merle and William Graham Submitter ID: 74066	PC1-11263	Support in part	HortNZ supports the submission as it refers to nitrogen reference points being used to allocate nitrogen.
Rotorua Lakes Council Submitter ID: 73373	PC1-2465	Oppose in part	The submission seeks that new requirements to manage municipal and industrial point source discharges are treated specially under the plan change in respect to consideration of investment and infrastructure. HortNZ is of the view that this is a wider consideration than just applying to the infrastructure managed by territorial authorities.
Paterson, Chris and Amy Submitter ID: 73368	PC1-2300	Oppose	The submission point is focused on use of nitrogen as a proxy for intensification; and does not give due regard for a balanced approach across all of the contaminants of concern and their combined effects on freshwater values and objectives.
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11259	Support in part	HortNZ supports the provision being amended to recognise that prevention of land use change should not occur in all circumstances; and supports the identification of a nitrogen reference point at the enterprise scale or the sub- catchment scale.
A S Wilcox & Sons Ltd Submitter ID: 73142 Pukekohe Vegetable Growers Association Inc (PVGA) Submitter ID: 74220	PC1-4302 PC1-7768	Support	The submissions align with the submissions of HortNZ

Submitter	Submission point ID	Support / Oppose	Reason
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11149	Support	HortNZ considers an Objective relating to the values more closely is consistent with what is sought to be achieved by PC1.
Hamilton City Council Submitter ID: 74051	PC1-10170	Oppose	HortNZ consider the text proposed does not relate to the stated value
Watercare Services Ltd Submitter ID: 74077	PC1-8341	Oppose	HortNZ opposes special treatment of domestic and municipal values and considers that the Vision and Strategy overrides the NPS Freshwater where the NPS freshwater is consistent with the Vision and Strategy.
Department of Conservation Submitter ID: 71759	PC1-8152 PC1-8532	Oppose in part	The description of the value extends far beyond the purpose of freshwater management.
Lawson, John Submitter ID: 52942 van der Voorden, Vera and Nora Submitter ID: 74109	PC1-11227 PC1-11286	Oppose in part	The submitter proposes amendments to cultivation activities that are not sound practice and in some cases are not feasible. These include the provisions on the direction of cultivation proposed, as well as setbacks.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	PC1-6314	Oppose in part	There are some situations where it is desirable to prioritise competing uses; particularly where a use or value may be non-substitutable or scarce.
Hamilton City Council Submitter ID: 74051	PC1-10136	Oppose in part	HortNZ opposes the bundling of all municipal water supply
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10790	Oppose in part	The proposed new objective goes beyond what is practical or feasible.
Bailey, James Submitter ID: 73926	PC1-4790	Support in part	The submission aligns with relief sought by HortNZ
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11150	Support in part	Parts of the submission are aligned with relief sought by HortNZ. However submissions providing for an allocation regime based on natural capital are not supported if they materially increase contributions of the 4 contaminants. Land Use Capability is not supported

<table>
<tr><th>Submitter</th><th>Submission point ID</th><th>Support / Oppose</th><th>Reason</th></tr>
<tr><td></td><td></td><td>Oppose in part</td><td>as a suitable natural capital tool because it is focused on the productivity of pasture, not other crops and systems. If natural capital is to be used then natural capital should be defined; and the definition should relate to the risk of land discharging contaminants as opposed to the inherent productivity of the land for any given or particular system of farming.</td></tr>
<tr><td>Downie, Janna
Submitter ID: 71903
Hamilton, Malibu
Submitter ID: 74083
Lawson, John
Submitter ID: 52942</td><td>PC1-10137
PC1-9855
PC1-11223</td><td>Oppose</td><td>A greater range of measured attributes is not supported because it will increase the cost of monitoring the plan greatly. If more resources are allocated to measurement it will reduce the ability of the community to manage activities that will reduce the adverse effects on water quality. The current defined attributes provide suitable proxies in most cases to measure the state of water quality.

The LUC approach is not supported. However, if a LUC approach is to be adopted there should be a sufficient allocation of discharge to allow for existing and some new commercial vegetable production in order to preserve domestic food security.

Commercial vegetable production is most sustainable on LUC I – III. This submission proposes that the following load limits be set for existing and new commercial vegetable production on these classes of land; with remaining land defaulting to table numbers proposed by other submitters.

<table><tr><th>LUC</th><th>Existing production</th><th>New production</th></tr><tr><td>I</td><td>63 kg/N/ha/yr*</td><td>63 kg/N/ha/yr*</td></tr><tr><td>II</td><td>63 kg/N/ha/yr*</td><td>63 kg/N/ha/yr*</td></tr><tr><td>III</td><td>63 kg/N/ha/yr*</td><td>63 kg/N/ha/yr*</td></tr></table>*For consistency with the Section 32 Report for PC 1 the numbers have been provided as calculated in Version 6.1 of OVERSEER. A revision to the latest version may be required.</td></tr>
<tr><td>Farmers 4 Positive Change (F4PC)
Submitter ID: 73355</td><td>PC1-10422</td><td>Support</td><td>The submission aligns with relief sought by HortNZ</td></tr>
<tr><td>Matamata-Piako District Council
Submitter ID: 73419</td><td>PC1-3462</td><td>Support</td><td>Modelling of scenarios by the Technical Leaders Group indicated that there was some uncertainty about the ability to achieve the objectives. There may be a benefit in providing for a longer timeframe the science cannot provide solutions.</td></tr>
</table>

Submitter	Submission point ID	Support / Oppose	Reason
Watercare Services Ltd Submitter ID: 74077	PC1-8450	Oppose in part	The submission provides scope for unequal treatment of discharges based on whether the discharge is rural or urban. This is not effects based.
Advisory Committee on Regional Environment (ACRE) Submitter ID: 72441	PC1-9500	Oppose	The shorter timeframes proposed are not practicable or feasible
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10806	Oppose in part	HortNZ supports a transitional regime that prepares the community for an allocation based approach following the 1st 10 years up to 2026.
Beef + Lamb New Zealand Limited Submitter ID: 73369 Denize, Mathew John Submitter ID: 72701	PC1-11154 PC1-7616	Oppose in part	HortNZ is concerned that allowing for maintenance of water quality without any improvement in some subcatchments does not consider the cumulative effects of all contributions on downstream water quality; and consequentially on downstream activities subject to targets and limits that require improvements to be made in a holistic way.
Guy, Denise and John Submitter ID: 73945	PC1-3809	Oppose	The submitter proposes that nitrogen is used as a proxy for intensification and this is not supported. HortNZ is supportive of an approach that considers the combined impact of discharges across all 4 contaminants as an alternative and has proposed relief consistent with this.
Macdonald, Hamish Stuart Submitter ID: 71433	PC1-2713	Support in part	Potentially it is useful to consider how a natural capital based approach can be used in combination with a sub catchment based approach along the lines of what is proposed by HortNZ. However, a natural capital approach based on LUC is not supported.
Maraekowhai Ltd Submitter ID: 73776	PC1-8825	Support in part	Ensure that targets and limits take account of flow variation in a sensible manner consistent with managing effects on freshwater values.
Mayne, Anna Submitter ID: 72881	PC1-8982	Oppose in part	HortNZ does not support a flat cap on nitrogen application because it is not an effects-based method to manage discharges.

Submitter	Submission point ID	Support / Oppose	Reason
Miraka Limited Submitter ID: 73492	PC1-8767	Support in part Oppose in part	It may be appropriate to provide for a sub- catchment to become a freshwater management unit as long as the cumulative impacts of all subcatchments are part of the consideration of how activities are treated within each unit.
Sherlock, Jon and Fiona Submitter ID: 73847	PC1-5031	Support in part	HortNZ recognises that everybody has a responsibility to manage freshwater; including growers. The part of this submission supported relates to objectives, policies and methods around the control of pest fish including Koi carp, because they appear to be having a significant adverse effect on water quality in the Waikato River system.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8218	Oppose	HortNZ is not supportive of the way that the objective is restated and is not supportive of the shorter timeframe proposed.
Gleeson, Graeme B Submitter ID: 73800	PC1-6449	Support	The submission is supported because it seeks to ensure that people and communities remain resilient in both the short and long terms.
Mercury NZ Limited Submitter ID: 73182	PC1-9506	Support in part	The wellbeing of national communities needs to be considered alongside the benefits and costs to regional communities.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	PC1-6366	Oppose	The deletion of Objective 2 is not supported.
Advisory Committee on Regional Environment (ACRE) Submitter ID: 72441	PC1-9502	Oppose	The suggested timeframe is too short. The Objective should be retained as notified
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-9502	Oppose	The amendments to the explanatory narrative are not supported and the addition of reference to the Vision and Strategy is not required.

Submitter	Submission point ID	Support / Oppose	Reason
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10459	Support in part	Better clarification of the Freshwater objectives, targets and limits is required. However, the wording around actions being “sufficient to achieve” may be more appropriate as the effect of some actions may not be observed at the measurement point within the 10 year period.
Matamata-Piako District Council Submitter ID: 73419	PC1-3464	Support in part	The effect of some actions may not be observed at the measurement point within the 10 year period.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8221	Oppose	Immediate measurable change may not be practicable.
Treweek, Glen Submitter ID: 72747	PC1-5761	Support in part	It is important to consider the time frames for action as a result of unexpected or lengthy delays in the process of implementation that are beyond the control of parties affected by implementation of PC 1.
Advisory Committee on Regional Environment (ACRE) Submitter ID: 72441	PC1-9502	Oppose	The suggested timeframe is too short and does not provide for the wellbeing of communities.
A S Wilcox & Sons Ltd Submitter ID: 73142	PC1-4307	Support	The submission aligns with the relief sought by HortNZ
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10809	Oppose	The suggested amendments do not provide appropriately for the wellbeing of communities.
Chapman, Sharon M Submitter ID: 73084	PC1-10720	Support	The submission aligns with the relief sought by HortNZ

Submitter	Submission point ID	Support / Oppose	Reason
Dunlop, Tania Submitter ID: 71249	PC1-406	Support in part	The nitrogen reference point should not be used as a proxy for intensification; and alternatives should be developed that allow for a broader consideration across all 4 contaminants of concern.
Primary Land Users Group Submitter ID: 71427	PC1-11132	Support	The submission is aligned with the relief sought by HortNZ.
Ravensdown Limited Submitter ID: 74058	PC1-10099	Support	The percentage reduction should be measured as the change in overall state and the percentage of progress towards achieving the state desired in 80 years.
Ryan Farms Ltd Submitter ID: 73425	PC1-2239	Support	The nitrogen reference point may be a usual place to measure the status quo from, but it should not be used as a proxy for intensification.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8221	Oppose	The suggested change is not practical or reasonable
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11265	Support in part	The idea of an overall achievement is supported, but the contribution of upstream activities to the state of water quality in the lower Waikato River system as a result of cumulative impacts need to be considered as well as the subcatchment load limit.
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11483	Support in part	HortNZ supports the implementation of a subcatchment based option for the management of freshwater values and Objectives.
Clements, Robyn Ethel Submitter ID: 73097	PC1-7727	Oppose	The staged approach is an important part of transition. LUC is not supported as a tool to assess landuse as it is pastorally focussed.
Department of Conservation Submitter ID: 71759	PC1-10542	Oppose	The health and wellbeing of communities is an important part of the Vision and Strategy for the Waikato River. While it is recognised that the intrinsic values are important they should not necessarily have a priority over all other values in every particular circumstance.

Submitter	Submission point ID	Support / Oppose	Reason
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10468	Support in part	While all the Objectives are important; the attribute numbers may be less important that achieving a desired set of outcomes and protecting freshwater values.
Guy, Denise and John Submitter ID: 73945	PC1-3812	Oppose in part	The emphasis on nitrogen discharges and the reliance on an input standard is not supported.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8224	Oppose	The health and wellbeing of communities is an important part of the Vision and Strategy for the Waikato River. While it is recognised that the intrinsic values are important they should not necessarily have a priority over all other values in every particular circumstance.
Wallace, Martin Lindsay Submitter ID: 72975	PC1-8305	Support in part	Land use activities and land with a low footprint should be encouraged.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8230	Oppose	Set dates for consent review are not consistent with the transitional nature of the Plan and do not provide for the certainty to invest in environmental infrastructure.
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11270	Support	The amendment sort is consistent with relief sought by HortNZ
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8233	Oppose	The health and wellbeing of communities is an important part of the Vision and Strategy for the Waikato River. While it is recognised that the intrinsic values are important they should not necessarily have a priority over all other values in every particular circumstance.
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11271	Support	The amendment sort is consistent with relief sought by HortNZ.

Submitter	Submission point ID	Support / Oppose	Reason
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10833	Oppose	The relief sought is not specific enough to determine what changes are being sought.
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11484	Support in part Oppose in part	Nitrogen allocation regimes are not the only appropriate method for determining the contribution to managing freshwater values each enterprise should make. Nor are the targets and limits for each subcatchment the only consideration as the cumulative impacts of upstream activities on downstream water quality must also be taken into account. Management of issues by catchment collectives is supported.
Chapman, Victor J Submitter ID: 72779	PC1-10715	Support	The ability to manage rotational land managed within a single enterprise is a necessity for commercial vegetable cropping enterprises.
Fertiliser Association of New Zealand Submitter ID: 73305	PC1-10748	Support	Longer consent duration allows for business certainty to encourage investment in environmental infrastructure.
Hamilton, Malibu Submitter ID: 74083	PC1-10259	Oppose in part	While the desire to ensure that one subcatchment is not degraded at the expense of another, the need to manage commercial vegetable production across multiple subcatchments must be provided for without materially affecting the balance of contaminant reduction required to achieve desired freshwater outcomes.
Hamilton City Council Submitter ID: 74051	PC1-10259	Oppose	An exemption from the need to meet discharge reduction requirements for urban developments is not effects based and is effectively a wealth transfer from rural communities to urban communities, as rural communities will be required to absorb the increase in discharge from the allowed urban activities. These new activities could be extensive enough to make a real difference to the ability of the Waikato to achieve the Vision and Strategy objectives.
Lyons-Montgomery, Stephen Submitter ID: 73449	PC1-9984	Oppose	A flat input cap on nitrogen is not an effects based method or policy.

Submitter	Submission point ID	Support / Oppose	Reason
Waikato River Authority Submitter ID: 74033	PC1-11560	Oppose in part	The overall effect of introducing a new activity should be considered, not the effect of each contaminant separately. Recognition is sought in particular for commercial vegetable production where it replaces ruminant agriculture in an application for new commercial vegetable production at a scale greater than the existing footprint of the enterprise. HortNZ seeks that this is enabled in cases where it can be demonstrated that any increase in nitrogen discharge compared to the existing activity at the site or property can be mitigated by: • Estimation of the elimination or significant reduction of ruminant based bacteriological discharges as measured by discharges of Escheria coli from the site. • Measures to reduce the output of phosphorus and sediment discharges from the site compared to the existing activity. • Revegetation over time of land on the site that exceeds 20 degrees in slope. • Riparian vegetative planting targeted at shading freshwater and stabilising bank structure while enhancing ecosystem function. To enable this; it is suggested that Policy 3 be amended in the following manner: Add new (j) to Policy 3 (as amended by the HortNZ submissions) to state: "*Notwithstanding Policy 3 (b) and (d); an application for new commercial vegetable production at a scale greater than the existing enterprise may be granted where it can be demonstrated that increases in the estimated nitrogen discharge compared to the existing activity (as of June 2016) at the site or property can be mitigated by:* *i) Demonstration that discharges of faecal bacteria sourced from ruminant farm animals will be significantly reduced or eliminated.* *ii) A commitment to measures aimed at reducing the output of phosphorus and sediment discharges from the site compared to the existing activity at June 2016.* *iii) A commitment to progressive revegetation of slopes greater than 20 degrees on the property or site.* *iv) A progressive riparian planting programme over the life of the consent*." Add a new advice note to Policy 3 stating: "*Any successful application for new commercial vegetable production at a scale greater than the existing enterprise will not be expected to*

<table>
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<tr><td></td><td></td><td></td><td><u>achieve the reductions within the cap of existing commercial vegetable production activities in line with policies 3(b) and (d).</u>”</td></tr>
<tr><td>Advisory Committee on Regional Environment (ACRE)
Submitter ID: 72441</td><td>PC1-9536</td><td>Oppose in part</td><td>It is not clear how an assessment of highest discharge to lowest can be established across 4 contaminants</td></tr>
<tr><td>Auckland/Waikato Fish and Game and Eastern Region Fish and Game
Submitter ID: 74085</td><td>PC1-10875</td><td>Support in part
Oppose in part</td><td>The allocation of responsibility for <u>diffuse discharges is supported as opposed to land use rules.</u> The use of allocation approaches that allocate strong property rights are not supported though. PC1 is a transitional plan that will lead to a more comprehensive considered and science based approach to the allocation of discharge post 2026. Riparian buffers are only supported on marginal land and where they are the most appropriate means of preventing contaminant discharge.</td></tr>
<tr><td>Balle Bros Group
Submitter ID: 67834</td><td>PC1-11399</td><td>Support</td><td>The submission appropriately targets action on the discharges that are most effective at achieving water quality objectives.</td></tr>
<tr><td>Beef + Lamb New Zealand Limited
Submitter ID: 73369</td><td>PC1-11485</td><td>Oppose</td><td>The allocation of nitrogen through LUC as a proxy for natural capital is not supported as a general approach. If an allocation approach was to be adopted through PC1 HortNZ seeks that discharges are allocated in a way that does not prevent the continued operation of commercial vegetable operations on land classed 1 to 3 (LUC) in the following manner:

Commercial vegetable production is most sustainable on LUC I – III. This submission proposes that the following load limits be set for existing and new commercial vegetable production on these classes of land; with remaining land defaulting to table numbers proposed by other submitters.

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<tr><th>LUC</th><th>Existing production</th><th>New production</th></tr>
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Submitter	Submission point ID	Support / Oppose	Reason
			The proposed nitrogen allocation approach is an inappropriate way of allocating the responsibility for contaminant discharge. It does not reflect the contribution of any of the other three important discharged contaminants that are the focus of the plan. The focus on nitrogen in the absence of allocation of phosphorous, sediment and biological contaminants such as faecal bacteria is skewed to pastoral sectors and presents a natural justice issue for commercial vegetable growers. The natural justice issue develops from: • The per hectare approach to managing discharges, that ignores the cumulative effect of an enterprise, operation or activity in general. • The lack of consideration for the absence of biological contaminant discharge from some activities such as fruit, vegetable and arable production. • The total footprint of an activity within a catchment and the cumulative effects on water quality downstream. So, the per hectare approach to the allocation of a contaminant is not effects based and does not meet the purpose of the RMA 1991. A better approach would be to consider the total contaminant discharge from an enterprise and or a property across the four contaminants. Consideration should also be given to the substitutability of the activity and the importance of the activity to domestic food production. HortNZ notes there are many submissions on many provisions that pertain to the use of LUC. This further submission seeks to reserve the position of HortNZ where relief is sought regarding use of LUC in Objectives, policies, methods, schedules, appendices and definitions; in order to ensure that the thrust of this further submission is recognised and provided for. In addition, the targets and limits for each subcatchment are not the only consideration as the cumulative impacts of upstream activities on downstream water quality must also be taken into account.
DairyNZ Submitter ID: 74050	PC1-10196	Support	The submission is in line with the proposals by HortNZ to manage specific activities not create general rules.
DairyNZ	PC1-12592	Support	The submission propose very similar relief to the relief sought by HortNZ.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 74050			
Gleeson, Graeme B Submitter ID: 73800	PC1-12600	Support	The submission is aligned with relief sought by HortNZ.
Guy, Denise and John Submitter ID: 73945	PC1-3813	Support	The submission identifies a problem for water quality that is not recognised and provided for in plan provisions, and the management of effects from this source of discharges should be managed through appropriate policies rules and methods
NZ Transport Agency Submitter ID: 73542	PC1-4829	Oppose	Everybody has a responsibility to manage water quality. Focussing discharge reduction requirements on rural activities is not effects based and is effectively a wealth transfer from rural communities to urban communities and transport providers, as rural communities will be required to absorb the increase in discharge from the allowed urban and transport related activities. These new activities could be extensive enough to make a real difference to the ability of the Waikato to achieve the Vision and Strategy objectives.
Advisory Committee on Regional Environment (ACRE) Submitter ID: 72441	PC1-9505	Oppose in part	The submission does not identify how the “highest discharge” would be calculated across 4 contaminants. The submission also does not provide for the cumulative effects of low intensity discharges that operate at a large proportional scale.
Alcock and Easton, Jo and John Submitter ID: 73374	PC1-9227	Support	The submission support and approach that addresses all relevant contaminants and remove the focus on nitrogen as a proxy for intensification.
Allen, John Submitter ID: 73734	PC1-4890	Oppose	Commercial vegetable production is defined.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10876	Oppose in part	HortNZ does not support the deletion of industry schemes or the provisions that focus on nitrogen in absence of an assessment of other discharges.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game	PC1-12693	Support in part	Riparian buffer should only be promoted as the preferred method where they are the most effective means to reduce discharges.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 74085			
Chhagn Bros Co Ltd Submitter ID: 73762	PC1-5539	Support	The submission is consistent with the relief sought by HortNZ.
DairyNZ Submitter ID: 74050	PC1-12741	Oppose	Nitrogen is the only contaminant that cannot increase in the relief proposed.
Federated Farmers of New Zealand Submitter ID: 74191	PC1-12754	Support	The proposed wording support the investment in environmental infrastructure.
Fonterra Shareholders Council Submitter ID: 72610	PC1-10636	Oppose	The differentiation in the treatment of contaminants is not supported.
Fonterra Shareholders Council Submitter ID: 72610	PC1-12760	Oppose	It is not appropriate to prefer commercially a model that is heavily focussed on one particular form of farming and which is a commercially proprietary model. There are viable alternatives that should be recognised and provided for.
Hahn, Jacqueline Marie Submitter ID: 53103	PC1-11451	Oppose	The differentiation in the treatment of contaminants is not supported. It is not appropriate to prefer commercially a model that is heavily focussed on one particular form of farming and which is a commercially proprietary model. There are viable alternatives that should be recognised and provided for.
Hahn, Jacqueline Marie Submitter ID: 53103	PC1-12778	Support	Everyone who uses water should have a responsibility in managing the water quality outcomes.
Hamilton, Malibu Submitter ID: 74083	PC1-10415	Oppose	Allocative approaches to phosphorous are opposed for similar reasons to the opposition expressed by HortNZ to allocation of nitrogen proposals.
McGovern, Annette Submitter ID: 72969	PC1-8312	Support in part	The size of an enterprise and the location of the discharge are relevant criteria for the determination of discharge controls.
McLaughlin, Robyn and Peter Submitter ID: 72984	PC1-12836	Support in part	The idea of a discharge interval or range is worth considering given modelling error.
Waikato Regional Council Submitter ID: 72890	PC1-2997	Support in part	Generally, the use of the 75th percentile is not supported. However, if it is to be used it should be limited to pastoral activities and should not be considered as an amount that a lower leaching activity can increase up to.

Submitter	Submission point ID	Support / Oppose	Reason
		Oppose in part	
Wai Shing Ltd Submitter ID: 73069	PC1-12957	Support	The idea of managing outside the boundary of an enterprise or a property provides greater options for managing and decreasing discharges.
Advisory Committee on Regional Environment (ACRE) Submitter ID: 72441	PC1-9508	Oppose	The submission proposes that the systems discharging the greatest level of contaminants be asked to reduce the most, the soonest. The systems most vulnerable to this approach are the systems that produce winter greens and leafy vegetables for domestic food chains. The effect on national communities of reducing these systems first is the greatest effect possible on commercial vegetable supply.
AFFCO New Zealand Limited Submitter ID: 74140	PC1-7656	Oppose	Good Management Practice is an accepted term within the farming sector.
Alcock, Carl and Jo Submitter ID: 73376	PC1-2189	Oppose	Vegetable do not require fences. If stock are present in part of the rotation fencing would be required.
Alcock and Easton, Jo and John Submitter ID: 73374	PC1-9231	Oppose	It is not appropriate to make a current land or property user responsible for the actions required by a future property owner or user.
Allen, John Submitter ID: 73734	PC1-4891	Oppose	Commercial vegetable production is defined.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10877	Support in part Oppose in part	The qualification to the policy about avoiding significant adverse effects is not opposed. It is not clear why the submission as opposed to a Certified and independently audited industry scheme, although it is recognised that the requirement for consent should be certainty enough. The amendment to clause g) should be clarified to allow for commercial vegetable production to continue to benefit the wider New Zealand community while avoiding significant adverse effects on water quality targets. A new farm schedule has been proposed for commercial vegetable production by HortNZ. Riparian buffers are not the most appropriate mitigation tool for managing sediment discharges in all cases. The most effective practical method should be utilised.
Ballance Agri-Nutrients Limited	PC1-6863	Support in part	Use of the term “good management practice” is preferred however it is noted that the vegetable growers minimum standards in the farm plan schedule are considered best

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 74036			management practices in the Code of Practice for Nutrient management for Commercial Vegetable Production. The idea that reductions and mitigations are guided by actions undertaken in a Farm Environment Plan is supported.
Charion Investment Trust Submitter ID: 71344	PC1-7691	Support in part Oppose in part	Deletion of the policy is not supported. The amendment to policy 3 (b) may assist with interpretation. The other proposed amendments have to be considered alongside amendments proposed by HortNZ submissions.
Costar, Rosemarie Submitter ID: 60404	PC1-3620	Support in part	HortNZ has supported a new restricted discretionary activity rule for new vegetable production. However, HortNZ would support a controlled activity for new vegetable production if this could be supported by an analysis of the impacts as being less than minor on water quality outcomes.
Department of Conservation Submitter ID: 71759	PC1-10653	Oppose	HortNZ has proposed alternative changes to the policy and does not support the changes suggested in the submission point. HortNZ does not support the inclusion of a more efficient land-based allocation regime and does not consider that this would recognise and provide for continued rotation of vegetable production across shared and leased land; and given that rotation is critical in conserving the life supporting capacity of soil it should be encouraged.
Dunlop, Tania Submitter ID: 71249	PC1-642	Support	The submission point aligns with proposed changes suggested by HortNZ.
Federated Farmers of New Zealand Submitter ID: 74191	PC1-10817	Support in part	The submission point aligns in part with proposed changes suggested by HortNZ submissions.
Fertiliser Association of New Zealand Submitter ID: 73305	PC1-9731	Support in part	The submission point aligns in part with proposed changes suggested by HortNZ submissions.
Juno, Anne and Allen Submitter ID: 71200	PC1-805	Oppose	It is not clear how the water testing will contribute to the efforts required to implement good management practice, and the financial effort should be focused on implementation of practice. Industry and Council research programs provide adequate links to ensure that the effectiveness of good management practices are quantified.
Primary Land Users Group	PC1-11145	Support	The submission point aligns in part with proposed changes suggested by HortNZ submissions.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 71427			
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8207	Oppose	Established case law does not support the relief sought. The emphasis on a nitrogen reference point is also not supported.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8256	Support in part	The increase in diffuse discharges needs to result in an adverse effect for it to be relevant.
Department of Conservation Submitter ID: 71759	PC1-10661	Oppose	The submission does not clearly outline the relief being sought so the relief cannot be responded to in the submission. The use of a land based discharge allocation framework is not supported for reasons clearly stated in HortNZ's submission.
Fletcher Trust Submitter ID: 73848	PC1-5934	Oppose in part	Change to the provision is supported but HortNZ is not of the view that the changes provide any additional clarity to the policy.
Smuts-Kennedy, Robin Submitter ID: 73323	PC1-6313	Oppose	The reduction in timeframe proposed does not provide for the Health and wellbeing of communities.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8257	Oppose	The reduction in timeframe proposed does not provide for the health and wellbeing of communities.
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11490	Support in part	Viewing the policy as an assessment of the discharge across all 4 contaminants could provide for better water quality outcomes while allowing some flexibility in terms of land use change.

Submitter	Submission point ID	Support / Oppose	Reason
DairyNZ Submitter ID: 74050	PC1-10230	Oppose	Viewing the policy as an assessment of the discharge across all 4 contaminants could provide for better water quality outcomes while allowing some flexibility in terms of land use change.
Department of Conservation Submitter ID: 71759	PC1-10664	Oppose	Prohibited activity status for Rule 3.11.5.7 is too restrictive and would not provide for the well-being and health of communities.
HortNZ (HortNZ) Submitter ID: 73801	PC1-10057	Support	The submission is supported and could be usefully improved by a policy that provided guidance on when an application may be considered to be in the balance an improvement on the status quo. The policy should provide some criteria to allow for the consideration of significant removal of problem contaminants from the discharge profile and potentially should provide for increases in 1 of the contaminants in some circumstances.
Ravensdown Limited Submitter ID: 74058	PC1-10107	Support in part	It is the deterioration or potential deterioration in water quality that the policy should be seeking to manage; not a material increase or decrease in the numeric value of the discharge.
Verkerk, Gwyneth Submitter ID: 60476	PC1-1281	Support	The submission aligns with the proposals for policy change sought by HortNZ.
Waikato Regional Council Submitter ID: 72890	PC1-3005	Support	The clarity around comparison with the existing use as of 22 October 2016 is supported.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10880	Oppose	The proposal to move immediately to an allocation regime is not supported; and this submission provides no detail on how a trading regime is to be achieved. The focus on one contaminant is also not supported because it is not an effects-based measure.
DairyNZ Submitter ID: 74050	PC1-10229	Oppose	HortNZ opposes the deletion of policy 7 (a to d).
Hamilton City Council Submitter ID: 74051	PC1-10754	Oppose	If growth is to be provided for, it should be accompanied with a detailed explanation of how discharges of contaminants to water will be improved.

Submitter	Submission point ID	Support / Oppose	Reason
HortNZ (HortNZ) Submitter ID: 73801	PC1-10070	Support	Useful clarification could be provided around the “polluter pays” principle proposed. A contribution to discharge should be considered at the enterprise or property level as opposed to a blanket per hectare approach that does not take account of the cumulative effect of many hectares under the same management by an enterprise or property. This reflects the management of the proportion of the contaminant load more fairly; as it is the overall contaminant load that is more important than the concentration per hectare.
A S Wilcox & Sons Ltd Submitter ID: 73142	PC1-4315	Support	Management of shared and leased land that is part of soil rotation will occur in many instances across subcatchments. Under the current plan provisions a consent would be required within each sub- catchment. This is most likely unmanageable for existing commercial vegetable production enterprises. It is unlikely that changes in the location of discharge will significantly influence water quality outcomes given the scarcity of land and the relatively low percentage of land that can potentially be used for commercial vegetable production, so management across sub- catchments under a single consent should be provided for in the case of commercial vegetable production.
Reeves and Taylor, James Gordon Livingston and Amy Louise Submitter ID: 71614	PC1-8537	Oppose	The submission proposes that the commercial vegetable production systems discharging the greatest level of contaminants be asked to reduce the most, the soonest. The systems most vulnerable to this approach are the systems that produce winter greens and leafy vegetables for domestic food chains. The effect on national communities of reducing these systems first is the greatest effect possible on commercial vegetable supply.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8253	Oppose	The inclusion of edge of field mitigation measures in rule standards and other methods decreases the opportunity to adopt new and innovative measures that work be on the paddock scale and adopt an ecosystem based approach to catchment management at a scale greater than a property.
Hamilton City Council Submitter ID: 74051	PC1-10755	Oppose	If growth is to be provided for, it should be accompanied with a detailed explanation of how discharges of contaminants to water will be improved.
Matamata-Piako District Council Submitter ID: 73419	PC1-3505	Oppose	There is already a definition of regionally significant industry that is more inclusive than the list provided. Guidance on regionally significant industry can be found on the values statements section of PC 1 and in the regional policy statement.

Submitter	Submission point ID	Support / Oppose	Reason
Oil Companies Submitter ID: 73716	PC1-2593	Oppose	The amendments are not effects based and are discriminatory.
Shaw and Hall, Leigh Michael and Bradley John Submitter ID: 73858	PC1-2623	Support	The submission is aligned with relief sought by HortNZ
Waikato Regional Council Submitter ID: 72890	PC1-3061	Support in part	If an exemption on the effects of flood protection and drainage infrastructure is to be provided for, the cost of improving deteriorated freshwater should not be transferred to businesses and communities operating within limits lower in the catchment. There needs to be some recognition that lower catchment communities are not responsible for mitigating against the effects of a flood protection and drainage networks that is upstream, or as protecting private property and public infrastructure that provides a benefit to all.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10601	Support	The suggested amendments to the policy improve the connection between freshwater outcomes and point source discharges; and ensures that the policy better meets the purpose of the RMA.
Balle, Patricia Katherine Submitter ID: 72557	PC1-4506	Support	HortNZ supports the policy being retained as notified apart from amendments that extend the scope of the policy to all activities contributing to discharges within the Waikato River system.
Balle, Patricia Katherine Submitter ID: 72557	PC1-4507	Support	HortNZ supports the policy being retained as notified apart from amendments that extend the scope of the policy to all activities that require consent for contribution to discharges within the Waikato River system.
Waikato Dairy Leaders Group Submitter ID: 74049	PC1-11013	Support	The intent of the submission point aligns with the thrust of the HortNZ submission.
Fletcher Trust Submitter ID: 73848	PC1-5996	Support	The intent of the submission point aligns with the thrust of the HortNZ submission.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10910	Oppose	There is no clear relief sought by the submitter to enable a non statutory method on nitrogen allocation in the Objectives and policies of PC1.

Submitter	Submission point ID	Support / Oppose	Reason
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10911	Oppose	HortNZ supports the development of Certified Industry Schemes as a critical component to enhancing the adoption of good management practice to improve freshwater quality.
Aitken, David John Submitter ID: 71238	PC1-704	Support	The submitter makes a range of amendments that would add to growers having confidence in the plan that is produced as a result of the method. In particular, ensuring growers aren't reliant on mitigations modelled in Overseer, ensuring growers can write their own farm plans in the 1st instance and ensuring that the information provided by the farmer remains confidential due to its commercial nature.
Nicholson, Chris and Vikki Submitter ID: 72447	PC1-3964	Support	The intent of the submission point aligns with the thrust of the HortNZ submission.
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11359	Support	Preparation of a farm plan by an appropriately qualified or experienced person is preferable to developing a list of certified farm plan developers.
Balle Bros Group Submitter ID: 67834	PC1-11414	Support	The management of pest fish should be addressed within the plan.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10933	Oppose	Creation of a trading regime for nitrogen within the non-statutory methods is not supported at this stage without more clear objective and policy support within the statutory controls. The amendment proposed by HortNZ to the method is preferable because it establishes the accounting framework that is required should a trading regime be established in the future.
Waikato Regional Council Submitter ID: 72890	PC1-3106	Oppose in part	The Waikato Regional Council should consider co-funding decision support tools in the framework for nesting sub catchment based decision support tools within wider water management units to improve freshwater decision-making in the future.
Turangawaewae Marae Submitter ID: 74173	PC1-12204	Support	The intent of the submission point aligns with the thrust of the HortNZ submission.

Submitter	Submission point ID	Support / Oppose	Reason
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-10959	Oppose	The tools, objectives, policies and statutory methods have not been developed to a suitable level to undertake an allocation regime of the nature proposed by the submitter at the current time.
New Zealand Pork Industry Board Submitter ID: 73780	PC1-4631	Support	The intent of the submission point aligns with the thrust of the HortNZ submission.
DairyNZ Submitter ID: 74050	PC1-10242	Oppose in part	HortNZ has suggested amendments to the method that it considers more appropriate relief and does not support the deletion of clause (d).
Buckley, Peter Ross Submitter ID: 71423	PC1-1424	Support	HortNZ supports retention of the method as notified
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-11003	Oppose	There is no clarity as to what is envisaged by reference to a buffer. HortNZ does not support the absence of mitigation, the considers a prohibited activity rule to be more than is required to ensure mitigations are adopted.
Wairakei Pastoral Ltd Submitter ID: 74095	PC1-11382	Oppose in part	Many submitters are suggesting a transfer regime. HortNZ does not support the adoption of a transfer and trading regime for nitrogen at this stage given the transitional nature of PC 1. However, should a transfer and trading regime be adopted within the course of the plan; relief along the lines of the relief sought by the submitter in this submission point is preferred to other relief sought.
Waikato Regional Council Submitter ID: 72890	PC1-3115	Oppose in part	HortNZ has sought alternative relief to address low intensity enterprises operating across more than one property in our submission on Variation 1 to PC1.
Miraka Limited Submitter ID: 73492	PC1-8890	Support	HortNZ supports the rule being retained as notified.
Waikato Regional Council Submitter ID: 72890	PC1-3117	Support in part	HortNZ supported the rule being retained as notified. However; it considers that the clarification around the existing use at 22 October 2016 to be useful.
Auckland/Waikato Fish and Game	PC1-10998	Oppose	HortNZ opposes the deletion of rule 3.11.5.3.

Submitter	Submission point ID	Support / Oppose	Reason
and Eastern Region Fish and Game Submitter ID: 74085			
Waikato and Waipa River Iwi Submitter ID: 74035	PC1-3523	Oppose in part	HortNZ understands the intent of the submission but does not believe you can add discretion to the standards of a permitted activity rule.
Mercury NZ Limited Submitter ID: 73182	PC1-9600	Support	HortNZ supports the rule being retained as notified and does not oppose the amendment suggested by the submitter in relation to Certified Sector Schemes.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8208	Oppose in part	The rule is unlikely to be utilised by many commercial vegetable growers. However, there is a reference into this submission point to commercial vegetable production that is not supported. Alternative relief has been provided in other submission points from HortNZ
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-11000	Oppose	The majority of the changes suggested are unworkable and alternative relief has been suggested by HortNZ.
Brooks, Hayden Gregory and Susan Jennifer Submitter ID: 71174	PC1-87	Oppose	HortNZ does not support deletion of the rule.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10505	Oppose	The majority of the changes suggested are not considered necessary and alternative relief has been suggested by HortNZ.
HortNZ (HortNZ) Submitter ID: 73801	PC1-10117	Support in part	Alternative relief has been provided in the HortNZ submission on Variation 1 to PC1
The Royal Forest and Bird Protection Society of New Zealand Incorporated	PC1-8211	Oppose	Alternative relief has been suggested in the submission by HortNZ on Variation 1 to PC1.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 74122			
Tuaropaki Trust Submitter ID: 73769	PC1-3027	Support	HortNZ was not of the view that covered cropping or glasshouse production was captured by the rule. Amendment to the definition to ensure they are covered as a low intensity activity is supported.
Waikato Regional Council Submitter ID: 72890	PC1-3444	Support in part Oppose in part	HortNZ supports clarification of the permitted and controlled activity status. It does not support the amendment to condition (e) or the restriction to a sub catchment based approach for reasons stated elsewhere in further submissions. Nor does it support a nitrogen reference point being tied to the land is that increases the likelihood that the nitrogen reference point becomes an allocation akin to a property right. Significant problems have been uncovered in other Regional Council jurisdictions with attempts to combine land use and discharge controls that are no longer the responsibility of the enterprise. In the case of leased and shared land, if the discharge is retained by the landowner when the lease finishes, no new land can be leased without an equivalent discharge permission. In addition, it is impractical to break down the nitrogen reference point to a property level on a yearly basis. Alternative relief has been suggested as part of the HortNZ submission on Variation 1 to PC 1. The submissions include the establishment of a nitrogen reference point proxies in line with amendment suggested to non statutory method 3.11.4.7.
Wildman, Anna Mary Submitter ID: 72505	PC1-3876	Support in part	Alternative relief has been suggested as part of the HortNZ submission on Variation 1 to PC 1 in respect to a nitrogen reference point.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10506	Oppose	HortNZ has provided alternative relief in the form of the contents of a restricted discretionary activity rule as part of our submission on Variation 1 to PC 1.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8213	Oppose in part	HortNZ has provided alternative relief in the form of the contents of a restricted discretionary activity rule as part of our submission on Variation 1 to PC 1.
Waikato Regional Council	PC1-3477	Oppose	The addition of the new proposed matter of discretion effectively makes the rule a discretionary rule.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 72890			
Adams, Neville Submitter ID: 74154	PC1-5064	Support in part	HortNZ does not support a blanket exemption on new commercial vegetable production from the noncomplying activity rule; but has provided alternative relief to ensure that there is some limited capacity to undertake new vegetable production in particular circumstances.
Ata Rangi 2015 Limited Partnership Submitter ID: 74045	PC1-6201	Support in part	HortNZ does not support a blanket exemption on new commercial vegetable production from the noncomplying activity rule; but has provided alternative relief to ensure that there is some limited capacity to undertake new vegetable production in particular circumstances. HortNZ prefers the relief suggested in its submissions in relation to new commercial vegetable production compared to the suggestions of this submitter.
Gourmet Mokai Ltd Submitter ID: 73795	PC1-7250	Support	HortNZ was not of the view that covered cropping or glasshouse production was captured by the rule. Amendment to the definition to ensure they are covered as a low intensity activity is supported.
ST Growers Ltd Submitter ID: 67421	PC1-1275	Support	The submission is supported because it provides for an assessment of equal or lesser discharge across all 4 contaminants when taken in combination.
Tuaropaki Trust Submitter ID: 73769	PC1-3009	Support	The intent of the submission point aligns with the thrust of the HortNZ submission.
Waikato Regional Council Submitter ID: 72890	PC1-3480	Oppose in part	HortNZ does not see how a conversion of commercial vegetable production land to dairy farming can avoid adding an entire new contaminant class to the discharge profile at the location of the activity so does not support the exemption.
Ballance Agri-Nutrients Limited Submitter ID: 74036	PC1-6915	Support	HortNZ is keen to ensure that the registration process and the portal are easy to access and present the right toolbox and information resources for growers to register in a trouble free and efficient manner; particularly given the complexity of some enterprises. The portal would ideally have an option to update shared and leased land as a means of notifying the Council regarding changes in shared and leased land as well.
Cheyne, David Submitter ID: 71443	PC1-1502	Support	Private information can be commercially sensitive and landowner or enterprise approval should be obtained before any information collected can be released to a third party agent. Approval should also be obtained from the landowner or enterprise for the information to be used for any purpose other than water quality management.

Submitter	Submission point ID	Support / Oppose	Reason
Department of Conservation Submitter ID: 71759	PC1-11060	Oppose in part	See the other further submissions made regarding confidentiality of information. In addition, HortNZ considers the information collection requirements need to be practical and cost effective to ensure the efforts required on practical mitigation are not hindered or misdirected into excessive reporting. The reporting schedule should be designed to suit the farming system; and should not be arbitrarily controlled by a blanket reporting interval.
Ngaati Tamaoho Trust Te Taiao Roopuu Submitter ID: 74088	PC1-11613	Support in part	The provision of land parcels is supported; but there should be an option to identify the land parcels in an Arcview or GIS tool as opposed to providing a map.
NZ Transport Agency Submitter ID: 73542	PC1-4838	Support	Clarify that roads are not urban properties.
Advisory Committee on Regional Environment (ACRE) Submitter ID: 72441	PC1-11211	Oppose in part	OVERSEER may be the preferred tool for some farming systems but should not be the preferred tool. Provision must be made for a range of preferred tools.
Aitken, David John Submitter ID: 71238	PC1-687	Support in part	There are many mitigations not modelled in OVERSEER. This should not preclude the use of these options and the plan should clarify this.
Ashdale Enterprises Ltd Submitter ID: 72465	PC1-1681	Oppose in part	OVERSEER should not be the only tool that can be utilised to calculate a Nitrogen reference point.
Allan, Eric Submitter ID: 73438	PC1-6107	Support in part	The nitrogen reference point should not be used as a proxy for intensification. The measurement of intensification should be across the four contaminants and the schedule should be amended to reflect this. The schedule should also allow for the use of a farm proxy to calculate a reference point.
Auckland Council Submitter ID: 73518	PC1-5930	Support in part	Clarification of roles and responsibilities are supported but not exclusion of some catchments from PC1.

Submitter	Submission point ID	Support / Oppose	Reason
Ballance Agri-Nutrients Limited Submitter ID: 74036	PC1-6570	Oppose in part	A certified farm nutrient advisor allows for a greater range of relevant experience and qualifications than a certified nutrient management advisor. The amendment of timeframe for the calculation of the reference point for commercial vegetable production is also opposed, because the shorter timeframe may not properly account for rotational variance. And the Schedule should not be amended to any point that excludes the use of an alternative model or method to calculate a reference point.
Balle Bros Group Submitter ID: 67834	PC1-11433	Support in part	HortNZ supports amendment in line with the proposed relief.
B Das and Sons Ltd Submitter ID: 73689	PC1-9071	Support	The submitter is aligned with the thrust of HortNZ submissions
Bennett, Martin Submitter ID: 73409	PC1-5971	Oppose in part	The identification of alternative mitigations is supported but not as a method in the plan because it will not allow for innovative practice and new science to be used.
Clarke, Hamish Submitter ID: 71621	PC1-8471	Oppose in part	The submitter proposes the use of Olsen P as a proxy for determining nutrient and sediment loss, and this is opposed as not being a scientifically valid proxy.
Lee, Malcolm and Sally Submitter ID: 72932	PC1-8878	Oppose	LUC is opposed as a proxy for measuring natural capital.
Pamu Farms of New Zealand Submitter ID: 74000	PC1-5849	Support	The submitter is aligned with the thrust of HortNZ submissions
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8451	Oppose	The average does not provide for the rotation of crops over a number of years so the highest year need to be provided for.
Waikato Regional Council Submitter ID: 72890	PC1-3553	Support in part Oppose in part	Use of a lesser period to calculate the NRP is supported if it is not practical or records are not available.

Submitter	Submission point ID	Support / Oppose	Reason
			The level of information provided should be relative to the impact or effect of the operation. The amount of information provided must also be practical in terms of the effort required, and where possible should not have to be provided only made available for inspection. Financial information and intellectual property provided to Waikato Regional Council must remain secure from disclosure to any 3rd party.
Dunlop, Tania Submitter ID: 71249	PC1-622	Support	The schedule should provide for temporary stock exclusion fencing where the dominant land use activity is arable or horticultural production including commercial vegetable production.
Fertiliser Association of New Zealand Submitter ID: 73305	PC1-12401	Oppose	HortNZ opposes removal and amendment to the sections proposed that does not align with the submissions sought by HortNZ. Reliance on the generic Code of Practice for Nutrient Management is also not supported.
Ravensdown Limited Submitter ID: 74058	PC1-12502	Support in part Oppose in part	HortNZ prefers the suggested relief in the submissions of HortNZ to the relief proposed by the submitter but is prepared to discuss the reasons for the preferred relief.
Taylor, Janet Submitter ID: 71081	PC1-17	Support in part Oppose in part	The submission is supported in calling for mitigations to be based on science that has been independently validated. The science behind the commercial vegetable erosion and sediment control guidelines relies on over 20 years of research and investigation and has had independent peer review from science agencies such as Landcare Research and Plant and Food. No other sector has invested as much time and effort on erosion and sediment control, so it is interesting that the Guidelines attract the comment; rather than the lack of guidelines and methods observable in other sectors. The current programme is two years into pilot trials assessing the effectiveness of vegetative buffers as opposed to other mitigation techniques on cropping land and is demonstrating that in many situations the other mitigations are more effective at managing channelised overland flow. So HortNZ opposes the mandatory requirement for vegetative controls if they are less effective than other mitigations.

Submitter	Submission point ID	Support / Oppose	Reason
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8201	Oppose	The submitter does not specify what is meant by reductions and it is not clear how the submitter expects to test this across the four contaminants. The reductions philosophy is also clearly specified in policy and methods. Nor is it possible for a business or activity to reduce a contaminant it does not discharge for example bacterial contaminant from permanent cropping. Many growers have also invested substantively in discharge reduction measures but will still be required to reduce under this submitter's proposal.
Waikato Regional Council Submitter ID: 72890	PC1-3575	Oppose in part	The erosion and sediment control plan for commercial vegetable production should be able to be compiled by the enterprise in the first instance using the sector process guidance. Review and certification may be required following compilation. Oppose deletion of the reference to other suitable mitigations. Support more clarity in how the discretion is exercised.
Waikato Regional Council Submitter ID: 72890	PC1-12545	Support in part	Alignment with the permitted activity rule for use of water is supported in part but the duplication of compliance requirement should be addresses and a note should be added that deems compliance with the PC1 condition compliance with Rule 3.4.5.6.
Gleeson, Graeme B Submitter ID: 73800	PC1-12417	Support in part	The submission recognises the important distinction to be made regarding commercial vegetable production and the wider community benefits of it.
Lichtwark, Quintin Owen Submitter ID: 72535	PC1-1871	Support in part	A sub- catchment based nitrogen reference point may be appropriate in circumstances where a consent has been issued for a sub- catchment collective, although the relief may not be most appropriately given effect to in this schedule and may be more suited to policies and methods, and if it is found appropriate to do so this further submission seeks the scope to give effect to the relief sought in the policies and methods.
Moss, George Wilder Submitter ID: 74078	PC1-11078	Oppose	All current science demonstrates that slope is the critical factor in soil loss from cultivation and that slope is a relative useful and practical proxy to utilise. HortNZ does support better clarification of the method to measure slope and suggests that Waikato Regional Council could consider the method adopted by Horizons Regional Council.

Submitter	Submission point ID	Support / Oppose	Reason
New Zealand Association of Resource Management Submitter ID: 71702	PC1-7991	Oppose in part	Land Use Capability is not the defining tool for assessment of all land use activities and does not necessarily indicate a level of proficiency that would be required in assessment of all activities.
Ravensdown Limited Submitter ID: 74058	PC1-10174	Oppose	The preparation of a nutrient budget needs to be done by someone with the suitable qualifications and experience. While some certified nutrient management advisors may have experience with cropping and vegetable rotation many do not and the courses contain little of the current science and relevant content required to make a reasoned assessment.
Ravensdown Limited Submitter ID: 74058	PC1-12502	Oppose in part	HortNZ opposes the amendments to the vegetable growing minimum standards. The standards have been prepared with considerable consultation among growers and have been agreed as necessary steps to improve the health and well-being of the Waikato River.
Waikato River Authority Submitter ID: 74033	PC1-11563	Support	The submission supports an effects-based approach that assesses water quality outcomes across the 4 contaminants as opposed to a single focus on nitrogen. This is supported.
Aitken, David John Submitter ID: 71238	PC1-710	Support	Keeping enterprise/grower information confidential is critical to ensuring the plan has success.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10561	Support in part Oppose in part	HortNZ supports a standard formatting agreement for non-compliance to be reported but does not support removal of the independent third-party audit requirement.
Poohara Marae Submitter ID: 73545	PC1-12044	Oppose in part	It is not clear what the amendments to clause 2 are designed to achieve as the coordinated management of farm plans is not necessarily the core competency of a scheme designed to certify, audit and report the results of activities. Auditors also do not have the competency to assess the effectiveness of mitigations adopted. That is the job of the farm plan certifier and the person preparing the farm plan.
The Royal Forest and Bird Protection	PC1-8205	Oppose	The submitter provides no reason for the deletion. Standardisation of farm plans is a necessary component of achieving the plan outcomes and no alternative has been offered.

Submitter	Submission point ID	Support / Oppose	Reason
Society of New Zealand Incorporated Submitter ID: 74122			
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11158	Support in part Oppose in part	HortNZ has offered alternative relief in submissions but recognises that this is a critical part of the plan that may benefit from further discussion and refinement. HortNZ reserves its position on the final table until it has clarified the nature of what is being sought by the submitter.
Department of Conservation Submitter ID: 71759	PC1-10536	Support in part Oppose in part	HortNZ has offered alternative relief in submissions but recognises that this is a critical part of the plan that may benefit from further discussion and refinement. HortNZ reserves its position on the final table until it has clarified the nature of what is being sought by the submitter.
Watercare Services Ltd Submitter ID: 74077	PC1-8435	Support in part	Amending in Table 3.11-1 the long term water quality targets for Total Nitrogen, Total Phosphorus and Chlorophyll-a to recognises the gradual deterioration of water quality along the length of the Waikato River.
Ata Rangi 2015 Limited Partnership Submitter ID: 74045	PC1-11376	Support in part	There may be some benefit in de will fining low intensity and high intensity farming activities
Department of Conservation Submitter ID: 71759	PC1-10658	Support in part	Definitions must align with references in the text of PC 1 and with definitions in the Regional Policy Statement.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10616	Oppose in part	Enterprises should be able to consider all of the aspects under management within the enterprise. It is entirely appropriate for parts of the farm that are not involved in the activity being assessed under any rule or policy to consider the cumulative effect of all activities including the non-productive parts of the farm or the low intensity activities that are undertaken.
Lumbercorp NZ Ltd Submitter ID: 71753	PC1-9960	Oppose	The list excludes particular sectors and industries and is not aligned with the definition in the regional policy statement or references in the values section of PC1.
Mercury NZ Limited Submitter ID: 73182	PC1-9687	Oppose	The list excludes particular sectors and industries and is not aligned with the definition in the regional policy statement or references in the values section of PC1. OR if the definition has retained ensure that commercial vegetable production and its significance to domestic food

Submitter	Submission point ID	Support / Oppose	Reason
			chains and community well-being is recognised and provided for within the definition including the significant post harvest infrastructure associated with commercial vegetable production.
Waipa District Council Submitter ID: 67704	PC1-3243	Oppose in part	Oppose deletion of reference to alternative nutrient budget models for the many reasons suggested in other submission / further submission points.
Te Arawa River Iwi Trust Submitter ID: 73697	PC1-11820	Support in part	Support as long as the length of the occasion is more closely specified: under the proposed definition it could be for 11 months and 29 days.
FarmRight Submitter ID: 73720	PC1-9634	Oppose in part	The inclusion of commercial vegetable production in the 75th percentile is opposed for reasons stated elsewhere in this further submission; being in summary that requiring reductions to the 75th percentile for the high discharging horticultural operations will have the most adverse effect on production of leafy green vegetables, carrots and potatoes at the time of year where Waikato production is relied on by the community across New Zealand.
Wairarapa Moana Incorporation Submitter ID: 72480	PC1-2158	Support in part	The 75th percentile should not be used as a proxy for allocation of nitrogen to a particular sector and the definition should be clarified to ensure that the 75th percentile is only used as a figure for reduction targets.
Pukerimu Farms Limited Submitter ID: 73073	PC1-4813	Oppose	The definitions are critical to rule/activity status. Permitted activity status may prove unviable through the plan process in the commercial vegetable sector has chosen to adopt a requirement for a controlled activity that has not been chosen as a pathway for the arable industry/sector, so the definitions are required.
Ata Rangi 2015 Limited Partnership Submitter ID: 74045	PC1-6255	Support	HortNZ supports the recognition of all activities across an enterprise that may be considered to be offset mitigations.
The Royal Forest and Bird Protection Society of New Zealand Incorporated	PC1-8192	Oppose	HortNZ prefers the use of incorporation by reference as opposed to a schedule in the plan.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 74122			
DairyNZ Submitter ID: 74050	PC1-10250	Support in part	HortNZ prefers that the relevant experience is emphasised as opposed to simply the qualification.
Ballance Agri-Nutrients Limited Submitter ID: 74036	PC1-7113	Oppose	The submitter emphasises a single qualification pathway and this is an anti-competitive approach. There are also many aspects of a farm environment plan that are not covered by the certificate of completion in advance sustainable nutrient management from Massey University.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8478	Support in part	Proficiency is the important thing to demonstrate and a code of ethics is also an important matter to consider.
Ballance Agri-Nutrients Limited Submitter ID: 74036	PC1-7090	Oppose	Oppose a singular definition and a particular training programme and prefer the relief and definition sought by HortNZ
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8494	Support in part	Support the definition being more open to a range of qualification pathways that ensure the competence and experience of the certified professional is appropriate to the activity being assessed.
Waitomo District Council Submitter ID: 73688	PC1-10851	Support in part	Support the definition in the regional plan being amended to reflect PPC1.
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10583	Support in part	Support the language in Schedule 2 being reflected in the definition so there is certainty that all the assessment criteria are met.
The Royal Forest and Bird Protection	PC1-8497	Oppose	The submitter provides no reason for the deletion. Standardisation of farm plans is a necessary component of achieving the plan outcomes and no alternative has been offered.

Submitter	Submission point ID	Support / Oppose	Reason
Society of New Zealand Incorporated Submitter ID: 74122			
Gourmet Mokai Ltd Submitter ID: 73795	PC1-7253	Support	The definition could be appropriately amended to crops grown outdoors due to the different approaches available for the management of discharge and the consequentially lower footprint.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8498	Oppose	Certainty is needed in the definition to ensure that the rule pathway is transparent.
Waiawa Farms Submitter ID: 71346	PC1-5853	Oppose	The definitions are critical to rule/activity status. Permitted activity status may prove unviable through the plan process in the commercial vegetable sector has chosen to adopt a requirement for a controlled activity that has not been chosen as a pathway for the arable industry/sector, so the definitions are required.
Genetic Technologies Ltd Submitter ID: 73953	PC1-3336	Support in part	Support if there is evidence to demonstrate that minimum tillage and strip tillage do not have the potential for adverse environmental effects that are similar to cultivation.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8678	Oppose	The activities excluded are different to broad acre cultivation and the exceptions are reasonable.
Fertiliser Association of New Zealand Submitter ID: 73305	PC1-10666	Support	The amendment clarifies the definition.
Fertiliser Association of New Zealand Submitter ID: 73305	PC1-10668	Support	The common Oxford dictionary definition of channel does not exclude pipes/water conduits that are not open to the surface.

Submitter	Submission point ID	Support / Oppose	Reason
Ata Rangi 2015 Limited Partnership Submitter ID: 74045	PC1-6266	Support in part	The submitter proposes useful clarifications to the definition, however the control may also be extended to one party that is responsible for managing the discharges of a collective group of responsible parties that have agreed to operate in a coordinated fashion under a responsible legal entity.
Southern Pastures Limited Partnership Submitter ID: 74062	PC1-11203	Oppose in part	The requirement for land parcels to be contiguous across multiple subcatchments is not supported.
Te Whakakitenga o Waikato Incorporated (Waikato-Tainui) Submitter ID: 74105	PC1-8173	Support in part	Support if it is clarified that associated land uses may include other financial activities that contribute to the function of the Enterprise.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8702	Support in part	The reason for the exclusion to the definition should be made clear, and it should be clarified that crops irrigated with municipal wastewater discharges are managed appropriately to avoid adverse effects.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	PC1-8934	Support	HortNZ understands that OVERSEER constructs a 10year rolling average at all times so the reference to a 3 or 5 year rolling average needs to be clarified.
Ballance Agri-Nutrients Limited Submitter ID: 74036	PC1-7095	Oppose	The definition of good management practice should be inclusive of all effective practices whether they be in a book or not.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8193	Oppose	The definition of good management practice should be inclusive of all effective practices whether they be listed in a schedule or not.

Submitter	Submission point ID	Support / Oppose	Reason
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-10580	Oppose	The change the definition excludes the use of other models or methods.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	PC1-8941	Oppose in part	Ensure the definition allows for the use of models and methods other than OVERSEER.
Waikato Regional Council Submitter ID: 72890	PC1-3673	Oppose	Ensure the definition allows for the use of models and methods other than OVERSEER.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	PC1-11018	Support in part	The amendment appropriately measures effects on water quality as opposed to the reduction of a single contaminant. In some places measurable outcomes may need to be modelled in the 1st instance to allow for a consent to be assessed.
The Royal Forest and Bird Protection Society of New Zealand Incorporated Submitter ID: 74122	PC1-8719	Oppose	Offsets should be provided for in all cases to ensure that the greatest range of options to reduce adverse effects on water quality are available.
Waikato Regional Council Submitter ID: 72890	PC1-3680	Oppose	If a point source discharge is material to water quality outcomes it should be considered as a discharge from a point source.
Fullerton, Angela Margaret Submitter ID: 71297	PC1-6393	Support in part	Ensure that a setback includes vegetated banks where they are extensive as in the case of the Whakapipi Stream.
Waikato Regional Council Submitter ID: 72890	PC1-3685	Support	Also sought in submissions by HortNZ
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	PC1-8953	Oppose	The consideration of water allocation should factor in the requirement for water quality to be improved, and should consider that irrigation provides opportunities to reduce the discharge of contaminants. If identified minimum standards relate to irrigation demand management they should be a factor in considering water take applications.

Submitter	Submission point ID	Support / Oppose	Reason
Fonterra Co-operative Group Ltd Submitter ID: 74057	PC1-13193	Support	All discharges not just farming activities should be required to consider Chapter 3.11
Mercury NZ Limited Submitter ID: 73182	PC1-9694	Oppose	Oppose deletion of reference to water quality objectives in 3.11.
Mercury NZ Limited Submitter ID: 73182	PC1-9697	Oppose	Oppose deletion of reference to water quality objectives in 3.11.
Beef + Lamb New Zealand Limited Submitter ID: 73369	PC1-11510	Support in part	HortNZ has proposed its own relief that is similar and while it prefers its own relief; it reserves a position on the relief sought here for the purposes of clarification and alignment.
AgFirst Waikato (2016) Ltd Submitter ID: 81854	V1PC1-39	Oppose	Oppose the construction of a nutrient trading scheme until a finalised allocation approach has been established prior to 2026 as proposed in the notified plan.
Ashby, Joanna Lee and Raymond John Submitter ID: 82008	V1PC1-855	Oppose	HortNZ wishes to ensure that the Waikato catchment can be considered as a single discrete entity and supports the re-notification of the catchments removed. HortNZ has made submissions on Variation 1. HortNZ wishes to ensure that where similar matters are covered in submissions on Variation 1 to proposed PC 1; our further submissions apply to both PC 1 and Variation 1 to PC 1 to ensure that there is alignment and consistency in the treatment of issues across the whole of the catchment of the Waikato River.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1707	Oppose in part	HortNZ wishes to ensure that section 9 functions are not combined with section 15 functions and considers that all the rules apart from the noncomplying activity rule for land use change should be considered as discharge rules, not combined discharge and land use rules incorporating section 9 and section 15 elements.
Department of Conservation Submitter ID: 71759	V1PC1-1698	Oppose in part	Oppose the construction of a nutrient trading and allocation scheme until a finalised allocation approach has been established prior to 2026 as proposed in the notified plan. The allocation regime proposed is not supported as unattenuated loads have not been calculated appropriately and no holistic decision support tools have been constructed that would meet a standard suited to prescriptive allocation. Nor is there support for a prescriptive allocation approach based on nitrogen discharges as opposed to wider consideration of other contaminants.

Submitter	Submission point ID	Support / Oppose	Reason
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-778	Support in part Oppose in part	HortNZ has proposed its own relief that is similar and while it prefers its own relief; it reserves a position on the relief sought here for the purposes of clarification and alignment.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-801	Support in part Oppose in part	HortNZ has proposed its own relief that is similar and while it prefers its own relief; it reserves a position on the relief sought here for the purposes of clarification and alignment. In terms of the development of proxy approaches to establishing nitrogen reference points; the proxy established should be designed in a manner appropriate to the activity and the scale of effects from the sector or activity. Proxies should be developed in coordination with sector approved agents and if methods are established prior to the completion of PC 1 they should be meaningfully incorporated into the plan.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-901	Oppose	The requirement for a farm plan should be commensurate to the level of intensity for the activity assessed on an Enterprise basis.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1359	Support in part	There should be greater clarity about what are limits, targets, freshwater objectives and attribute states.
Watercare Services Ltd Submitter ID: 74077	V1PC1-888	Support in part	Support clarification of how the values are to be used in assessing consent applications.
Wairakei Pastoral Ltd Submitter ID: 74095	V1PC1-442	Support in part	Some clarification of the definition of a spring would aid interpretation of the plan.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1554	Oppose in part	Freshwater standards should be set to enable a range of values not just one value.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-109	Support	Support stronger alignment with the NPS value in line with the amendments proposed by Federated Farmers.

Submitter	Submission point ID	Support / Oppose	Reason
Watercare Services Ltd Submitter ID: 74077	V1PC1-889	Oppose in part	Amend existing and future domestic and municipal supply to refer to “existing and future essential drinking water and sanitation”.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1558	Oppose in part	Point and non point source discharges are not the only activities that affect ecosystem function and health. Structures, dams, diversions, the presence or absence of plants and animals (including introduced plants and animals) can have adverse effects as well and these should be managed in conjunction with point and non point source discharges to achieve freshwater outcomes sought.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1656	Support in part Oppose in part	HortNZ has proposed its own relief that is similar and while it prefers its own relief; it reserves a position on the relief sought here for the purposes of clarification and alignment.
Department of Conservation Submitter ID: 71759	V1PC1-1701	Support in part Oppose in part	Support an approach that recognises cumulative effect down through the catchment from the mountains to the sea. Qualify that not all contaminant discharges end up in the estuary.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1657	Support in part	Support a more tangible link to the values in the Objectives. Support recognition of the need to maintain economic wellbeing to encourage investment in water quality solutions.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-122	Support	The submission clarifies the approach is managing discharges.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	V1PC1-1113	Support in part	There may be benefit in clarifying a mid term water quality goal.
Waikato Regional Council Submitter ID: 72890	V1PC1-1479	Support in part	Climate change should be a factor in managing freshwater outcomes.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1659	Support in part	For community wellbeing to be maintained in the long term the transitional cost to the community needs to be carefully considered.

<table>
<tr><th>Submitter</th><th>Submission point ID</th><th>Support / Oppose</th><th>Reason</th></tr>
<tr><td>Federated Farmers of New Zealand Submitter ID: 74191</td><td>V1PC1-157</td><td>Support in part</td><td>The submission usefully clarifies that it is the water quality state that is the desired outcome and not the number. However, some states may usefully be referenced back to the Tables to aid with the granting of consents and the assessment of effects.</td></tr>
<tr><td>Federated Farmers of New Zealand Submitter ID: 74191</td><td>V1PC1-175</td><td>Support</td><td>The change usefully clarifies the use of farm plans and the requirement for flexibility when considering different farming conditions and locations.</td></tr>
<tr><td>Federated Farmers of New Zealand Submitter ID: 74191</td><td>V1PC1-240</td><td>Support in part</td><td>The new policy should also consider unique circumstances where there are adverse effects to communities beyond the Waikato Region. For example, where changes may impact on seasonal supply of domestic vegetables.</td></tr>
<tr><td>Beef + Lamb New Zealand Limited Submitter ID: 73369</td><td>V1PC1-1661</td><td>Oppose in part</td><td>Clarity is sought that the allocation of nutrients to land by LUC will not cause a situation where the Vision and Strategy cannot be achieved.

Productive capability does not recognise the adverse cumulative effects of land use activities on water quality appropriately. Any allocation system would be better based on the risk associated with the activity discharging contaminants from any particular site.

The LUC table proposed does not quantify the effect on load across the Waikato catchment and does not adequately provide for commercial vegetable production.

The LUC approach is not supported. However, if an LUC approach is to be adopted there should be a sufficient allocation of discharge to allow for existing and some new commercial vegetable production in order to preserve domestic food security.

Commercial vegetable production is most sustainable on LUC I – III. This submission proposes that the following load limits be set for existing and new commercial vegetable production on these classes of land; with remaining land defaulting to table numbers proposed by other submitters.

<table><tr><th>LUC</th><th>Existing production</th><th>New production</th></tr><tr><td>I</td><td>63 kg/N/ha/yr*</td><td>63 kg/N/ha/yr*</td></tr><tr><td>II</td><td>63 kg/N/ha/yr*</td><td>63 kg/N/ha/yr*</td></tr></table></td></tr>
</table>

Submitter	Submission point ID	Support / Oppose	Reason
			<table><tr><td>III</td><td>63 kg/N/ha/yr*</td><td>63 kg/N/ha/yr*</td></tr></table> *For consistency with the Section 32 Report for PC 1 the numbers have been provided as calculated in Version 6.1 of OVERSEER. A revision to the latest version may be required. The most significant contribution should not be judged on a per hectare basis, rather it should be measured as the cumulative total impact of an enterprise in comparison to other enterprises within the water management unit. The cumulative effects of contaminant discharge from the mountains to the sea needs to be considered. The transfer and allocation system proposed is unworkable for Enterprises with a significant share of leased / shared land that are required to rotate across land to maintain soil health and reduce disease risks associated with static production systems.
Balle Bros Group Submitter ID: 67834	V1PC1-1030	Support in part	A nitrogen reference point as the basis for an allocation decision is not supported because it undermines an approach that looks more broadly across the 4 contaminants and makes an overall assessment. However, a nitrogen reference point may be a useful factor in considering the overall combined effect of an activity and should not be precluded from use as long as there is some level of parity in the consideration of all four contaminants. For the benefit of doubt, HortNZ does not support the use of a nitrogen reference point as a proxy for intensification because it favours some land use activities and disadvantages others; including commercial vegetable production.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-164	Support in part	The policy usefully provides some flexibility and guidance in how applications will be assessed.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-748	Oppose	The submission does not account for discharges other than nitrogen in an assessment and is not effects based.
Waikato Regional Council Submitter ID: 72890	V1PC1-207	Support in part	A wider consideration needs to be provided for than simply the subcatchment.

Submitter	Submission point ID	Support / Oppose	Reason
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1563	Oppose	HortNZ has proposed alternative relief.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-176	Support in part Oppose in part	There is a need to ensure that existing commercial vegetable production can be continued through the notified controlled activity rule. While it is desirable to have some new commercial vegetable production the scope of change needs to be managed based on assessment of individual applications. A restricted discretionary activity is supported for the application for new commercial vegetable production is supported because it provides scope for the Council to turn down applications that are not well considered or are likely to produce a significant adverse effect across the entire discharge profile when compared to the existing landuse activity.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1357	Oppose	It is not appropriate to manage many commercial vegetable production businesses at the property level, nor is a focus on nitrogen an effects based approach.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	V1PC1-1173	Oppose	The proposed approach provides no certainty for commercial vegetable production. The sector is of a nature that a tailored approach is justified in the plan.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1348	Oppose in part	The per hectare nitrogen focussed approach is not effects based. The overall effect of an enterprise should be considered.
Devine, Clare Submitter ID: 82004	V1PC1-80	Oppose in part	The science to accurately calculate the required reductions in ten year steps has not been completed.
Tuwharetoa Maori Trust Board Submitter ID: 73356	V1PC1-933	Support	The change in wording improves the policy.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1662	Support in part Oppose in part	Support the flexibility for a change in use that improves the values across the suite of contaminants being assessed as opposed to using nitrogen as the proxy for intensification. Seek clarification of what is meant by “intensive land uses”

Submitter	Submission point ID	Support / Oppose	Reason
			Seek clarification that cumulative effects will be considered in the assessment Seek a standard of proof that the land use change proposed will result in an improvement in water quality outcomes despite an increase in nitrogen discharge.
Maniapoto Maori Trust Board Submitter ID: 73730	V1PC1-1300	Support in part	Support the concept of removal or significant decrease in one of the four contaminants being recognised – would suggest that rotation of vegetable crops be considered in the relief being proposed.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1674	Oppose	HortNZ considers the transition to a sustainable allocation approach needs to consider more than nitrogen; needs to be supported by the development of a greater range of tools; needs an accounting system to be developed and should be more widely consulted on before being implemented. HortNZ also recognise that an allocation approach undertaken now could hamper the resolution of iwi rights and interests in freshwater.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-224	Support in part	Support clarification on the status of the Nitrogen Reference Point.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1353	Support in part Oppose in part	Support further research Oppose the allocation system being decided in this plan change and deletion of reference to future allocation.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1350	Support in part	A quicker move to the establishment and implementation of farm plans better supports the potential to achieve the water quality outcomes desired in the short term; and allows the community more time to consider land use choices that may be required to meet longer term water quality outcomes.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-234	Oppose	The enterprise should be considered, not the land use – the term enterprise allows for multiple land use activities anyway.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1366	Oppose	The omittance of the proposed advice note provides greater flexibility in preparing for enduring changes to freshwater quality.

Submitter	Submission point ID	Support / Oppose	Reason
Waikato Regional Council Submitter ID: 72890	V1PC1-209	Support in part	HortNZ has offered a preferred approach to enable shared implementation of mitigations.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-235	Support	Everyone has a responsibility to manage effects on water quality.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1567	Oppose	Use of an offset should not be the last option considered. The option that provides the greatest level of benefit to water quality objectives at the least cost should be the first consideration.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-236	Support	Use of an offset should not be the last option considered. The option that provides the greatest level of benefit to water quality objectives at the least cost should be the first consideration.
Waikato Regional Council Submitter ID: 72890	V1PC1-1506	Oppose in part	The flood protection scheme concentrates discharges and changes the temporal nature of discharges; allowing for an increase in effect compared to the naturalised rate of discharge without the scheme. The scheme needs to consider the effects of the engineered infrastructure on downstream water quality; including some consideration of the effect of this concentration and impoundment of discharges from upstream land use activities.
Watercare Services Ltd Submitter ID: 74077	V1PC1-817	Oppose in part	The cumulative effect of discharges needs to be a consideration not just significant discharges with adverse effects.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-239	Support	Everyone has a responsibility to manage effects on water quality.
Waikato Regional Council Submitter ID: 72890	V1PC1-1507	Oppose	The technical report prepared by Jacobs for the submission by HortNZ adequately demonstrates that the statement is incorrect.
Watercare Services Ltd Submitter ID: 74077	V1PC1-824	Oppose	It is not appropriate to have particular regard for these matters in light of the status of the Vision and Strategy for the Waikato River. They should appropriately be “taken into account”.
Auckland/Waikato Fish and Game	V1PC1-1542	Support in part	New method ab) is not entirely supported but it could usefully be modified to address matters such as the past record of compliance with discharge conditions and the RMA in general.

Submitter	Submission point ID	Support / Oppose	Reason
and Eastern Region Fish and Game Submitter ID: 74085			
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-241	Support in part	Consent terms should not frustrate the achievement of freshwater objectives but a longer consent term may be appropriate for more substantive mitigation approaches, in consideration of the investment required and this should be open to all parties not just point source discharges.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-831	Support	Speaks to the compliance matter raised in the further submission by HortNZ on V1PC1-831.
Balle Bros Group Submitter ID: 67834	V1PC1-170	Support	The submitter makes useful clarifications to improve the policy and related methods.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1544	Oppose in part	All these methods may be required to establish an allocation framework but should not be focussed simply on nitrogen use. The methods should also establish timeframes beyond 2026 in line with the intent of the notified plan to transit over time into an allocation regime, rather than implementing it during the duration of this notified plan.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-290	Support in part	The main effort should be directed to sub catchment / catchment accounting frameworks but consideration should also be provided to reporting in addition.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-314	Support	The calculation of the 75th percentile is unclear and the submission appropriately seeks greater transparency in the method for determining it.
Maniapoto Maori Trust Board Submitter ID: 73730	V1PC1-1310	Support in part	The submission is aligned with the relief sought by HortNZ.
Maniapoto Maori Trust Board Submitter ID: 73730	V1PC1-1313	Support in part	A fair and efficient programme of assessing compliance with farm plans is important and a randomised approach may be suitable.
Te Whakakitenga o Waikato	V1PC1-1460	Support in part	Support is qualified to the audit schedule aligning with individual sector third party audit schedules to ensure there is an efficient compliance checking arrangement and that audits are not occurring in an ad hoc nature.

Submitter	Submission point ID	Support / Oppose	Reason
Incorporated (Waikato-Tainui) Submitter ID: 74105			
HortNZ (HortNZ) Submitter ID: 73801	V1PC1-1636	Support	Support and amend the text to make clear: "*h. In support of method 3.11.4.7, utilise (and coordinate the management of) public funds to share the cost of constructing decision support tools meeting the criteria specified in Schedule 1C to assess likely compliance with limits / targets in Table XX.*"
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1573	Oppose	The submitter has not clarified why there is no public benefit from improvements made that should exclude the use of general rate funding.
Raukawa Charitable Trust Submitter ID: 74073	V1PC1-1261	Oppose in part	The most critical science required to implement the Vision and Strategy is the measurement of the effectiveness of mitigations. The deletion of 3.11.4.11 (b) is not supported.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-312	Support	The amendments improve the method.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-499	Oppose	It is not clear why the new rule is focussed on the nitrogen reference point as opposed to other contaminants, and it is not clear how the water quality objectives have any certainty of being achieved if every application for a new activity exceeding the NRP needs to be granted by the Council.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-570	Support in part Oppose in part	The submitter is usefully trying to clarify the need to protect rotation and the need to make the conditions clear for the landowner and the lessee. However, there are a range of matters referred to in the rule that will not provide appropriately for Commercial Vegetable operations, including the requirement to use OVERSEER.
Maniapoto Maori Trust Board Submitter ID: 73730	V1PC1-1320	Oppose	It does not seem consistent with an approach that seeks to delay concrete allocation of contaminants to make the controls land use controls. Land use controls tying the contaminant loss to the land will not only halt rotation but will also lock in for longer periods the discharge profiles of existing landuse. In many respects the rights granted as land use rules appear to be stronger rights.

Submitter	Submission point ID	Support / Oppose	Reason
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-762	Oppose in part	The amendments to the rule do not seem to provide for cropping and other plant-based production systems, that may occur on a broader scale but still be low intensity activities. The requirement for blanket input controls on feed also do not seem to be effects based – for example a cut and carry dairy goat farm may not raise nutrient levels or contaminant discharges because animals are barn housed.
Oji Fibre Solutions (NZ) Limited Submitter ID: 73725	V1PC1-1176	Support in part Oppose in part	Clarify the requirements for permanent fruit cropping systems and amend to allow for enterprises that are low intensity activities.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-765	Oppose in part	Clarify that the permitted activity rule as drafted provides the scope to achieve the freshwater objectives. For example, it appears that any arable cropping is provided for under the rule; whether existing or new.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-357	Oppose in part	The relief provides more time for FEP's in priority 3 catchments; effectively not requiring a plan until 2 years after the expiry of the non complying rule for land use change 3.11.5.7.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-779	Support in part Oppose in part	Improving the timeframes for the completion of farm plans may be necessary to achieve the short term freshwater objectives. Use of the 50th percentile places even more emphasis on use of nitrogen as a proxy for intensification, and is not supported. The proxy system proposed may be appropriate for some activities but it should be clarified that the approach is not intended to apply to commercial vegetable production systems.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1664	Support in part Oppose in part	Ensure that commercial vegetable production is not captured by the rule by providing for commercial vegetable production in other rules including 3.11.5.5; or amend the rule in line with the proposed relief of HortNZ.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1725	Support in part Oppose in part	Ensure that commercial vegetable production is not captured by the rule by providing for commercial vegetable production in other rules including 3.11.5.5; or amend the rule in line with the proposed relief of HortNZ.

Submitter	Submission point ID	Support / Oppose	Reason
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-1579	Oppose	The revision of the rule does not provide appropriately for commercial vegetable production and is not consistent with the preferred relief of HortNZ. In particular, the use of a trading platform to provide for commercial vegetable production is fraught with risk and the unintended consequences of doing so have not been fully assessed.
Department of Conservation Submitter ID: 71759	V1PC1-421	Oppose	Support the changes proposed in the Variation to dates.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-498	Support in part Oppose in part	HortNZ has provided alternative relief but supports some of the clarification about the use and amendment of Farm Plans.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1354	Oppose in part	Oppose the use of the words “any single year” as being ambiguous. Commercial vegetable production can often return to land that was used prior so the amendment to condition g cannot be supported.
Shearer & Baverstock Cropping Ltd Submitter ID: 82019	V1PC1-403	Support	It should be clear that the Enterprise leasing land is only responsible for activities on the land leased for the period of time over the lease and that the certified industry scheme only covers the land utilised for commercial vegetable production.
Waikato Regional Council Submitter ID: 72890	V1PC1-1517	Support in part Oppose in part	Some of the amendments clarify the rule, for example the differentiation of the permitted and controlled time periods. The intent of the change to the rules around provision of information needs to be clarified. Holding the nitrogen reference point with the land is opposed.
Fonterra Co-operative Group Ltd Submitter ID: 74057	V1PC1-1351	Oppose in part	Clarify so the discretionary rule and conditions proposed do not cover commercial vegetable growing activities and provide alternative relief as proposed by HortNZ (new restricted discretion rule).
Waikato Regional Council Submitter ID: 72890	V1PC1-1520	Oppose in part	In some cases; the information may be required to be provided by the lessee in terms of an Enterprise operating on shared or leased land.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-717	Support in part	“estimate” is an appropriate change to make regarding the modelled nitrogen reference point and provision should be made for the estimate to be expressed as a range from high to low.

Submitter	Submission point ID	Support / Oppose	Reason
			Support the use of alternative models. Support reference to suitable proxies.
Waikato Regional Council Submitter ID: 72890	V1PC1-229	Support	Use of Soil Order is not appropriate where there is more accurate data that can be used. It is preferable to use the S-Map classification or the exact soil type if it is available and the standards should be changed to allow for the best available information to be utilised.
Wairakei Pastoral Ltd Submitter ID: 74095	V1PC1-688	Support in part	The amendment usefully allows for the consent application process to be utilised as the means of providing the NRP.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-287	Oppose in part	Confirm that the table contains freshwater objectives not limits and targets. Make appropriate amendments consequential to this relief.
Auckland/Waikato Fish and Game and Eastern Region Fish and Game Submitter ID: 74085	V1PC1-299	Oppose in part	Clarify that the proposed amendments are realistic or achievable. Confirm that the table contains freshwater objectives not limits and targets. Make appropriate amendments consequential to this relief.
Beef + Lamb New Zealand Limited Submitter ID: 73369	V1PC1-1658	Support in part Oppose in part	Clarify that the proposed amendments allow for achievement of freshwater objectives. Ensure that any assessment of freshwater objectives is cognisant of the cumulative effects on downstream water quality outside the subcatchment unit.
Department of Conservation Submitter ID: 71759	V1PC1-1006	Oppose in part	The appropriate accounting tools have not been developed yet to establish limits and targets. These should be developed prior to the next plan change related to freshwater quality. An appropriate short term assessment tool that could be utilised as an alternative is the new table of attenuated sub catchment load limit table prepared by HortNZ and attached to submissions.
Waikato Regional Council	V1PC1-1525	Support in part	Support the enablement of an approach covering multiple subcatchments.

Submitter	Submission point ID	Support / Oppose	Reason
Submitter ID: 72890			
Waikato Regional Council Submitter ID: 72890	V1PC1-1528	Oppose in part	Clarify that the amendments provide appropriately for the use of alternative methods and models from OVERSEER.
Waikato Regional Council Submitter ID: 72890	V1PC1-1532	Oppose in part	Clarify that the amendments provide appropriately for the use of alternative methods and models from OVERSEER.
Federated Farmers of New Zealand Submitter ID: 74191	V1PC1-807	Support in part	An alternative term may be more appropriate such as “rehabilitation”.

Healthy Rivers Plan Change - Technical Support for Horticulture New Zealand

Horticulture New Zealand

Additional Technical Report for Further Submission

IZ081700-RP-0005 | Final

September 17, 2018

Healthy Rivers Plan Change - Technical Support for Horticulture New Zealand

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Contents

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1. Introduction

The Waikato Regional Proposed Plan Change 1 (PC1) was notified in October 2016. Following this notification, Pare Hauraki raised concerns with Waikato Regional Council that they had not been consulted with in the manner required by the RMA. As such, WRC withdrew part of the proposed plan change on 3 December 2016 in order for consultation to take place. Submissions were called on PC1 in its revised state during 2017, with Horticulture New Zealand (HortNZ) submitting a submission on behalf of its growers.

In March 2017, Jacobs completed a report that provided technical assessments and analysis to support Horticulture New Zealand's submission to PC1 (Jacobs, 2017). This technical work involved:

- summarising the impact of horticultural landuse in the catchment on the attributes identified by the Collaborative Stakeholders Group (CSG), and the corresponding effect that this impact has on values identified in PC1;
- discussion on a balanced approach to contaminant reductions across all four contaminants which are the focus of PC1 (nitrogen, phosphorous, sediment and chlorophyll *a*), rather than just utilising a nitrogen reference point;
- analysis of the effect of a key mitigation strategy for commercial vegetable growers (irrigation to raise crop yields) given the previous decisions in Variation 6 to restrict surface takes in the Waikato catchment;
- a review of potential offset measures for horticulture including alternative locations and non-point source discharge locations in order to lessen any residual adverse effects of the discharge(s) that will or may result from activities;
- discussion regarding potential amendments to the Farm Management Plan Schedule 1 given its current lack of focus on managing losses from cultivation practices across broader rural land than that occupied by the vegetable sector;
- analysis to support the HortNZ proposed change to Objective 3 to add the '*achievement of the contaminant load reduction targets specified for each subcatchment in Table 3.11.'* This analysis would be further supported if the requested catchment loads associated with the 10-year water quality targets from Waikato University were provided.

In conjunction with the submission process, WRC were undertaking consultation with Hauraki iwi. This consultation was completed in November 2017, with Variation 1 to the PC1 notified in April 2018. Further submissions on Variation 1 are now required, which will include a review of the specific components of Variation 1 as well as a response to original submissions on PC1.

HortNZ have requested Jacobs undertake additional technical work to support their further submission on Variation 1, and continues to outline HortNZ's view that water quality needs to be assessed at both the sub-catchment and whole catchment scale.

HortNZ's key further submission points (and supporting technical work) are as follows:

- HortNZ supports the controlled activity status for existing users proposed in the plan under Rule 3.11.5.5 through grandparenting. However, as outlined in Jacobs (2017) and elaborated on in this technical report, HortNZ's submission[1] proposes a multiple contaminant approach to assessing effects and delivering water quality objectives (Section 9.4, page 43 of the HortNZ submission). Jacobs have been commissioned to further analyse this position, and this work is outlined in **Section 2**. This work shows that the effect of contaminants on the values protected by PC1 will vary depending on the subcatchment and location of the enterprise. For example, there are subcatchments where microbiological contamination is causing adverse effects on the values identified in PC1 and commercial vegetable production may be a mitigation that reduces the microbiological load and its associated effect on the values.
- PC1 currently has new commercial vegetable growing as a non-complying activity under Rule 3.11.5.7. This rule unduly restricts new production, while not improving water quality outcomes. HortNZ opposes the non-complying activity status for land use change to commercial vegetable production (as outlined in

[1] HortNZ's initial submission to PC1, dated 8 March 2017.

sections 9.13 – 9.15, page 48 of the HortNZ submission) and proposes that the plan should enable opportunities for new vegetable production through either a discretionary or restricted discretionary rule. HortNZ supports extending Rule 3.11.5.6 in PC1 (as outlined in Sections 9.5 to 9.11, page 46, of the HortNZ submission) to provide for new commercial vegetable cropping activities that can demonstrate reductions in contaminant discharge when assessed across all contaminants. **Section 3** is technical evidence to support HortNZ's position and demonstrates that the freshwater quality values and associated targets identified in PC1 may be achieved while allowing for sufficient and suitable land to be allocated for commercial vegetable production. This section involves two case studies, the first which demonstrates the change in contaminant loss loads with regards to the expansion of horticultural area across the whole Waikato River catchment. The second case study in this section outlines a comparison of nutrient losses from arable cropping on dairy farms for the purpose of animal feed. This assessment indicates that cropping on dairy farms can have greater impacts on nutrient loads into rivers than horticulture for human consumption. There is potential to undertake commercial vegetable cropping on dairy farms provided that the nutrient leaching losses are offset by lower leaching rates on other parts of the farm.

- In addition to the specific points above, many submitters have put forward an argument that a natural capital (using the Land Use Capability classification) allocation would be a better approach than that currently outlined in PC1. In their submission on Variation 1 to PC1[2], HortNZ opposes the use of nitrogen as a proxy for intensification and a tool to allocate discharges. Farmers should be considering how they manage their responsibility for contaminant discharges, as opposed to seeking the allocation of discharge rights in the years to 2026. This form of allocation has also proven unworkable for vegetable growing in other regions where this approach has been implemented. Case study 4 in **Section 4** of this technical report presents evidence against the idea that a natural capital based allocation of nitrogen will achieve freshwater quality targets and the provision of identified values. In addition, Case Study 5 in **Section 4** outlines a possible Hybrid Natural Capital approach proposed by HortNZ (in the event that the current grandparenting approach is not adopted) and shows the change in total N loads across subcatchments when horticultural land use is provided for.

[2] HortNZ's submission on Variation 1 to Plan Change 1, dated 23 May 2018.

2. PC1 emphasis on Nitrogen Reference Points

The values and water quality attributes for PC1 were prepared by the CSG and consist of Mana Atua (intrinsic values) and Mana Tangata (use values) of the water. The attributes that the plan focuses on are the following water quality indicators: nitrogen (N), phosphorus, chlorophyll, sediment and *E. coli.*

The technical report *Healthy Rivers Plan Change Technical Support for Horticulture New Zealand's submission* (Jacobs, 2017) provides a detailed overview of the identified values and targets of PC1, and these are summarised in the section below. PC1 has a strong emphasis on N as a water quality indicator above all other water quality indicators, and a strong focus on N reference points. Under Rule 3.11.5.5, existing commercial vegetable production is a controlled activity, subject to matters of control including provisions to achieve Policy 3(d).

Policy 3(d) requires a 10% decrease in the diffuse discharge of nitrogen and that a tailored reduction in the diffuse discharge of phosphorus, sediment and microbial pathogens is achieved across the sector through the implementation of Best or Good Management Practices. However, a 10% reduction in N has been shown as having a substantial financial effect by Agribusiness Group (2014). More specifically, although the "Mitigation 2" technique described in Agribusiness Group (2014) did achieve N leaching reductions in the order of 10%, it was described as having "a substantial financial effect as the amount of N applied decreases from 10 to 40% due to the associated reductions in yield. It causes losses to be occurred from a point between the 10% and 20% reduction in N application, which reflects the relative profitability of growing the crops" (Agribusiness Group, 2014). HortNZ seeks to amend Policy 3(d) to allow a tailored reduction of no more than 5% through the implementation of Best or Good Management Practices in the diffuse discharge of three of the contaminants: nitrogen, phosphorus, and sediment, while recognising that there is no (or minimal) discharges of microbial pathogens from commercial vegetable production.

This section aims to show that the emphasis on N will not result in an improvement in overall water quality, with regards to the three core values of the plan, for many catchments within the Waikato. The effect of contaminant discharges will vary depending on the subcatchment and the location of the enterprise, and reduction in contaminant discharges should be assessed across all four contaminants.

Case Study 1 – Water quality comparisons across select catchments	
Background	PC1 identifies 3 core values with regard to water quality within the Waikato: human health for recreation, ecosystem health, and mahinga kai. These values are impacted by a suite of water quality attributes: 1) **Human Health for Recreation** is measured against concentrations of *E. coli* (in lakes, rivers, and lake-fed rivers), chlorophyll *a* (lakes and lake fed rivers) and planktonic cyanobacteria (lakes only), and levels of clarity (lakes, rivers, and lake-fed rivers). Visual clarity is measured as the horizontal sighting range of a black disc under base flow conditions. The key contributors to visual clarity are considered to be yellow substance, phytoplankton (floating algae) and fine sediment. 2) **Ecosystem Health** is measured against trophic state indicators such as concentrations of chlorophyll *a* (lakes and lake-fed rivers) and planktonic cyanobacteria (lakes only), TP and TN concentrations (lakes and lake-fed rivers), and nitrate-N and ammoniacal N (as toxicants in rivers and lake-fed rivers). 3) **Mahinga kai** is measured against concentrations of *E. coli* (in lakes, rivers, and lake-fed rivers) and chlorophyll *a* (lakes and lake-fed rivers) and planktonic cyanobacteria (lakes only). Table 1 below outlines how the relevant water quality attributes in PC1 impact on the three core values. When lakes are not taken into consideration, there are four water quality attributes that are used to assess the water quality of rivers: nitrogen (consisting of total nitrogen (TN – Waikato River sites only), nitrate, and ammonia), total phosphorus (TP – Waikato River sites only), *E. coli*, and chlorophyll *a* (Waikato River sites only). However, PC1

	has a heavy focus on reducing nitrogen loads into rivers (through defining a Nitrogen Referencing Point). Table 1 shows that N is only a direct measure for one of the core values identified within PC1 (Ecosystem Health), and is not directly used as a measure of the state of the other two values. However, *E. coli* is used as a direct measure for two of the core values within PC1 (Human Health for Recreation and Mahinga kai). Table 1: The chosen water quality attributes and the corresponding effect that each have on the three core values identified in PC1. (See Table 1 at the end of this section) HortNZ submission supports the controlled activity status for existing users proposed in the plan under Rule 3.11.5.5 through grandparenting. However, HortNZ opposes the introduction of a Nitrogen Reference Point as it places an unhealthy emphasis on one contaminant. This section aims to assess whether a focus on the N reference point is the most effective means of improving water quality, with regards to the three core values of the plan in the Waikato. The technical work below shows what the main water quality problems are for the subcatchments within the Waikato Region, and indicates that N is not the only water quality attribute contributing to poor water quality in the Waikato region. This approach supports HortNZ's view that water quality needs to be assessed on both the subcatchment and whole catchment scale, in order to determine the overall effect. This case study outlined the following: • Background information on the NPS for Freshwater; • Background water quality information for the Waikato River and its tributaries for *E. Coli*, Nitrogen, Phosphorus, sediment and clarity; • A discussion on the proportion of sediment versus phytoplankton in clarity measurements and the N:P limitation in the Waikato River; • The contribution of horticulture to the 4 contaminants outlined in PC1 and current mitigation techniques being undertaken by horticulturists; • A detailed review of the water quality within subcatchments in which horticulture is undertaken.
NPS for Freshwater	The National Policy Statement for Freshwater Management (NPSFM) directs regional councils to set objectives for the state of fresh water bodies in their regions and to set limits on resource use to meet these objectives. The National Objectives Framework (NOF) is part of the NPSFM and its aim is to help councils and communities set water quality objectives and subsequent limits in regional plans that reflect their values for freshwater. Appendix 2 of the NPSFM outlines the NOF attribute (water quality parameter) tables with attribute states which is the level to which an attribute is to be managed. There are six attribute states for each of the identified values (i.e. A, B, C, D, E and National Bottom Line), with A state representing a healthy and resilient system, while states D and E represent ecosystems that are under stress. The NOF measures ecosystem health in rivers using periphyton (with councils setting their own criteria for dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP) to achieve the outcomes), nitrate, ammonia, dissolved oxygen. In addition, the NOF measures human health for recreation using *E. coli*.
***E. coli* concentration in Waikato rivers**	*E. coli* is used in PC1 as a measure of human health for recreation and mahinga kai, but is not a direct measure of ecosystem health. Horticulture contributes no *E. coli* to waterways, except at those sites where manure is used as a fertiliser. In contrast, dairy, sheep and beef, and urban land uses all contribute *E. coli* to the waterways. Appendix B of the NPSFM outlines that NOF tables for specific attributes, with four criteria specified for assigning an *E. coli* state to a river,

1) Percentage exceedances over 540 cfu/100 ml,

2) Percentage exceedances over 260 cfu/100 ml,

3) median concentrations (cfu/100 ml), and

4) 95th percentile *E. coli*/100 ml.

We have been provided with baseline *E. coli* concentrations in the Waikato based on criteria 3 and 4 above and have used this information to assign an *E. coli* state to each subcatchment, either A, B, C, D, or E, which outlines the risk of infection to swimmers. This data was compiled by NIWA to inform PC1 and is baseline data from 2010-2014.

In the case of *E. coli*, the following narrative attribute state is assigned to the following attribute states:

A - for at least half the time, the estimated risk is <1 in 1000 (0.1% risk). The predicted average infection risk is 1%.

B – For at least half the time, the estimated risk is <1 in 1000 (0.1% risk). The predicted average infection risk is 2%.

C – For at least half the time, the estimated risk is <1 in 1000 (0.1% risk). The predicted average infection is 3%.

D – 20-30% of the time the estimated risk is ≥50 in 1000 (>5% risk). The predicted average infection risk is 3%.

E – For more than 30% of the time the estimated risk is ≥ 50 in 1000 (> 5% risk). The predicted average infection risk is >7%.

It should be noted that the assigned *E. coli* state is conservative as we are missing criteria for 1 and 2 to give an overall score (e.g. the score can only either stay the same or get lower with the addition of the missing criteria). The analysis for each catchment is shown in Appendix A (Table A1), however a summary table (Table 2) displays the number of subcatchments within each *E.coli* NOF state.

Table 2 below shows that 62% of subcatchments within the Waikato region are within the D or E state in *E. coli*.

Table 2 : *E. coli* in the Waikato

E. coli State	No. of subcatchments
A	11
B	3
C	1
D	21
E	26
Unable to assign	12
Total	74

Nitrogen concentration in Waikato rivers

Total nitrogen (TN) is a measure of the state of ecosystem health, and can indirectly impact on the state of the water body for human health for recreation in respect to the influence of nitrogen on chlorophyll a and the impact of chlorophyll a on clarity.

Nitrate (Toxicity)

The NOF includes nitrate toxicity values applicable to lakes and river environments.

There are two criteria for assigning a nitrate state to rivers using the NOF,

1) annual median concentration, and

2) annual 95th percentile concentration.

Baseline information for both these data have been provided for the 74 subcatchments in the Waikato. This data was compiled by NIWA to inform PC1 and is baseline data from 2010-2014. We have used this information to assign a nitrate state to each subcatchment, either A, B, C, or D.

In the case of nitrate, the following narrative attribute state is assigned to the following attribute states:

A – High conservation value system. Unlikely to be effects even on sensitive species.

B – Some growth effect on up to 5% of species.

C (National Bottom Line) – Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.

D – Impacts on growth of multiple species, and starts approaching acute impact level (i.e. risk of death) for sensitive species at higher concentrations (>20 mg/L).

The analysis for each catchment is shown in Appendix A (Table A2), however a summary table (Table 3) displays the number of subcatchments within each nitrate NOF state. Table 3 shows that there is only 1 subcatchment below the national bottom line. The majority of catchments fall into the "A" NOF state, which indicates a high conservation value system where there is unlikely to be effects even on sensitive species.

Table 3 : Nitrate in the Waikato

Nitrate State	No. of subcatchments
A	41
B	16
C	5
D	1
Unable to assign	12
Total	74

Trophic State - TN

Total Nitrogen (TN) is used as an indicator of ecosystem health via the trophic state in the NOF for lakes only, however there are TN default trigger levels for lowland rivers outlined in the ANZECC (2000) guidelines and water quality guidelines developed by WRC.

Table 4 shows that over half of all the Healthy Rivers subcatchments are unsatisfactory for TN when compared to the WRC guidelines, and have TN concentrations greater than the default TN trigger values in ANZECC guidelines.

Table 4: Total nitrogen in the Waikato. Comparison to Waikato Regional Council guidelines and ANZECC default trigger values (DTV) for lowland rivers.

Guideline values	No. of subcatchments
WRC guidelines	
Unsatisfactory	50
Satisfactory	12
Excellent	0
Unable to assign	12
ANZECC DTV	
Above DTV	43
Below DTV	19
Unable to assign	12

Trophic State - Phytoplankton

Phytoplankton (floating/planktonic algae) is a natural part of river and lake food webs, providing energy to the food chain and cycling nutrients. Chlorophyll a (chl-a) is a component of phytoplankton cells and therefore increases in phytoplankton biomass production causes an increase in chl-a concentrations. Phytoplankton also contributes to the degradation of water clarity (by increases in chl-a concentrations).

Phytoplankton concentration is an indicator of trophic state. Chl-a is used in PC1 as a measure of all three core values (e.g. human health for recreation, ecosystem health, and mahinga kai). The NOF states that to achieve a freshwater objective for phytoplankton within a freshwater management unit, regional councils must at least set appropriate instream concentrations and exceedance criteria for DIN and DRP. This has not been done in PC1.

Phytoplankton only becomes problematic in the main stem of the Waikato, and is influenced by a number of factors including: the residence time of river water (influenced by the hydrodams), light, temperature, inputs from the shallow riverine lakes, and nutrients (both N and P) which can limit growth if the supply of either nutrient is limited.

Baseline information for chl-a have been provided for 8 subcatchments in the Waikato. These sites are all on the Waikato River and due to the influence of the hydrodams these have been compared to NOF states for lakes. We have used this information to assign a conservative phytoplankton state to each subcatchment, either A, B, C, or D. The overall state is the lower of the two states assigned to the median and maximum measured values. The analysis for each catchment is shown in Appendix A (Table A3), however a summary table (Table 5) displays the subcatchments within each phytoplankton NOF state.

In the case of phytoplankton, the following narrative attribute state is assigned to the following attribute states:

A – Lake ecological communities are healthy and resilient, similar to natural reference conditions.

B – Lake ecological communities are slightly impacted by additional algal and/or plant growth arising from nutrient levels that are elevated above natural reference conditions.

C (National Bottom Line) – Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrient levels that are elevated well above

natural reference conditions. Reduced water clarity is likely to affect habitat available for native macrophytes.

D – Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state (without native macrophytes/seagrass cover) due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

Table 5: Phytoplankton values and NOF states at sites along the Waikato River.

Subcatchment	Overall NOF state
Waikato at Ohaaki	B
Waikato at Ohakuri	B
Waikato at Whakamaru	-
Waikato at Waipapa	B
Waikato at Narrows	C
Waikato at Horotiu Br	C
Waikato at Huntly-Tainui Br	C
Waikato at Mercer Br	C
Waikato at Tuakau Br	C

Chl-a median concentrations quadruple from Ohaaki to Narrows, likely demonstrating the influence of the hydrodams and nutrient loads in the upper catchment. A small decrease can be seen between Horotiu and Huntly where the inflow from the Waipa River occurs, which does not support phytoplankton. There is a marked increase in concentration between Huntly and Tuakau, likely a response to the inflows from the hypertrophic riverine lakes - Lake Whangape and Lake Waikare. In the Lower Waikato the chl-a population is influenced by the main chl-a concentration in the main stem, which is influenced by a number of factors, including the residence time in the hydrodams and river and the upstream nutrient loads.

The Waikato River is at a “C” state from the Narrows all the way downstream to Tuakau, and is therefore at a “C” state prior to following through the majority of horticultural land that is located in the Lower Waikato catchment.

Phosphorus concentration in Waikato rivers

Like nitrogen, phosphorous (P) is used to measure the state of the ecosystem health and can in-directly impact on the state of the water body for human health for recreation in respect to the influence of phosphorus on phytoplankton biomass and therefore chl-a concentrations, and the impact of chl-a on clarity. Total Phosphorous (TP) is used as an indicator of ecosystem health via the trophic state in the NOF for lakes only, however there are TP default trigger levels for lowland rivers outlined in the ANZECC (2000) guidelines and water quality guidelines developed by WRC.

Table 6 shows that nearly half of all the Healthy Rivers subcatchments are unsatisfactory for TP when compared to the WRC guidelines, and have TP concentrations greater than the default TP trigger values in ANZECC guidelines.

Table 6: Total phosphorus in the Waikato. Comparison to Waikato Regional Council guidelines and ANZECC default trigger values (DTV) for lowland rivers.

Guideline values	No. of subcatchments
WRC guidelines	
Unsatisfactory	42
Satisfactory	18
Excellent	1
Unable to assign	13
ANZECC DTV	
Above DTV	44
Below DTV	17
Unable to assign	13

Sediment in Waikato rivers

Elevated sediment concentrations in rivers can adversely affect both suitability for swimming (due to reductions in water clarity) and ecosystem health, either through deposition and smothering of biota or through the clarity reductions altering the success of visual feeders such as fish and birds (Hughes 2015, Yalden and Elliot 2015).

Sediment trigger levels (total suspended solids (TSS)) are not part of the NOF or PC1. Instead sediment is addressed in PC1 with regards to clarity which is discussed below.

Clarity in Waikato rivers

The visual clarity of water, i.e. how far an observer can see through the water, is primarily determined by its water quality; in particular, the concentrations of light-attenuating constitutes. Water clarity is directly measured in the water body as the horizontal sighting range of a black disc under base flow conditions. The main light-attenuating constituents are yellow substance (coloured dissolved organic suspended material), fine sediment (silts and clays) and phytoplankton (floating algae), and water itself. N and P are the key nutrients that contribute to phytoplankton growth, which is measured as chl-a. Therefore, the factors affecting water clarity can also be understood by measuring N, P, chl-a, and sediment.

As previously outlined above, water clarity, encompassing all of these constituents, is a measurement of ecosystem health; and is used to assess the suitability of water for human health for recreation and mahinga kai practices. As clarity is used as a measurement and assessment criteria for all of the main core values established in PC1, it is an important component to assess in terms of assessing actual and potential effects of landuses/activities on water quality.

Clarity trigger levels are not part of the NOF, although target clarity levels have been determined and reported in PC1. In addition, there are clarity default trigger levels for rivers outlined in the ANZECC guidelines and water quality guidelines developed by WRC.

Table 7 shows that greater than half of all Healthy Rivers subcatchments are unsatisfactory in terms of clarity when compared to the WRC guidelines. Over half of the subcatchments have clarity measurements lower than the default trigger values in the ANZECC guidelines.

Table 7: Clarity in the Waikato. Comparison to Waikato Regional Council guidelines and ANZECC default trigger values (DTV) for lowland rivers.

Guideline values	No. of subcatchments
WRC guidelines	
Unsatisfactory	48
Satisfactory	11
Excellent	0
Unable to assign	15
ANZECC DTV	
Below DTV	39
Above DTV	20
Unable to assign	15

A study by Vant (2015) showed that on average, yellow substance was a minor contributor (c. 2%) to beam attenuation in the Waikato River during 2005–14. Even in the Waipa River its contribution was usually small (<5%), apart from at the most upstream site (where it was c. 8%). On average, phytoplankton contributed an estimated 50–60% of the observed beam attenuation in the section of the Waikato River upstream of the confluence with the Waipa River (at Ngaruawahia). Further downstream, phytoplankton contributed about one-third of beam attenuation on average (Vant, 2015).

Non-algal beam attenuation, which can be mainly attributed to suspended silts and clays, is apparently responsible for the other 40–50% of the beam attenuation in the section of the Waikato River upstream of Ngaruawahia, and most of the beam attenuation in the reach downstream of there. Non-algal attenuation is expected to dominate beam attenuation in the Waipa River (Vant, 2015).

NIWA (Yalden & Elliot, 2015) developed a model to predict change in clarity in the main stem of the Waikato in relation to PC1. The model indicates contribution due to phytoplankton for the upper main stem Waikato River sites is generally high with Ohakuri at 44% and Waipapa at 36% before increasing to 52% at the Narrows site. The Narrows site is downstream from Karapiro dam, which is the final dam on the Waikato River.

Downstream of the dams, the contribution of phytoplankton starts to decrease and drops to 27% at Tuakau. This implies that the relative contribution to phytoplankton has dropped by half by the time the flow reaches Tuakau, with the sediment contribution increasing below Narrows.

Analysis of clarity measurements in the Waikato subcatchments (in Jacobs, 2017) shows that there is a decreasing water clarity trend throughout the Waikato catchment, which generally reflects the increasing concentrations of other constituents that influence it, including nitrogen, phosphorous, sediment and chlorophyll a. Horticultural land is concentrated in the Lower Waikato with poor water clarity largely influenced by upstream landuse and lakes processes. However horticultural land can be expected to have some impact with the discharge of sediment and nutrients.

Interconnection of the four contaminants impact on clarity	The above shows a high level analysis on the current state of water quality within the Waikato region, using the baseline (or modelled) data that was used to inform PC1. However, the four water quality parameters are interconnected when it comes to chl-a concentrations and clarity. A study by Verburg (2016) that analysed chlorophyll, TP, and TN concentrations in the Waikato River shows that: • Chl-a is typically lowest in winter and higher in spring, summer and autumn. • In contrast, DIN and DRP show seasonal patterns of higher concentrations in winter and minima in summer (dissolved nutrients show stronger patterns than TP and TN). • TN:TP ratios are lowest in summer and autumn and highest in winter at all sites from Ohakuri downstream to Tuakau. This is evidence that occasional N limitation may occur during summer and autumn. The outcome of the study by Verburg (2016) is that phosphorus is more important than nitrogen in controlling the annual median phytoplankton biomass in the Waikato at present and efforts to control phytoplankton biomass should focus most on controlling phosphorus. However, nitrogen limitation on phytoplankton biomass during summer and autumn can occur when N levels are reduced by catchment retention processes. The secondary focus should be on nitrogen control to help control summer/autumn chlorophyll a levels.
Horticulture contribution to four contaminants and mitigation techniques	This section outlines the contribution of horticulture to the four contaminants that are lost to the waterways, as well as covering mitigation techniques currently undertaken by horticulturists. Through these mitigation measures, horticultural properties are reducing their contaminant losses and reducing their effects on the environment, and therefore contributing to the achievement of water quality objectives and the core values outlined in PC1. ***E.coli*** Horticulture does not contribute *E. coli* to waterways, except on the rare occasions when a grower may use manure as a fertiliser, and therefore does not contribute to *E. coli* guideline exceedances in the Waikato subcatchments In contrast, dairy, sheep and beef, and urban land uses all contribute *E. coli* to the waterways. **Nitrogen** In the nutrient modelling undertaken by NIWA (Semadeni-Davies, 2015) for the Healthy Rivers process, horticulture had the highest nitrogen leaching value compared to all other land uses. Based on the modelling data provided by NIWA, in total, horticultural land occupies 0.6% of the total area of the Waikato River catchment, and accounts for 2.5% of the TN loads in the overall Waikato River catchment. The majority of the horticultural property in the Waikato is in the lower catchment of the Waikato River, meaning the impact of nitrogen leaching from horticultural enterprises covers a small proportion of the overall Waikato River catchment, and therefore is unlikely to contribute to TN guideline exceedances in the Upper and Central Waikato subcatchments. Horticulture properties undertake the following mitigation techniques to manage N losses: • Nutrient management planning • Proper fertiliser material selection • Cover crops • Careful management of N application e.g. timing, volume, and placement of application

	• Improved irrigation scheduling e.g. irrigation use for maximum uptake of N (as outlined in previous Jacobs technical report). This can help control summer/autumn chlorophyll a levels. **Phosphorus and sediment** Horticultural land occupies 0.6% of the total area of the Waikato River catchment, and accounts for 0.9% of the TP load in the overall catchment, as modelled by NIWA (Semadeni-Davies, 2015). Once again, given the location of the majority of the horticultural property, the impact of phosphorus losses from horticultural enterprises covers a small proportion of the overall Waikato catchment, and therefore is unlikely to contribute to TP guideline exceedances in the Upper and Central Waikato subcatchments. NIWA (Hughes, 2015) modelled annual sediment loads separately for each subcatchment of the Waikato River using the New Zealand Empirical Erosion Model (NZEEM), for the purposes of representing annual average sediment loads lost from the land for PC1. Sediment loads generated in each subcatchment were added into the TP model to estimate phosphorus losses from soil due to mass erosion (sediment-P). The majority of horticultural land is located downstream of Mercer. The sediment concentrations in the Lower Waikato are influenced by the inflow of the Waipa River at Ngaruawahia. In addition, between Rangiriri and Mercer, there are three significant tributaries that contribute high sediment loads. These are the Whangape Lake Catchment and Opuatia to the west, and the Whangamarino River to the east. The contribution of horticulture land to sediment loads predicted from each subcatchment is very low. Horticulture properties undertake the following mitigation techniques to manage sediment and the associated phosphorus (sediment-P) losses: • Erosion and sediment management plans which cover things such as: - cover crops, minimum tillage, setback or buffer strips, wind break crops, stubble mulching, wheel track ripping or dyking, contour drains, benched headlands, silt fences, decanting earth bund, silt traps.
Spotlight on horticultural catchment water quality	A summary of those discrete Waikato River subcatchments where horticulture is an important land use (e.g. horticulture greater than 35 ha of catchment) are in Table 8. These subcatchments (outlined in Table 8) do not include the Waikato River or Waipa River sites specifically as water quality at these sites are more likely to be influenced by wider catchment point source discharges e.g. Hamilton city wastewater discharge. Overall, it can be seen that the predominant landuse in each of the subcatchments is dairy or sheep/beef, with the largest percentage area of horticulture located within the Whakapipi Stream catchment. The median concentrations for water quality parameters for these subcatchments are outlined in Table 9. These values have been compared to the water quality categories that are used by Waikato Regional Council[3], and the ANZECC default trigger values.

[3] Waikato Regional Council, https://www.waikatoregion.govt.nz/Environment/Natural-resources/Water/Rivers/healthyrivers/How-we-measure-quality/ accessed 27 August 2018.

Table 8: Land use areas (as percentage of total area) in 8 catchments (all areas from NIWA data). Rounded to the nearest whole percentage. C = Central Waikato, L = Lower Waikato.

Subcatchment	Location	Area (ha)	Hort [area ha]	Dairy	Dairy support	Sheep and beef	Urban	Forest	MISC
Karapiro Stm	C	6741	1% [36]	19%	5%	62%	1%	4%	8%
Mangaone Stm	C	6760	2% [113]	27%	7%	33%	18%	1%	14%
Mangaonua Stm	C	8096	1% [90]	32%	8%	41%	2%	1%	15%
Mangawhero Stm	C	5347	1% [46]	42%	11%	37%	3%	0%	6%
Ohaeroa Stm	L	2033	6% [123]	14%	4%	56%	2%	3%	15%
Opuatia Stm	L	7319	1% [94]	3%	1%	65%	1%	20%	9%
Whakapipi Stm	L	4663	21% [1,000]	3%	1%	38%	21%	1%	15%
Whangamarino Island Block rd	L	14364	1% [204]	13%	3%	36%	3%	6%	37%

Table 9: Median concentrations for specific subcatchments. Bold font indicates that the concentration is **'unsatisfactory' when compared to WRC guidelines. Italics indicate that the concentration is greater than** the ANZECC default trigger value. Ticks indicate the water quality parameters that are used as a direct measure of each of the three core values of PC1.

Subcatchment	Median Total Nitrogen (g/m^3)	Median Total Phosphorus (g/m^3)	Median Ecoli (Ecoli/100ml)	Clarity Median Black Disk (m)
Karapiro Stm	***0.860***	***0.086***	295	**0.93**
Mangaone Stm	***3.060***	***0.118***	***800***	**0.97**
Mangaonua Stm	***1.905***	***0.054***	***1500***	**0.94**
Mangawhero Stm	***2.930***	***0.210***	**590**	***0.25***
Ohaeroa Stm	***1.825***	0.026	300	**0.81**
Opuatia Stm	***1.070***	0.031	390	***0.53***
Whakapipi Stm	***3.875***	***0.051***	320	**1.10**
Whangamarino Island Block rd	***1.831***	***0.152***	180	***0.20***
WRC guidelines				
Excellent	<0.1	<0.01	<55	>4
Satisfactory	0.1-0.5	0.01-0.04	55-550	1.6-4
Unsatisfactory	>0.5	>0.04	>550	<1.6
ANZECC guidelines				
ANZECC default trigger values[4]	0.614	0.033		0.8
PC1 Core Values				
Human health for recreation			✓	✓

Ecosystem health	✓	✓		✓
Mahinga kai			✓	✓

The dominant land uses in all catchments is dairy, and/or sheep and beef (Table 8). This analysis shows that for the majority of these catchments, water quality in terms of *E. coli* concentrations is 'unsatisfactory' in the Mangaone, Mangaonua, and the Mangawhero Streams. The other catchments all have *E.coli* concentrations as 'satisfactory'. TN for all catchments is 'unsatisfactory' and above ANZECC trigger values, with the Whakapipi with the highest median TN. However, the Whakapipi has the highest value in terms of clarity out of the selected catchments. This analysis shows that water quality measured in these catchments is the result of the mixture of landuses, and as such each landuse should be managed across all four constituents in order to aid in the improvement of water quality.

In addition, it can be seen that there is no specific evidence that horticulture is causing water quality issues in the catchments, given the small percentage of horticulture occurring in each of the subcatchments. However, there are some general trends that could be indicated from this data:

- Whakapipi subcatchment has an area of 4,663 ha and the corresponding percentage land uses are outlined in Table 8 (21% horticulture, 21% urban and, 38% sheep and beef). Baseline TN concentrations are 3.875 g/m^3 which is the largest concentration out of the 74 subcatchments. The Whakapipi has a high percentage of LUC class I and II land compared to other subcatchments in the Lower Waikato (Table 10). Although there are subcatchments in Central Waikato with higher percentages of LUC class I and II land, the frost free climate in the Lower Waikato results in prime conditions for growing vegetables all year round. Correspondingly, horticulture is unlikely to be able to expand in other subcatchments in the Lower Waikato due to the lower percentage of LUC I and II land.

  For horticulture to expand in the Whakapipi subcatchment, it would require offset mitigation or additional mitigations due to the relatively high TN concentration within the stream currently. This catchment is important for domestic food supply due to the high percentage of LUC class I and II land and the optimal climate at this location. Horticulture not being able to be undertaken on the high class soils would result in an increase in production on lower class land. Production on lower class land could mean less efficiency of food production, and as such there would be a loss in production yield and revenue from the land. Lower class land may also have faster draining soils, which would require additional irrigation and increased fertiliser to maintain the same yield (Andrew & Dymond, 2012). This could result in loss of baseflow to rivers and phosphorus pollution of rivers. Production on higher slopes can also lead to additional erosion, further polluting freshwater areas. As such expansion to lower class land may not be viable.

  It is also important to recognise that water quality within a catchment is affected by the volume of stream flow and this is affected by land use, vegetation cover, geology and climate. The catchment area of the Whakapipi is relatively small and there is a high percentage of urban land use, which suggests impervious land cover. The Whakapipi is likely to have lower average stream flows (and specific discharge) than other similar sized catchments due to lower baseflows as a result of impervious areas in the catchment. Therefore, there is less dilution of instream contaminant concentrations.

- Mangaonua subcatchment has an area of 8,096 ha and the corresponding percentage land uses are outlined in Table 8 (1% horticulture, 32% dairy, and 41% sheep and beef). Baseline TN concentrations are lower than many of the other sites,

[4] ANZECC guidelines, lowland river, Table 3.3.10.

however the median *E.coli* concentration is much higher than all other 74 catchments in the Waikato region. TN is not the main water quality issue in the catchment and the catchment may benefit from a decrease in *E.coli* into the river network. Table 9 shows that a reduction in *E. coli* will directly benefit towards the progression of two of the three core values within PC1. Therefore, horticulture should be able to expand into other subcatchments and those subcatchment may benefit with an increase in horticulture and decrease in either dairy or sheep and beef. This improvement would currently not be able to be undertaken under Rule 3.11.5.5 of PC1.

Table 10: LUC I and II land as percentage of total catchment areas.

Subcatchment	Location	Area (ha)	Hort as percentage of total area [area ha]	LUC I and II land as a percentage of total area
Karapiro Stm	C	6741	1% [36]	7%
Mangaone Stm	C	6760	2% [113]	91%
Mangaonua Stm	C	8096	1% [90]	56%
Mangawhero Stm	C	5347	1% [46]	82%
Ohaeroa Stm	L	2033	6% [123]	33%
Opuatia Stm	L	7319	1% [94]	3%
Whakapipi Stm	L	4663	21% [1,000]	52%
Whangamarino Island Block rd	L	14364	1% [204]	20%

Conclusion

This section has shown that the many of subcatchments in the Waikato have poor water quality due to *E. coli*. *E. coli* is a direct measure of two of the core values within PC1, while N is a direct measure of only one of those core values. Therefore, a focus on N, as proposed in PC1, is unlikely to achieve the fulfilment of those core values.

Furthermore, the sensitivity of the receiving environment and the associated main water quality indicator varies between catchments, and needs to be taken into account for values to be provided for. As discussed above, for those catchments in the Central Waikato with relatively high *E. coli* and relatively low N, an increase in horticultural area may be beneficial in order to reduce the *E. coli* load into those catchments. This would improve water quality for recreational purposes and mahinga kai, which are two of the three core values promoted by PC1.

As discussed previously, under Rule 3.11.5.5 existing commercial vegetable production is a controlled activity, subject to matters of control including provisions to achieve Policy 3(d). PC1 also currently has new commercial vegetable growing as a non-complying activity under Rule 3.11.5.7. HortNZ proposes that the plan should enable opportunities for new vegetable production through either a Discretionary or Restricted Discretionary rule.

What we have shown in the above section is that assessing a new land use (e.g. new commercial vegetable production area) based on the comparison of the N reference point is unlikely to achieve the fulfilment of the water quality objectives and core values outlined in PC1. The technical work above has also shown that each of the four contaminants have different effects on the core values in PC1. Horticultural land has a range of mitigations that can reduce the effects of those four contaminants, however the severity of the effects really depends on the vulnerability of the receiving environment (which is different between each subcatchment). Because of this, HortNZ are proposing new assessment criteria for horticultural land as a restricted discretionary activity and have outlined the new assessment

	criteria in their submission. Overall, Jacobs believe the following technical areas should be included within the assessment criteria: • Assessment against all four water quality parameters and core values in PC1 • Area and sensitivity of the receiving environment (subcatchment scale) • Area and sensitivity of whole catchment (either Waikato or Waipa River) • Main water quality indicator for the specific subcatchment

Table 1 : The chosen water quality attributes and the corresponding effect that each have on the three core values identified in PC1.

Values	Description	Total Nitrogen[1], Nitrate[2], Ammonia[2]	Total Phosphorus[1]	Clarity[3]	*E. coli*[3]	Chlorophyll *a*[1] Planktonic cyanobacteria[4]
Human health for recreation ('Swimmability')	The rivers are a place to swim and undertake recreation activities in an environment that poses minimal risk to health.	**Not directly used to measure the state of this value.** However, elevated nutrients and increased residence time can lead to excessive algal and/or plant growth may limit visibility.	**Not directly used to measure the state of this value.** However, elevated nutrients and increased residence time can lead to excessive algal and/or plant growth may limit visibility.	Reductions in water clarity which may limit visibility resulting in injury. Water clarity influences people's choice of where to swim, but does not directly affect human health (Scarsbrook, 2016).	Pathogens such as *E. coli* are harmful to human health. People can be exposed to a risk of infection from contact with water during activities and with occasional immersion and some ingestion of water (such as wading and boating). (MfE, 2014).	Planktonic cyanobacteria - Potential health risks (eg, respiratory, irritation and allergy symptoms) exist from exposure to cyanobacteria (from any contact with fresh water) (MfE, 2014).
Ecosystem Health	The Waikato and Waipa catchments support resilient freshwater ecosystems and healthy freshwater populations of indigenous plants and animals.	Trophic state - Ecological communities may become degraded due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom waters of deep lakes (MfE, 2014). Toxicity – Nitrate and ammonia may impact on growth of multiple species and approach acute impact level (i.e. risk of death) for sensitive species at higher concentrations (MfE, 2014).	Trophic state - Ecological communities may become degraded due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom waters of deep lakes (MfE, 2014).	**Not directly used to measure the state of this value.** Affects ecosystem health either through deposition and smothering of biota or through the clarity reductions altering the success of visual feeders such as birds and fish (Hughes, 2015; Yalden & Elliot, 2015).	**Not directly used to measure the state of this value.**	Trophic state - Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat (MfE, 2014).
Mahinga kai	The ability to access the Waikato and Waipa and their tributaries to gather sufficient quantities of kai (food) that is safe to eat and meets the social and spiritual	**Not directly used to measure the state of this value.** Ecological communities may become degraded due to elevated nutrients and increased residence time leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom waters of deep lakes (MfE, 2014).	**Not directly used to measure the state of this value.** Ecological communities may become degraded due to elevated nutrients and increased residence time leading to excessive algal and/or plant growth, as well as the loss of oxygen in bottom	**Not directly used to measure the state of this value.** Affects ecosystem health either through deposition and smothering of biota or through the clarity reductions altering the success of visual feeders such as birds and	Pathogens such as *E. coli* are harmful to human health	Planktonic cyanobacteria - Potential health risks (eg, respiratory, irritation and allergy symptoms) exist from exposure to cyanobacteria (from any contact with fresh water) (MfE, 2014).

Values	Description	Total Nitrogen[1], Nitrate[2], Ammonia[2]	Total Phosphorus[1]	Clarity[3]	*E. coli*[3]	Chlorophyll *a*[1] Planktonic cyanobacteria[4]
	needs of their stakeholders.		waters of deep lakes (MfE, 2014).	fish (Hughes, 2015; Yalden & Elliot, 2015).		

Notes:

1. TN, TP and chlorophyll *a* (phytoplankton) attributes apply to lakes but also over the entire length of the main stem of the Waikato River from Taupo Gates to Port Waikato. This recognises that the Waikato River is lake-fed, the eight hydro-dam affected reaches function as lakes and phytoplankton growth occurs along the entire river.
2. Nitrate and ammonia attributes apply to rivers, and lake-fed rivers.
3. Water clarity and *E. coli* attributes apply to lakes, rivers, and lake-fed rivers.
4. Planktonic cyanobacteria attribute applies to lakes only.

3. Contaminant losses associated with the expansion of commercial vegetable production

PC1 currently has new commercial vegetable growing as a non-complying activity under Rule 3.11.5.7. WRC have outlined their reasoning behind this activity status in the Section 32a Evaluation Report for PC1. In essence WRC state that commercial vegetable growing has the highest per-hectare contaminant discharges for all landuses across the Waikato and given the complexity of crop rotations, a non-complying activity was considered the most appropriate way to manage the whole rotation of crops rather than trying to regulate it on individual parcels of land.

For determining the non-complying status for new commercial vegetable growing, WRC drew on a technical report undertaken by Monagan et al (2010). This report was undertaken to assess the land use and land management risks to water quality in Southland. It should be noted that there are many differences between Southland and the Waikato, including soils, rainfall, landuse etc, and hence a direct comparison of the findings of this study to the Waikato must be considered with some level of conservativism. The main points on cropping from this report are as follows:

- Grazed winter forage crops (arable crops on farms, rather than commercial vegetable areas) have been identified as having relatively large N leaching losses on a per hectare basis and are the subject of on-going research;
- Cropping systems show a large potential to lose N in drainage, although adherence to key good management practices can greatly decrease these losses;
- Intensive field vegetation systems have the potential to lose very large amount of N via nitrate leaching, through ample quantities of fertiliser which are often used to grow the crop and the large amounts of N that can be left behind in crop residues.

In addition, it was acknowledged within the Section 32a report that commercial vegetable production covers a small percentage of land area in the Waikato catchment and therefore is likely to make only a small contribution to overall catchment-scale water quality degradation. However, it was then concluded that it is a very intensive land use, can lose significant quantities of sediment and phosphorus, and can have a high nitrogen leaching rate per hectare.

Although it is acknowledged by HortNZ that the points regarding the potential for vegetable cropping to lose significant quantities of nutrients are valid, it disagrees with the Non-Complying status of this activity particularly given the very point raised by WRC, e.g. the small percentage of land area that horticulture takes up in the Waikato Region. In addition, given the rotation of crops (as shown in the figure below) only small areas of the entire property are cropped at any one time (in many cases only cropped for 4-8 months, with a covered crop planted for the remainder of the year). This will result in variations of nitrogen throughout the year as well as across successive years. PC1 needs to allow more flexibility for growers for this crop rotation into new parcels of lease land, which may not have been previously used for commercial vegetable growing in the past. This concept is covered in a separate report (Jacobs, 2018).

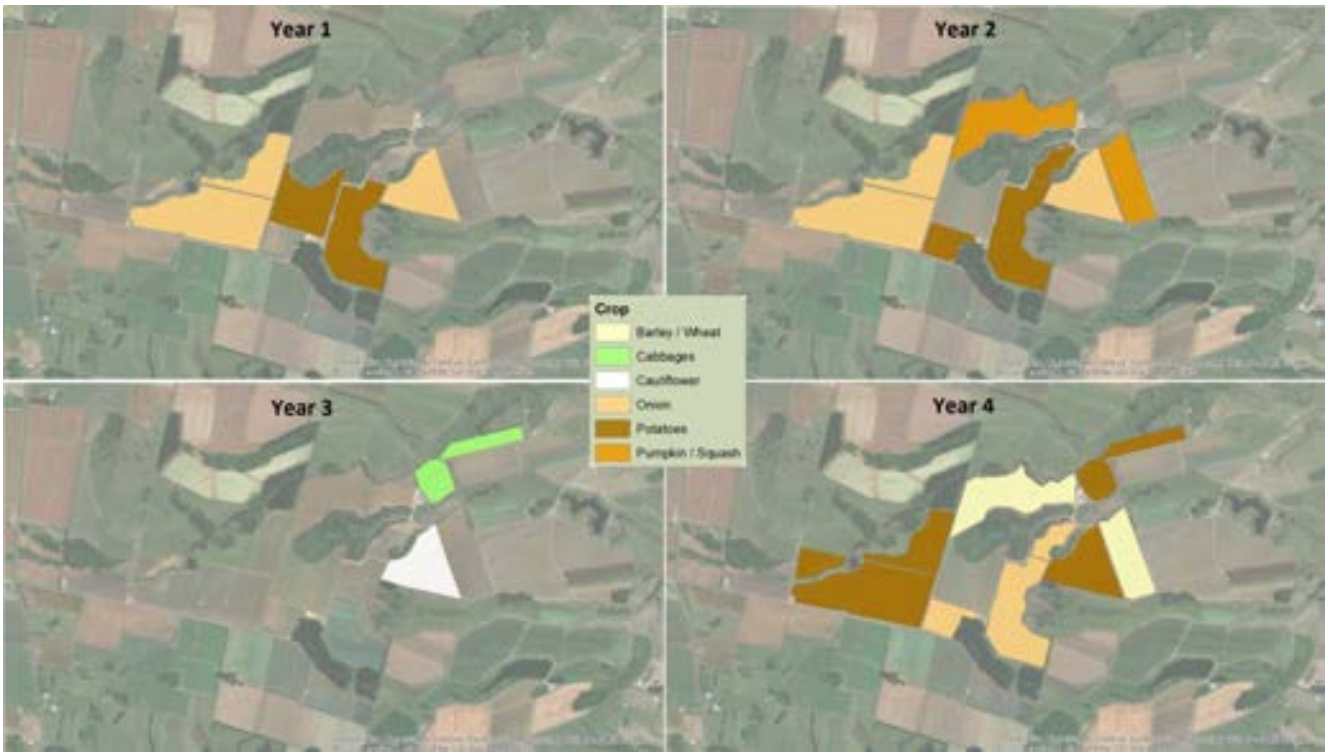


Figure 1: Snapshots of a commercial vegetable crop rotation over four years.

As stated in the HortNZ submission, they propose that the plan should enable opportunities for new vegetable production through either a Discretionary or Restricted Discretionary rule, as long as it is proven that water quality can be shown to be improved on balance with all four water quality parameters. This approach would still allow the new landuse to be assessed against PC1 objectives and policies.

To further support the points raised above, analysis was undertaken to determine whether the freshwater quality values and associated targets identified in PC1 could still be achieved while allowing for sufficient and suitable land to be allocated for commercial vegetable production as well as arable cropping (under either a Restricted Discretionary or Discretionary activity status). The results showed that PC1 values and targets are still achievable with commercial vegetable production. This section provides an overview of the results from two separate case studies:

- Case study 2 – contaminant losses associated with commercial vegetable production; and
- Case study 3 - turnip crops for dairy cattle consumption in the Waikato

Case Study 2 – Contaminant losses associated with commercial vegetable production	
Background	Currently PC1 assesses whether a landuse has an effect on water quality by assessing nitrogen and the N reference point for the land parcel. In addition, PC1 currently has new commercial vegetable cropping as a non-complying activity under Rule 3.11.5.7. The following section will demonstrate that the expansion of commercial vegetable production does not necessarily result in water quality degradation across all of the water quality parameters outlined in PC1.

	Currently, horticulture occupies 0.6% of the total area of the Waikato River catchment and accounts for 2.5% of the TN loads and 0.9% of the TP loads. Horticulture contributes no *E. coli* to waterways, except at those sites where manure is used as a fertiliser which is very rare. In contrast, dairy, sheep and beef, and urban land uses all contribute *E. coli* to the waterways. Faecal source tracking has shown that ruminant and avian sources are the dominant sources of *E. coli* in the Waikato, with ruminant pollution dominant following rainfall (ESR, 2015). Similarly, sediment yields from horticulture are likely to be less than other cultivating land uses (such as those that take place on dairy farms) due to the requirement of sediment mitigating management plans. Therefore, PC1 could apply a multi-contaminant approach to assessing intensification based equally on the risk of nitrogen, phosphorus, *E. coli*, and sediment discharging to water from land – rather than increased emphasis on N and requiring a N reference point as currently proposed.
Scenario Modelling	The scenario modelling below focuses on total N load, rather than leaching rates or yields. As outlined above, horticulture in the Waikato makes up 0.6% of the total land area in the Waikato and contributes 2.5% to the total N load in the Waikato River. Dairy (and dairy support) on the other hand makes up 28% of the total area and contributes 61.4% to the total N load. WRC state that horticulture should be restricted due to its high per-hectare contaminant loss, however when assessing the water quality of the Waikato River catchment, the small area that horticulture covers needs to be taken into consideration. The assessment of N load allows for land area to be taken into consideration and hence a more appropriate comparison of landuse effects can be completed. It also illustrates the proportion of the contribution to water quality per sector in a more meaningful way than comparing leaching data directly. In addition, MfE state that the "interpretation of limit as a load is more consistent with the intent of the NPS-FM and the ability to allocate assimilative capacity explicitly. Loads are also more relevant when considering the impact on receiving environments" (MfE, 2017). **N, P, and *E. coli*** The attenuated annual in-stream loads of N, P, and *E. coli* water quality constituents from the NIWA Healthy Rivers modelling information were compared under different land use scenarios. Baseline unattenuated nutrient and *E. coli* load data for each land use in the Waikato was provided by NIWA. Using the methodology described in the NIWA nutrient modelling report (Semadeni-Davies, 2015) and *E. coli* modelling report (Semadeni-Davies *et al.*, 2015), this data allowed us to model attenuated in-stream nutrient and *E. coli* loads across different land use scenarios. **Sediment** NIWA (Hughes, 2015) modelled annual sediment loads separately for each Healthy River subcatchment using the New Zealand Empirical Erosion Model (NZEEM), for the purposes of representing annual average sediment loads lost from the land for PC1. The NZEEM layer does not differentiate between bare land and pasture and therefore possibly underestimates sediment loss from commercial vegetables. As such, a review of further studies of sediment loads from horticulture was undertaken. Basher and Peterson (2018) undertook erosion trials from two cropping sites in Pukekohe. The trials on the Pukekawa soils resulted in no significant change in surface elevation in any of the plots and no visible evidence of soil movement. However, on the more erodible Onewhero soil there was a measurable change. Across the 6 plots (covering control sites, wheel ripped, and wheel dyked areas) erosion rates ranged from 5.5 t ha^{-1} to 30.9 t ha^{-1}. For

	this scenario modelling we have taken an average of those 6 results and applied it to all horticulture land (17.6 t ha^{-1}). As the study was only a 3 month study we have increased the average by four to represent sediment loss over a year (70.5 t ha^{-1} yr^{-1}). The average has been used as there will be variability across the Waikato with different soil types and mitigation strategies on each property. The new sediment loss rates were applied to horticulture land to calculate a more realistic baseline for sediment load across the Waikato region than that provided using the NZEEM layer. **Scenarios** The three scenarios modelled are outlined below: 1) Scenario 1 – 5% horticultural mitigation: This assumes a 5% reduction in horticultural N losses due to mitigation strategies. 2) Scenario 2 – 10% horticultural mitigation: This assumes a 10% reduction in horticultural N losses due to mitigation strategies. 3) Scenario 3 – 10% growth in horticultural area: This assumes a 5% reduction in horticultural N losses due to mitigation strategies, along with a 10% growth in horticultural area into dairy and dairy support landuses.
Scenario Results	These scenarios were tested on all subcatchments within the Waikato. The change in total N load across the region was calculated for all three scenarios. P, *E. coli* and sediment loads were calculated for the final scenario only. For some of the subcatchments, NIWA assumed that N loads would increase over time due to lagged N load in the groundwater. They multiplied N loads in these subcatchments by an 'ultimate' attenuation factor to account for those loads. For the following assessment we have used the initial attenuation factor in our calculations in order to have a direct comparison to the current baseline loads as the influence of lagged N in groundwater would mask the effect of horticulture in the scenarios. For the N calculations there are 6 subcatchments[5] where we could not match NIWA modelling. We have just used the baseline load for these subcatchments. The results of the scenario modelling per subcatchment are in Appendix A (Table A4 for Scenario 1, Table A5 for Scenario 2, Tables A6-A9 for Scenario 3). A summary table of the total attenuated contaminant loads for the entire Waikato region are displayed in Table 11.

[5] Little Waipa, Pokaiwhenua, Pueto, Waikare, Waikato at Karapiro, and Waikato at Ohaaki.

Table 11 : Scenario results totalled for all 74 subcatchments.

	N attenuated load (t N/yr) [percentage change from baseline]	P attenuated load (t P/yr) [percentage change from baseline]	*E. coli* attenuated load (10^{15} organisms/yr) [percentage change from baseline]	Sediment load (t/yr) [percentage change from baseline]
Baseline	12,726	1,002.1	86.22	2,375,817
Scenario 1	12,710 [-0.13%]	1,002.1	86.22	2,375,817
Scenario 2	12,694 [-0.25%]	1,002.1	86.22	2,375,817
Scenario 3	12,729 [0.02%]	1,002.3 [0.02%]	86.16 [-0.07%]	2,418,490 [1.76%]

With the implementation of mitigation strategies to reduce N losses by 5% in Scenario 1, the total attenuated N load in the Waikato region reduces by 16 t N/yr. Similarly, with the implementation of mitigation strategies to reduce N losses by 10% in Scenario 2, the total attenuated load decreases by 32 t N/yr.

With the implementation of Scenario 3, which incorporates mitigation strategies to reduce N losses by 5% and the 10% growth in horticultural area, the total attenuated N load across the Waikato increases slightly by 3 t N/yr (0.02%). Correspondingly, the attenuated P load increases by 0.2 t P/yr (0.02%) and sediment loss increases by 1.76%. There is also a slight decrease in the *E. coli* loads of 0.06 x 10^{15} organisms/yr (reduction of 0.07%).

Using data from Semani-Davies (2015), dairy and dairy support make up 28% of the area and correspondingly 61.4% of the total baseline unattenuated N load (8,257 t N/yr of 15,661 t N/yr) into the Waikato catchment. Horticulture is 0.6% of the area, and contributes 2.5% of the unattenuated N load (397 t N/yr). Instream processes result in attenuation of N with a decrease from an unattenuated load of 15,661 t N/yr to an attenuated load within the river of 12,726 t N/yr (attenuation of 2,935 t N/yr). Growth of 10% in horticulture area and incorporated mitigation strategies only increase the attenuated load of N by 3 t N/yr or 0.02%, which is minimal when compared to the contribution of N by other sectors and the amount of attenuation that occurs instream.

Please note that these calculations only correspond to the change due to mitigation strategies for horticultural properties and not by any other land uses. In addition, the mitigation strategies are for N only and do not take into account mitigation strategies for P or sediment loss.

This analysis doesn't take into account of any reduction of dairy properties where leaching rates are greater than the 75th percentile. Previous work undertaken by Jacobs (2017) has shown that the reduction by the dairy sector to comply with N leaching level at the 75th percentile to be the equivalent of the whole nitrogen load for the horticultural section (397 t N/yr).

Conclusion	An increase in horticultural area will not result in an increase in all four contaminant loads to receiving waters as indicated by WRC in their Section 32a report. The analysis above shows that while N, P and sediment loss may increase slightly, *E. coli* loads will decrease within catchments. Currently the plan heavily focuses on the use of an N reference point (N leaching limit) to determine whether a land use is more intensive. HortNZ's submission seeks that intensification is assessed based on all four key contaminants and that new horticulture activities should be identified with Discretionary Activity status (or Restricted Discretionary) provided it can be shown that the change in all contaminant loads is minimal and that all contaminants are assessed as equal by Waikato Regional Council. Our findings show that additional restrictions on land conversion to commercial vegetable production may not achieve the water quality targets and values outlined above in Section 2 of this report and as proposed in PC1. Only small increases in N, P and sediment, along with small decreases of *E. coli* would result from land conversion to horticulture, provided that these properties continue to apply mitigation strategies for nitrogen. This analysis also shows that it is more effective to assess contaminant loads in order to achieve water quality outcomes, rather than leaching limits. Limits on contaminant loads, rather than yield and concentrations, will best achieve the water quality targets identified.

Case Study 3 – Turnip crops for dairy cattle consumption in the Waikato	
Background	Horticulture for human and animal consumption follow similar practises for soil cultivation, sowing, and fertilisation regime. Harvesting of crops for animal consumption can differ where crops are directly foraged by animals, as identified by Monaghan et al (2010). Direct foraging risks increased soil erosion and degradation through pugging and increased nutrient loss where vegetation is grazed. This section outlines a comparison of nutrient losses from arable cropping on dairy farms for the purpose of animal feed to the nutrient losses from commercial vegetable operations for human consumption. This assessment indicates that cropping on dairy farms can have greater impacts on nutrient loads into rivers than commercial vegetable cropping for human consumption. This case study also illustrates that new land use changes to commercial vegetable cropping can occur without resulting in degradation of water quality provided that the higher contaminant discharges are offset by areas of lower discharges. This needs to be taken into consideration when considering new development of horticultural land. Intensive cropping is undertaken on dairy farms, a 2016 report by MPI (MPI, 2016) showing that 18% of total dairy diet in New Zealand was made up of non-pasture feeds in 2014-2015, such as imported supplements and crops and vegetables grown on-farm, an increase from 4% in 1990-1991. Cultivated maize silage use has increased steadily while fodder beet crops have rapidly increased from less than 500 hectares in 2007-08 increasing to approximately 50,000 hectares grown in 2014-15, a 10,000% increase. Table 12 shows the cultivated area of non-pasture feed in NZ for the year 2014-15. The trend of non-pasture feed is shown in Figure 2.

Table 12 Cultivated non-pasture dairy feed in NZ (MPI, 2016)

Non-pasture feed	Area sown 2014-2015 (ha)
Maize Grain	19,800
Maize Silage	68,130
Barley	64,200
Wheat	47,700
Oats	6,400
Cereal Whole Crop Silage	15,000
Fodder Beet	50,000
Kale	150,000
Rape	130,000
Turnips	60,000
Swedes	93,000
Other Brassicas	90,000
Total	794,230

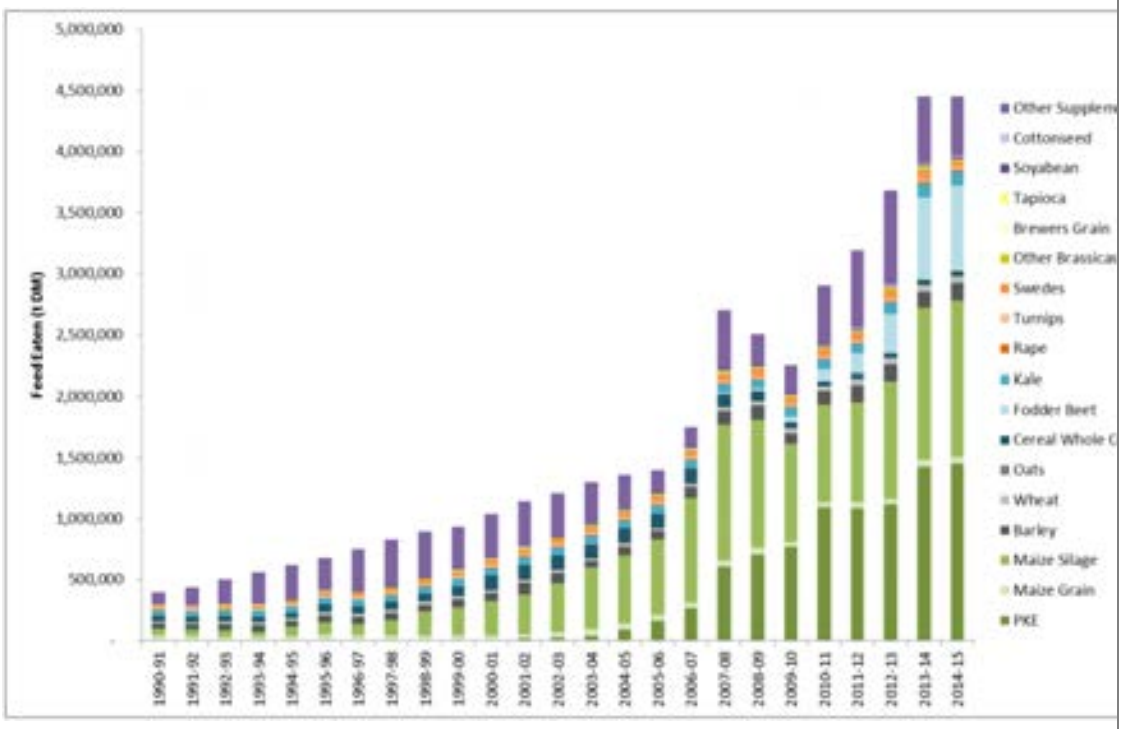


Figure 2 Total feed eaten as supplementary feed type form 1990-91 to 2014-15. From: MPI (2016). Please note that this also includes supplementary feed not grown on the same farm.

Turnip production on dairy farms in the Waikato

There is little data on the area of cropping in the Waikato used for non-pasture dairy feed. However, Table 13 compares the estimated commercial vegetable cropping (potatoes and onions) area for human consumption to three estimates of turnip production area for dairy feed in the Waikato.

Table 13 indicates that horticultural area for human consumption is likely greater than the estimated turnip area for dairy cattle in the lower Waikato, similar in the Central Waikato, and significantly lower in the Waipa and Upper Waikato FMU's. In total, horticultural area in the Waikato is likely to be lower than the total area cropped for dairy.

Horticultural enterprises for human food consumption generally have a higher N loss to water per hectare than most dairy farms. But horticulture do not have the area to average out high N loss of cropping compared to farming enterprises. If we consider that dairy farming includes a mixture of less intensive activities such as pasture and forestry blocks, and more intensive activities such as cropping, and if vegetable growing replaced the crops grown for animal consumption then the N losses to water would likely be less than what is currently occurring.

Table 13 Estimated turnip area for dairy cattle feed in the Waikato

FMU	Horticulture Area[1] (ha)	5% of Dairy Farm in Turnips[2] (ha)	10% of Dairy Farm in Turnips[2] (ha)	2.5 ha Turnips / 100 cows[3] (ha)
Lower Waikato	4,268	2,145	4,290	3,110
Waipa	734	4,415	8,830	6,402
Central Waikato	612	488	976	708
Upper Waikato	490	1,819	3,638	2,637
Total	**6,104**	**8,867**	**17,734**	**12,857**

1. NIWA Healthy Rivers modelling area for Horticulture (Potatoes and Onions).
2. 5-10% of Dairy Farm in turnips follows the demonstration in Shaw et al. (1997) and is consistent with Plant and Food Research (2012) crop rotation tests on an area equivalent to 10% of a dairy operation.
3. Dairy NZ recommend a planting area of 2.5 ha per 100 cows to get enough turnips for 60 days feeding (Dairy NZ, 2018[1]). Area assumes a stocking rate of 2.9 cows/ha (Dairy NZ, 2018[2]), and Dairy area from NIWA Healthy Rivers modelling for Dairy (Dairy only, not including Dairy Support).

Catchment Collectives

This assessment has shown that different landuses on individual pieces of land can have different leaching rates. This supports the work previously undertaken by Jacobs (2017) which proposed a table of subcatchment load limits rather than water quality concentration limits to be incorporated into PC1. These limits could be controlled through the formation of catchment collectives, as proposed by HortNZ in their submission. These collectives would enable the collaborative management of discharges at a scale greater than a single farm. Catchment collective managing discharges as a single enterprise within a subcatchment or a water management unit are very likely to achieve environmental outcomes in a more coordinated and effective way.

Conclusion

This section has outlined a comparison of nutrient losses from arable cropping on dairy farms for the purpose of animal feed to the nutrient losses from commercial vegetable operations for human consumption.

	This assessment has indicated that cropping on dairy farms can have greater impacts on nutrient loads into rivers than commercial vegetable cropping for human consumption, given the effect of direct animal foraging (resulting in high nutrient losses), and the fact that dairy farms are not required to complete a sediment management plan as part of the overall management of the farm. In addition, this case study illustrates that new land use changes to commercial vegetable cropping can occur without resulting in degradation of water quality provided that the higher contaminant discharges are offset by areas of lower discharges, i.e. current horticultural enterprises for human food do not have the area to average out high N loss, as is the case with farming enterprises. This needs to be taken into consideration when considering new development of horticultural land.

4. Existing land use and allocation

Some submitters, such as Beef + Lamb, have put forward an argument that a natural capital (using the Land Use Capability) allocation would be a better approach to achieving the core values identified within PC1 than the approach currently outlined, e.g. the grandparenting approach and good management practice for existing farming activities (with a Farm Environment Plan) and commercial vegetable production outlined under Rules 3.11.5.4 and 3.11.5.5, respectively.

The natural capital approach involves assigning predetermined nitrogen leaching rates (essentially an allocation) to blocks of land with the same qualities as determined by the Landuse Capability (LUC) classification. It should be noted that by using LUC classes, there is no consideration given to the existing water quality, sensitivity of the receiving environment, mitigations being undertaken on sites, which is an important aspect to take into consideration when determining the level of effects on various landuses and in order to meet the proposed Objectives outlined in PC1.

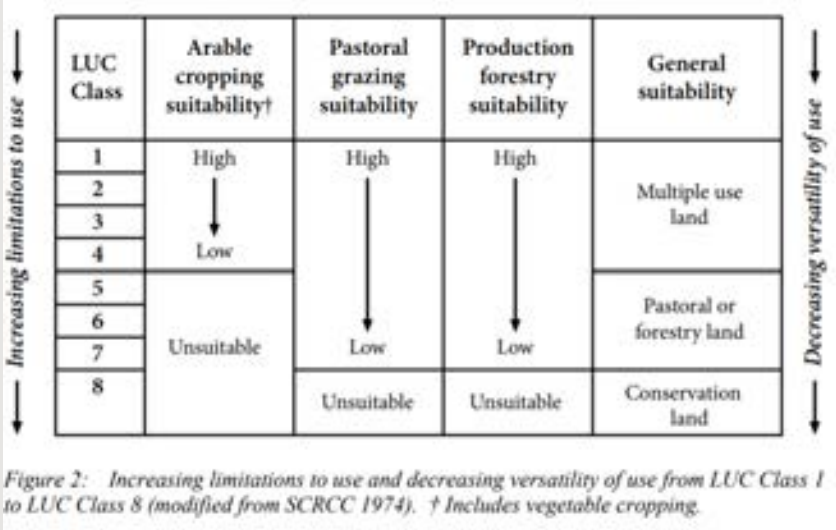
This approach is already being implemented in two regions across New Zealand, Hawkes Bay (under the Tukituki Plan Change 6) and Manawatu-Wanganui (under the Horizons One Plan). HortNZ's experience with these current natural capital allocation methods utilised in these regions is that their default starting point for allocation in livestock farming on hill country. As such, by the time the allocation is assigned to LUC Class I to IIIland, where the horticulture activities occur, there is insufficient allocation available for commercial vegetable growing to be undertaken.

If an approach similar to One Plan was adopted for PC1, it would require vegetable growers who grow for domestic markets to purchase N (i.e. trading) from hill country farmers or forest blocks. In addition, if the natural capital approach is used to set thresholds for rules, then similar to these plans it will focus on controlling the very small N load produced from high intensity commercial vegetable growing, while providing an opportunity for much greater intensification of pastoral land in the rest of the Waikato River catchments.

In this section, two case studies have been undertaken to demonstrate that a natural capital based allocation of N is unlikely to achieve freshwater quality targets and the protection of identified core values in PC1, as this approach ultimately does not result in a decrease in N across the Waikato region. The case studies are as follows:

- Case study 4 – Application of Horizons Regional Council LUC allocation to PC1
- Case Study 5 – Adoption of a Hybrid Natural Capital Approach to N loss

Case Study 4 – Application of Horizons Regional Council LUC allocation to PC1	
Background	The Horizons One Plan proposes a natural capital based N allocation based on land use capability (LUC) classification. Note, we have only assessed the natural capital based allocation from the Horizons One Plan as the allocation levels for N within the Tukituki Plan Change 6 are within the same range as those in the One Plan. This case study explores the impact of applying the N LUC allocation from the Horizons One Plan to the Waikato region and shows that while being unworkable for horticulture, it would also not result in lower N losses across the Waikato.
The LUC system	The LUC system is made up of two parts. Firstly, the Land Resource Inventory (LRI) is compiled based on physical factors such as rock, soil, slope, erosion and vegetation. These factors are critical for long-term land use and management. Secondly, the inventory from above is used for LUC classification, which is the classification of a parcel of land into one of

	eight classes according to its long term capability to sustain one or more productive uses. The classes are based on the physical limitations and site-specific management needs of that particular land parcel determined from the LRI (Lynn *et al.*, 2009). Land use suitability for each class is outlined in the figure below (from Lynn *et al.*, (2009).  *Figure 2: Increasing limitations to use and decreasing versatility of use from LUC Class 1 to LUC Class 8 (modified from SCRCC 1974). † Includes vegetable cropping.* LUC information for all of New Zealand is provided by Landcare Research. The LUC information for the Waikato was assessed against current landuse and shows that most commercial vegetable cropping occurs on LUC Class I and II land (with some on class III land).
Horizons LUC allocation	As previously outlined, Horizons Regional Council (Horizons) utilises the natural capital approach to allocate N leaching limits across the region under their One Plan. This approach derives blanket N leaching limits for a parcel of land based solely on the LUC classification of that land. Such an approach does not consider other factors that might influence N leaching, including mitigations and the activity being undertaken on site. The Horizons One Plan leaching values were originally derived using Overseer version 5.2.6, however Hanly et al (2018) undertook analysis to determine the extent to which N leaching was affected by the OVERSEER version changes (original OVERSEER version 5.2.6 compared to version 6.2.3). The cumulative N leaching maximum for each LUC class for the two Overseer versions is shown in Table 14. Table 14 Horizons One Plan N leaching allocation (Table 2 in Hanly et al., 2018)

LUC	1	2	3	4	5	6	7	8
N leaching maximum (kg/ha/yr) Overseer v5.2.6	30	27	24	18	16	15	8	2
N leaching maximum (kg/ha/yr) Overseer v6.2.3	49.8	44.4	35.7	26.2	22.7	21.6	10.6	3.3

Overall, it can be seen that the cumulative N leaching maximum for each of the LUC classes has increased by up to 66% through the use of Overseer v6.2.3 for individual LUC classes. Horizons have since updated the One Plan with cumulative N leaching maximums that are indicative of OVERSEER version 6.3.0. However, our analysis below is based on the N

	leaching numbers from versions 5.2.6, and 6.2.3 in Table 14 which are lower than those from version 6.3.0 and are therefore conservative. It is acknowledged that bio-physical parameters that govern N leaching (and how they are represented in Overseer simulations) are likely to be different between the Waikato and Horizons regions, therefore the Overseer numbers from Horizons will not strictly be able to be applied to the Waikato region; as such, this is an illustrative exercise only. In addition, the NIWA Healthy Rivers modelling uses Overseer version 6.0, and it is likely that if a similar methodology was applied in the Waikato using Overseer 6.0, the N allocation values would fall between the v5.2.6 and 6.2.3 values used in the Horizons application.
Application to the lower Waikato	For the purposes of determining the potential effects of the Natural Capital approach on the Lower Waikato, the leaching limits outlined in Table 14 for Overseer v5.2.6 were applied to the corresponding LUC land in the Lower Waikato Region. The LUC parcels were also assigned a current leaching rate depending on the current land use, using the NIWA leaching losses spreadsheet (used in Section 3). The current leaching losses per land use were compared with the leaching losses that were assigned using the Horizons leaching limits. Figure 3 shows which areas (in red) do not comply with the Horizons One Plan N leaching allocation. The commercial vegetable cropping (CVC) areas are identified by thatching on Figure 3. This shows that all CVC areas in the Lower Waikato do not comply with the Horizons One Plan N leaching allocation. Hence, if this allocation approach was undertaken in the Lower Waikato, rather than the current grandparenting approach, the existing vegetable cropping would not be able to continue. Figure 3 Compliance to Horizons One Plan - Lower Waikato (using detailed land use mapping and Horizons Overseer v5.2.6 allocation) (See Appendix B for A3 figure)
Application to the entire Waikato River Catchment	A further assessment was undertaken to determine whether N leaching loads would increase or decrease over the entire Waikato River catchment, with the adoption of the LUC allocation method. For this assessment, the leaching limits outlined in Table 14 were also applied to the corresponding LUC land over the Waikato River catchment (as shown in Figure 4). Figure 4 and Figure 5 shows which land area would have N losses above the Horizons One Plan allocation for Overseer v6.2.3 and v5.2.6, respectively. These figures show that there are large areas across the Waikato River catchment that will exceed the Horizons LUC allocation. Figure 4 Compliance to Horizons One Plan N allocation (using Horizons Overseer v6.2.3 allocation) (See Appendix B for A3 figure) Figure 5 Compliance to Horizons One Plan N allocation (using Horizons Overseer v5.2.6 allocation) (See Appendix B for A3 figure) Table 15 provides further assessment of the compliance to the Horizons One Plan allocations across the 74 Healthy Rivers catchments, based on the specific landuses and land area (as defined by the NIWA modelled land uses). Of the modelled land uses, no existing horticulture activities comply with the LUC limits set by Horizons regardless of the Overseer version. Between 10% and 53% of existing dairy land, 46% and 72% of dairy support land, and almost all remaining land uses comply with the LUC limits set by Horizons. This indicates that CVC would be significantly restricted under this allocation, while many of the other landuses will not be as affected.

Table 15 Compliance to Horizons allocation if applied in Waikato

Landuse	Area (ha)	Area (% of total)	N leaching maximum (kg/ha/yr) Overseer v5.2.6		N leaching maximum (kg/ha/yr) Overseer v6.2.3	
			Area complying to Horizons Allocation (ha)	Percent of landuse area complying to Horizons Limit	Area complying to Horizons Allocation (ha)	Percent of landuse area complying to Horizons Limit
Horticulture	6240	1%	0	0%	0	0%
Dairy	228,269	21%	23,567	10%	120,565	53%
Dairy Support	76,090	7%	35,254	46%	54,916	72%
Forestry	168,993	16%	166,774	99%	166,774	99%
Miscellaneous	205,376	19%	205,376	100%	205,376	100%
Sheep & Beef	366,564	34%	342,763	94%	352,119	96%
Urban	26,874	2%	25,573	95%	25,573	95%
Total	1,078,404	-	799,307	74%	925,322	86%

A further assessment was undertaken to determine the average allowable change in N that could occur within the 74 Healthy Rivers catchments (Table 16). The results clearly show that under this allocation approach, all land uses (except horticulture) would be able to increase the average N leaching if the Overseer version 6.2.3 derived LUC limits were applied. This clearly does not meet any of the objectives, polices and core values developed for PC1.

Table 16 Catchment average allowable N leaching under Horizons allocation

Landuse	Average percentage allowable change in N leaching	
	N leaching maximum (kg/ha/yr) Overseer v5.2.6	N leaching maximum ((kg/ha/yr) Overseer v6.2.3
Horticulture	-64%	-43%
Dairy & Dairy Support	-23%	+8%
Forestry	+305%	+493%
Miscellaneous	+547%	+865%
Sheep & Beef	+74%	+163%
Urban	+68%	+156%
Total	+50%	+120%

As a further comparison, Table 17 compares the total NIWA modelled diffuse unattenuated N load to the maximum allocated N load in the event that the Horizons One Plan LUC method

	was implemented in the Waikato. The total N load under the Horizons One Plan allocation is almost double the existing diffuse load. Once again, this does not meet the objectives, polices and core values developed for PC1. Table 17 Total N load comparison

Total NIWA Healthy Rivers diffuse N load (unattenuated) (kg)	Maximum allocated Horizons One Plan N load – Overseer 5.2.6 (kg)	Maximum allocated Horizons One Plan N load – Overseer 6.2.3 (kg)
15,240,424	19,361,065	28,095,686

Conclusion	The above technical work has clearly shown two conclusions: • It is not possible to undertake more intensive land uses such as vegetables cropping under the Horizons One Plan LUC leaching limits. Vegetables would not be able to be grown as N loss allocation has been transferred away from vegetable growing. All land uses apart from horticulture and dairy are able to increase N losses e.g. land uses such as sheep and beef, and forestry are allocated higher N limits than is necessary for such land use. • The new overall N loss load using the LUC allocation method would be larger than the current grandparented load. As such this allocation method would not result in lower N losses across the Waikato. Overall, HortNZ supports a scaled back approach which currently outlined in PC1 such as grandparenting and good management practice. It does not support a change of allocation method to an LUC based allocation of N as proposed by some submitters such as Beef + Lamb unless some changes are made to the allocation method, as investigated under Case Study 5 with a Hybrid Natural Capital Approach.

Case Study 5 – Adoption of a Hybrid Natural Capital Approach to N loss	
Background	HortNZ do not support a change of allocation method for PC1 to an LUC based allocation as outlined in Case Study 4. However, in the event that a Natural Capital approach is considered for PC1, HortNZ have proposed a Hybrid Natural Capital Approach and assessed how this approach could be implemented while allowing for a level of allocation for horticulture (e.g. making new commercial growing either a Discretionary or Restricted Discretionary activity). Natural capital is important for vegetable growing which tends of be on LUC I and II land (and some III). LUC I and II land encompass an area of 174,477 ha in the Waikato and the total area of horticulture is 6,240 ha. Therefore, only a small fraction of the 'best land" (at 3.6%) is currently utilised for vegetable growing. It should be noted that this work does not suggest that all LUC I and II land is allocated an N leaching rate sufficient to be used for vegetable growing. This is because the leaching of vegetables and pastoral uses are not comparable.
Methodology	To undertake this analysis, three scenarios were modelled. The steps undertaken for the scenarios are outlined below: 1) Scenario 1: We can see from Case Study 4 that the maximum allocated N load using the One Plan is almost double the baseline (grandparented) diffuse load in the Waikato.

	We have scaled down the One Plan LUC load by the same percentage in each LUC class, with LUC class VIII remaining at a maximum of 3kg N/ha/year, until the overall Waikato catchment load matches the baseline (grandparented) diffuse load. 2) Scenario 2: We have used the N loss numbers from Agribusiness Group (2014), which were adopted by NIWA for their modelled land uses (64.5-66.8 kg N/ha/yr), minus 5% for mitigation. These new numbers range from 61-63 kg N/ha/yr, depending on the subcatchment. This N loss rate was applied to all the land that is currently identified as horticulture and all other landuses were kept the same. Please note that the N loss rates used by NIWA were from Overseer version 6.1 and were provided by Agribusiness Group (2014) where the range in N loss rates was 64-73 kg N/ha/yr. Agribusiness Group (2018) have since updated their Overseer models to Overseer version 6.2.3 and all models have shown an increased in N loss to water, with a range from 114 kg N/ha/yr for more extensive rotations, to 174 kg N/ha/yr for a more intensive crop mix. However, for this scenario we have used the NIWA N losses from 2014 (with a reduction in 5% for mitigation) as these are comparable to the other landuse losses used for PC1. 3) Scenario 3: The area of horticulture was increased to simulate growth by 10% in the Lower Waikato and the Central Waikato subcatchments, while using the same N loss numbers from Scenario 2. It should be noted that growth per subcatchment was not even e.g. horticulture area did not increase by 10% across every subcatchment, but was placed in subcatchments in the Lower Waikato where growth was more realistic. Overall, the total area of horticulture was grown by 10% across the Waikato entire region.
Results and Discussion	Table 18 shows the resulting N allocation per LUC class when scaling the One Plan allocation to match the baseline (grandparented) diffuse load. It can be seen that the N loss maximums under WRC are significantly lower than those currently allowed under the One Plan, and these maximums under WRC are too low to allow for vegetable growing. Figure 6 shows the WRC grandparented load, and Figure 7 shows the new load using One Plan numbers, but scaled down to match the WRC grandparented load. Figure 6: WRC grandparented load. (See Appendix B for A3 figure) Figure 7: Scenario 1 - New load by area using the One Plan numbers, but scaled down to match WRC grandparented load. (See Appendix B for A3 figure) Table 18: Horizons One Plan N leaching allocation (from Table 2 in Hanly et al., 2018) and a new WRC N leaching allocation.

LUC	1	2	3	4	5	6	7	8
N leaching maximum (kg/ha/yr) Overseer v6.2.3	49.8	44.4	35.7	26.2	22.7	21.6	10.6	3.3
WRC N leaching maximum (kg/ha/yr) reduced to match WRC grandparented load	27.7	24.7	19.9	14.6	12.6	12.0	5.9	3.0

- Table 19 shows the percentage change with regards to the N catchment load under the three scenarios described above for the entire Waikato catchment. This analysis is shown per subcatchment in Appendix A (Table A10). This table shows that applying the WRC N leaching maximum from Table 18 will result in the same N baseline loads (Scenario 1). With horticulture landuse kept at the WRC N leaching maximum (24.7-27.7 kg N/ha/yr) and all other landuses reverting back to the current leaching rates, there will be a decrease in N loss by 1.73%.
- Increasing the N loss maximum only on horticulture land will only result in a 1.7% increase compared to the grandparented load (Scenario 2). Increasing the N loss maximum only on horticulture land and allowing other landuses to revert back to the current leaching rates, will result in a decrease in N loss by 0.13%.
- Increasing the N loss maximum and increasing horticultural land use area by 10% will only result in a 1.9% increase when compared to the grandparented load (Scenario 3). Increasing the N loss maximum and increasing horticultural landuse area by 10% and allowing other landuses to revert back to current leaching rates, will result in a slight increase of 0.11% compared to the grandparented load. The difference between this value and the value in Table 11 (Case Study 2) for N loss loads is because Case Study 2 uses attenuated losses and Case Study 5 uses unattenuated losses, and there is a difference in the landuse partitioning for dairy and dairy support between the two case studies.

Table 19: Percentage change in N loads in the total Waikato catchment.

Description	Grandparented baseline (kg N)	Scenario 1	Scenario 2	Scenario 3
Total catchment with other landuses at new WRC N leaching maximum	16,109,930*	16,109,930 0% change compared to grandparented load	16,367,298 1.6% increase compared to grandparented load	16,388,712 1.7% increase compared to grandparented load
Horticulture N load kg N	410,039	131,897	389,537	428,398
Total catchment with other landuses remaining at current N loss rates	15, 699,891	15,831,788 1.73% decrease compared to grandparented load	16,089,428 0.13% decrease compared to grandparented load	16,128,288 0.11% increase compared to grandparented load

* This value is slightly different from the value presented in Case Study 4 – Table 14 as dairy support has not been differentiated from dairy in this case study and the area has had the same leaching rates applied to as dairy (whereas in reality it would be slightly less).

Table 20 shows a comparison of the percentage change in N loads under the 3 Scenarios and per land use. This table shows:

- Under Scenario 1, the percentage contribution from the dairy sector is reduced by 46% of the baseline and horticulture drops by 68% of the baseline N load. Sheep and beef, forestry, urban, and miscellaneous sectors can all increase N losses. These increases and reductions are not evenly distributed across catchments and Table A10 in Appendix A shows that in those catchments where sheep and beef are dominant, there would additional N to be lost than currently occurring in baseline, which would provide for greater intensification in this land use such as winter forage grazing. In those catchments where horticulture or dairy dominate, there would be less N to be lost than

currently available in the baseline, meaning these land uses may no longer be viable in these subcatchments.

- Scenario 2 shows that under the maximum N loss rate, the contribution by horticulture will be the same amount as it is in the grandparented baseline load (at 0% change). The total load will only increase by 1.7% (which is shown above in Table 17) from the grandparented load. Figure 8 shows the hybrid natural capital allocation with horticulture ring fenced with a N loss rate of 61-63 kg N/ha/yr.
- Under Scenario 3, the N loss load for horticulture has increased to 4% to reflect the 10% increase in area, while only increasing total load by 1.9% (which is shown above in Table 17) from the grandparented load. Figure 9 shows the hybrid natural capital allocation with horticulture ring fenced with a N loss rate of 61-63 kg N/ha/yr and the total area increased by 10%.

Figure 8: Scenario 2 – natural capital allocation with increased allocation for horticulture land.
(See Appendix B for A3 figure)

Figure 9: Scenario 3 - natural capital allocation with increased allocation for horticulture land and an increase in area of 10%.
(See Appendix B for A3 figure)

Table 20: Percentage change in N loads across landuse.

Land use	Grandparented baseline (kg N)	Scenario 1 Percent change compared to grandparented load	Scenario 2 Percent change compared to grandparented load	Scenario 3 Percent change compared to grandparented load
Dairy and dairy support	10,209,963	-46%	-46%	-46%
Forestry	675,970	210%	210%	210%
Horticulture	410,039	-68%	-5%	4%
MISC	513,439	355%	355%	354%
Sheep and beef	3,978,034	38%	38%	38%
Urban	322,484	58%	58%	56%

Conclusion

For the above modelling, the leaching values assumed for the different LUC classes are illustrative and could differ. The maximum leaching limits for horticulture based on Stuart Fords analysis (Agribusiness Group, 2014) are lower than what has been modelled on a more recent version of Overseer (Agribusiness Group, 2018). However, these are comparative to the N loss rates used for the other land uses.

This work shows that if the natural capital approach is adopted, then new vegetable crop growing would not be possible. However, if the policy in PC1 allows for vegetable growing to exceed pastoral natural capital then vegetable growing could be provided for with a small decrease in the total N load (0.13% reduction in Scenario 2), and a small increase when vegetables are able to grow by 10% area (0.11% increase in Scenario 3). With the small increases in N load (under Scenario 3) and the expected reductions in *E. coli* (as discussed

	in Case Study 2), we believe that new vegetable growing should be a Restricted Discretionary Activity.

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Appendix A. Tables

Table A1 *E Coli* NOF bands – observed data

Site	FMU	Ecoli Median (no./100 ml)	Ecoli Median NOF band	Ecoli 95th percentile (no./100 ml)	Ecoli 95th percentile band	Overall Ecoli NOF band*
Kirikiriroa Stm	Central Waikato	570	2300	E	D	E
Waikato at Horotiu Bridge	Central Waikato	100	800	A	B	B
Waikato at Bridge St Br	Central Waikato	-	-	-	-	-
Waitawhiriwhiri Stm	Central Waikato	605	6520	E	D	E
Mangaonua Stm	Central Waikato	1500	7020	E	D	E
Mangakotukutuku Stm	Central Waikato	515	12600	E	D	E
Mangaone Stm	Central Waikato	800	2220	E	D	E
Karapiro Stm	Central Waikato	295	4960	E	D	E
Waikato at Narrows	Central Waikato	39	340	A	A	A
Mangawhero Stm	Central Waikato	590	3185	E	D	E
Mangatawhiri River	Lower Waikato	190	5615	D	D	D
Mangatangi River	Lower Waikato	380	6125	E	D	E
Whakapipi Stm	Lower Waikato	320	1910	E	D	E
Waikato at Tuakau Br	Lower Waikato	80	1700	A	D	D
Awaroa River (Waiuku)	Lower Waikato	240	1070	D	C	D
Waikato at Port Waikato	Lower Waikato	-	-	-	-	-
Ohaeroa Stm	Lower Waikato	300	5125	E	D	E
Whangamarino Jefferies Rd	Lower Waikato	600	5175	E	D	E
Waikato at Mercer Br	Lower Waikato	80	1600	A	D	D
Whangamarino Island Block rd	Lower Waikato	180	668	D	B	D
Opuatia Stm	Lower Waikato	390	3160	E	D	E
Waerenga Stm	Lower Waikato	500	5605	E	D	E
Waikare	Lower Waikato	-	-	-	-	-
Matahuru Stm	Lower Waikato	600	6770	E	D	E
Waikato at Rangiriri	Lower Waikato	-	-	-	-	-
Whangape Stm	Lower Waikato	220	589	D	B	D
Mangawara Stm	Lower Waikato	1000	5445	E	D	E

Site	FMU	Ecoli Median (no./100 ml)	Ecoli Median NOF band	Ecoli 95th percentile (no./100 ml)	Ecoli 95th percentile band	Overall Ecoli NOF band*
Awaroa (Rotowaro) at Harris/Te Ohaki Br	Lower Waikato	-	-	-	-	-
Awaroa Stm (Rotowaro0 Sansons Br	Lower Waikato	290	1940	E	D	E
Waikato Huntly-Tainui Br	Lower Waikato	115	2100	A	D	D
Komakorau Stm	Lower Waikato	1100	3800	E	D	E
Waikato at Karapiro	Upper Waikato	-	-	-	-	-
Little Waipa Stm	Upper Waikato	110	1470	A	D	D
Pokaiwhenua Stm	Upper Waikato	150	1455	D	D	D
Mangamingi Stm	Upper Waikato	580	2330	E	D	E
Whakauru Stm	Upper Waikato	480	2280	E	D	E
Tahunaatara Stm	Upper Waikato	110	810	A	B	B
Whirinaki Stm	Upper Waikato	16	98	A	A	A
Mangaharakeke Stm	Upper Waikato	170	700	D	B	D
Waiotapu Stm Campbell Rd	Upper Waikato	2	18	A	A	A
Otamakokore Stm	Upper Waikato	220	696	D	B	D
Kawaunui Stm	Upper Waikato	200	2535	D	D	D
Waikato River Waipapa	Upper Waikato	7	162	A	A	A
Waiotapu Stm Homestead Rd	Upper Waikato	110	281	A	A	A
Waikato River Ohakuri	Upper Waikato	2	15	A	A	A
Waikato River Whakamaru	Upper Waikato	7	60	A	A	A
Mangakara Stm	Upper Waikato	140	1700	D	D	D
Waipapa Stm (Mokai)	Upper Waikato	100	1215	A	D	D
Mangakino Stm	Upper Waikato	40	251	A	A	A
Torepatutahi Stm	Upper Waikato	54	216	A	A	A
Waikato River Ohaaki	Upper Waikato	13.5	70	A	A	A
Pueto Stm	Upper Waikato	21	92	A	A	A
Firewood	Waipa	-	-	-	-	-
Waipa at Waingaro Rd Br	Waipa	-	-	-	-	-
Ohote Stm	Waipa	275	2320	E	D	E

Site	FMU	Ecoli Median (no./100 ml)	Ecoli Median NOF band	Ecoli 95th percentile (no./100 ml)	Ecoli 95th percentile band	Overall Ecoli NOF band*
Waipa River Whatawhata Br	Waipa	387.3	4003	E	D	E
Kaniwhaniwha Stm	Waipa	250	2070	D	D	D
Mangauika Stm	Waipa	33	1060	A	C	C
Mangapiko Stm	Waipa	325	7800	E	D	E
Mangaohoi Stm	Waipa	65	987	A	B	B
Puniu River Bartons Corner	Waipa	140	3040	D	D	D
Moakurarua	Waipa	-	-	-	-	-
Waipa Pirongia-Ngutunui Rd Br	Waipa	300	4875	E	D	E
Waitomo Stm SH31 Otorohanga	Waipa	310	1555	E	D	E
Mangatutu Stm	Waipa	160	760	D	B	D
Puniu at Wharepapa	Waipa	-	-	-	-	-
Waipa River Otorohanga	Waipa	180	3595	D	D	D
Waitomo Stm Tumutumu Rd	Waipa	180	2430	D	D	D
Mangapu River	Waipa	480	4700	E	D	E
Mangarapa	Waipa	-	-	-	-	-
Waipa River Otewa	Waipa	235.9	2203	D	D	D
Mangarama	Waipa	-	-	-	-	-
Mangaokewa Stm	Waipa	490	6855	E	D	E
Waipa River Mangaokewa Rd	Waipa	210	2625	D	D	D

* Overall Ecoli NOF band in the NPS-FM is based on an additional two metrics not available in the provided data.

Table A2 Nitrate NOF bands

Site	FMU	Nitrate Median (mg/l)	Nitrate Median NOF band	Nitrate 95th percentile (mg/l)	Nitrate 95th percentile band	Overall Nitrate NOF band
Kirikiriroa Stm	Central Waikato	0.815	1.58	A	B	B
Waikato at Horotiu Bridge	Central Waikato	0.26	0.53	A	A	A
Waikato at Bridge St Br	Central Waikato	-	-	-	-	-

Site	FMU	Nitrate Median (mg/l)	Nitrate Median NOF band	Nitrate 95th percentile (mg/l)	Nitrate 95th percentile band	Overall Nitrate NOF band
Waitawhiriwhiri Stm	Central Waikato	0.88	1.24	A	A	A
Mangaonua Stm	Central Waikato	1.505	1.92	B	B	B
Mangakotukutuku Stm	Central Waikato	0.8	1.82	A	B	B
Mangaone Stm	Central Waikato	2.6	3.1	C	B	C
Karapiro Stm	Central Waikato	0.52	1.71	A	B	B
Waikato at Narrows	Central Waikato	0.235	0.5	A	A	A
Mangawhero Stm	Central Waikato	2.1	2.6	B	B	B
Mangatawhiri River	Lower Waikato	0.01345	0.37	A	A	A
Mangatangi River	Lower Waikato	0.1095	1.12	A	A	A
Whakapipi Stm	Lower Waikato	3.5	5.3	C	C	C
Waikato at Tuakau Br	Lower Waikato	0.325	0.88	A	A	A
Awaroa River (Waiuku)	Lower Waikato	1.41	2.4	B	B	B
Waikato at Port Waikato	Lower Waikato	-	-	-	-	-
Ohaeroa Stm	Lower Waikato	1.525	1.84	B	B	B
Whangamarino Jefferies Rd	Lower Waikato	0.625	1.88	A	B	B
Waikato at Mercer Br	Lower Waikato	0.365	0.87	A	A	A
Whangamarino Island Block rd	Lower Waikato	0.0745	0.7	A	A	A
Opuatia Stm	Lower Waikato	0.74	1.06	A	A	A
Waerenga Stm	Lower Waikato	0.82	1.41	A	A	A
Waikare	Lower Waikato	-	-	-	-	-
Matahuru Stm	Lower Waikato	0.715	1.71	A	B	B
Waikato at Rangiriri	Lower Waikato	-	-	-	-	-
Whangape Stm	Lower Waikato	0.0035	0.69	A	A	A
Mangawara Stm	Lower Waikato	0.765	2.9	A	B	B
Awaroa (Rotowaro) at Harris/Te Ohaki Br	Lower Waikato	-	-	-	-	-
Awaroa Stm (Rotowaro0 Sansons Br	Lower Waikato	0.7	1.19	A	A	A
Waikato Huntly-Tainui Br	Lower Waikato	0.365	0.9	A	A	A
Komakorau Stm	Lower Waikato	1.31	4.5	B	C	C
Waikato at Karapiro	Upper Waikato	-	-	-	-	-
Little Waipa Stm	Upper Waikato	1.58	2.1	B	B	B

Site	FMU	Nitrate Median (mg/l)	Nitrate Median NOF band	Nitrate 95th percentile (mg/l)	Nitrate 95th percentile band	Overall Nitrate NOF band
Pokaiwhenua Stm	Upper Waikato	1.755	2.1	B	B	B
Mangamingi Stm	Upper Waikato	2.8	3.3	C	B	C
Whakauru Stm	Upper Waikato	0.26	0.45	A	A	A
Tahunaatara Stm	Upper Waikato	0.555	0.83	A	A	A
Whirinaki Stm	Upper Waikato	0.77	0.87	A	A	A
Mangaharakeke Stm	Upper Waikato	0.525	0.75	A	A	A
Waiotapu Stm Campbell Rd	Upper Waikato	0.915	1.1	A	A	A
Otamakokore Stm	Upper Waikato	0.74	1.19	A	A	A
Kawaunui Stm	Upper Waikato	2.6	3	C	B	C
Waikato River Waipapa	Upper Waikato	0.1635	0.32	A	A	A
Waiotapu Stm Homestead Rd	Upper Waikato	1.285	1.57	B	B	B
Waikato River Ohakuri	Upper Waikato	0.0835	0.172	A	A	A
Waikato River Whakamaru	Upper Waikato	0.101	0.23	A	A	A
Mangakara Stm	Upper Waikato	1.3	1.6	B	B	B
Waipapa Stm (Mokai)	Upper Waikato	1.21	1.5	B	A	B
Mangakino Stm	Upper Waikato	0.65	0.86	A	A	A
Torepatutahi Stm	Upper Waikato	0.5	0.8	A	A	A
Waikato River Ohaaki	Upper Waikato	0.039	0.062	A	A	A
Pueto Stm	Upper Waikato	0.45	0.53	A	A	A
Firewood	Waipa	-	-	-	-	-
Waipa at Waingaro Rd Br	Waipa	-	-	-	-	-
Ohote Stm	Waipa	0.495	1.37	A	A	A
Waipa River Whatawhata Br	Waipa	0.673072	1.31866	A	A	A
Kaniwhaniwha Stm	Waipa	0.35	0.89	A	A	A
Mangauika Stm	Waipa	0.21	0.28	A	A	A
Mangapiko Stm	Waipa	1.41	2.6	B	B	B
Mangaohoi Stm	Waipa	0.23	0.39	A	A	A
Puniu River Bartons Corner	Waipa	0.65	1.28	A	A	A
Moakurarua	Waipa	-	-	-	-	-
Waipa Pirongia-Ngutunui Rd Br	Waipa	0.565	1.27	A	A	A
Waitomo Stm SH31 Otorohanga	Waipa	0.52	0.83	A	A	A

Site	FMU	Nitrate Median (mg/l)	Nitrate Median NOF band	Nitrate 95th percentile (mg/l)	Nitrate 95th percentile band	Overall Nitrate NOF band
Mangatutu Stm	Waipa	0.38	0.88	A	A	A
Puniu at Wharepapa	Waipa	-	-	-	-	-
Waipa River Otorohanga	Waipa	0.37	1.05	A	A	A
Waitomo Stm Tumutumu Rd	Waipa	0.63	0.8	A	A	A
Mangapu River	Waipa	0.86	1.36	A	A	A
Mangarapa	Waipa	-	-	-	-	-
Waipa River Otewa	Waipa	0.228125	0.502224	A	A	A
Mangarama	Waipa	-	-	-	-	-
Mangaokewa Stm	Waipa	0.53	0.98	A	A	A
Waipa River Mangaokewa Rd	Waipa	0.38	0.6	A	A	A

Table A3: Phytoplankton values and NOF states at sites along the Waikato River.

Subcatchment	**Median measured values 2010-2014 Chl-a (mg/m3)**	**Phytoplankton state (median)**	**Maximum measured values 2010-2014 Chl-a (mg/m3)**	**Phytoplankton state (maximum)**	**Overall NOF state**
Waikato at Ohaaki	1.5	A	13	B	B
Waikato at Ohakuri	3.2	B	11	B	B
Waikato at Whakamaru	-	-	-	-	-
Waikato at Waipapa	4.1	B	25	B	B
Waikato at Narrows	5.5	C	23	B	C
Waikato at Horotiu Br	6.2	C	23	B	C
Waikato at Huntly-Tainui Br	6.0	C	19	B	C
Waikato at Mercer Br	10.5	C	30	C	C
Waikato at Tuakau Br	12.0	C	38	C	C

Table A4 Predicted change in N load under a 5% mitigation of N losses in Scenario 1, Case Study 2

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% horticulture mitigation (t/year)	Overall Change in Load
Awaroa (Rotowaro) at Harris	48.70	48.70	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% horticulture mitigation (t/year)	Overall Change in Load
Awaroa (Waiuku)	31.84	31.75	-0.26%
Awaroa (Rotowaro) at Sansons Br	33.57	33.57	0.00%
Firewood	25.13	25.13	0.00%
Kaniwhaniwha	75.30	75.30	0.00%
Karapiro	19.02	19.00	-0.12%
Kawaunui	5.23	5.23	0.00%
Kirikiriroa	14.16	14.16	0.00%
Komakorau	403.28	403.21	-0.02%
Little Waipa*	154.51	154.51	0.00%
Mangaharakeke**	30.18	30.11	-0.22%
Mangakara	19.95	19.95	0.00%
Mangakino	212.48	212.48	0.00%
Mangakotukutuku	35.61	35.61	-0.01%
Mangamingi	195.19	195.19	0.00%
Mangaohoi	1.49	1.49	0.00%
Mangaokewa	158.13	158.13	0.00%
Mangaone	70.64	70.41	-0.32%
Mangaonua	80.14	79.96	-0.22%
Mangapiko	430.92	430.85	-0.02%
Mangapu	251.24	251.24	0.00%
Mangarama	71.89	71.89	0.00%
Mangarapa	71.47	71.47	0.00%
Mangatangi	120.91	120.90	-0.01%
Mangatawhiri	20.09	20.09	0.00%
Mangatutu	99.42	99.42	0.00%
Mangauika	4.21	4.22	0.10%
Mangawara	661.36	661.36	0.00%
Mangawhero	34.43	34.38	-0.15%
Matahuru	108.02	108.02	0.00%
Moakurarua	200.49	200.49	0.00%
Ohaeroa	19.77	19.51	-1.36%
Ohote	34.05	34.03	-0.06%
Opuatia	68.26	67.96	-0.44%
Otamakokore	48.85	48.85	0.00%
Pokaiwhenua*	115.74	115.74	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% horticulture mitigation (t/year)	Overall Change in Load
Pueto*	96.75	96.75	0.00%
Puniu at Wharepapa	188.83	188.83	0.00%
Puniu at Bartons Corner Rd Br**	410.42	409.68	-0.18%
Tahunaatara	170.12	170.12	0.00%
Torepatutahi	79.85	79.85	0.00%
Waerenga	5.49	5.49	0.00%
Waikare*	89.10	89.10	0.00%
Waikato at Bridge St Br	60.61	60.22	-0.65%
Waikato at Horotiu Br	262.36	262.36	0.00%
Waikato at Karapiro*	811.31	811.31	0.00%
Waikato at Mercer Br	504.64	501.58	-0.61%
Waikato at Narrows	269.01	268.68	-0.12%
Waikato at Port Waikato	396.84	393.87	-0.75%
Waikato at Rangiriri	88.26	88.26	0.00%
Waikato at Tuakau Br	159.59	157.34	-1.41%
Waikato at Huntly-Tainui Br	399.70	399.45	-0.06%
Waikato at Ohaaki*	613.21	613.21	0.00%
Waikato at Ohakuri**	320.15	320.23	0.02%
Waikato at Waipapa**	581.36	581.49	0.02%
Waikato at Whakamaru**	296.90	296.74	-0.05%
Waiotapu at Campbell	46.04	46.04	0.00%
Waiotapu at Homestead	250.40	250.40	0.00%
Waipa at Pirongia-Ngutunui Rd Br	753.35	752.97	-0.05%
Waipa at Waingaro Rd Br	124.96	124.75	-0.17%
Waipa at Mangaokewa Rd	16.89	16.89	0.00%
Waipa at Otewa	215.07	215.07	0.00%
Waipa at Otorohanga	184.06	184.06	0.00%
Waipa at SH23 Br Whatawhata	494.95	494.63	-0.06%
Waipapa**	53.52	53.49	-0.05%
Waitawhiriwhiri	25.17	25.17	0.00%
Waitomo at SH31 Otorohanga	42.95	42.95	0.00%
Waitomo at Tumutumu Rd	32.13	32.13	0.00%
Whakapipi	97.45	94.31	-3.22%
Whakauru	24.73	24.73	0.00%
Whangamarino at Island Block Rd	130.48	129.85	-0.49%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% horticulture mitigation (t/year)	Overall Change in Load
Whangamarino at Jefferies Rd Br	123.22	123.12	-0.08%
Whangape	322.04	322.04	0.00%
Whirinaki	8.38	8.38	0.00%

* Calculations of attenuated loads for this site did not match NIWA modelling and therefore the baseline load was used in the calculations for 6 catchments. The overall change in load was changed to be 0%.

** These catchments are likely to have slight overestimations or underestimations due to rounding. These results were left in as the total change for the 6 subcatchments only amounts to 0.02 tonnes of N.

Table A5 Predicted change in N load under a 10% mitigation of N losses in Scenario 2, Case Study 2

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 10% horticulture mitigation (t/year)	Overall Change in Load
Awaroa (Rotowaro) at Harris	48.70	48.70	0.00%
Awaroa (Waiuku)	31.84	31.67	-0.53%
Awaroa (Rotowaro) at Sansons Br	33.57	33.57	0.00%
Firewood	25.13	25.13	0.00%
Kaniwhaniwha	75.30	75.30	0.00%
Karapiro	19.02	18.98	-0.25%
Kawaunui	5.23	5.23	0.00%
Kirikiriroa	14.16	14.16	0.00%
Komakorau	403.28	403.14	-0.04%
Little Waipa*	154.51	154.51	0.00%
Mangaharakeke**	30.18	30.11	-0.22%
Mangakara	19.95	19.95	0.00%
Mangakino	212.48	212.48	0.00%
Mangakotukutuku	35.61	35.61	-0.01%
Mangamingi	195.19	195.19	0.00%
Mangaohoi	1.49	1.49	0.00%
Mangaokewa	158.13	158.13	0.00%
Mangaone	70.64	70.19	-0.64%
Mangaonua	80.14	79.79	-0.45%
Mangapiko	430.92	430.77	-0.03%
Mangapu	251.24	251.24	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 10% horticulture mitigation (t/year)	Overall Change in Load
Mangarama	71.89	71.89	0.00%
Mangarapa	71.47	71.47	0.00%
Mangatangi	120.91	120.89	-0.02%
Mangatawhiri	20.09	20.09	0.00%
Mangatutu	99.42	99.42	0.00%
Mangauika	4.21	4.22	0.10%
Mangawara	661.36	661.36	0.00%
Mangawhero	34.43	34.33	-0.30%
Matahuru	108.02	108.02	0.00%
Moakurarua	200.49	200.49	0.00%
Ohaeroa	19.77	19.24	-2.72%
Ohote	34.05	34.00	-0.13%
Opuatia	68.26	67.66	-0.87%
Otamakokore	48.85	48.85	0.00%
Pokaiwhenua*	115.74	115.74	0.00%
Pueto*	96.75	96.75	0.00%
Puniu at Wharepapa	188.83	188.83	0.00%
Puniu at Bartons Corner Rd Br**	410.42	408.93	-0.36%
Tahunaatara	170.12	170.12	0.00%
Torepatutahi	79.85	79.85	0.00%
Waerenga	5.49	5.49	0.00%
Waikare*	89.10	89.10	0.00%
Waikato at Bridge St Br	60.61	59.82	-1.30%
Waikato at Horotiu Br	262.36	262.36	0.00%
Waikato at Karapiro*	811.31	811.31	0.00%
Waikato at Mercer Br	504.64	498.53	-1.21%
Waikato at Narrows	269.01	268.35	-0.25%
Waikato at Port Waikato	396.84	390.90	-1.50%
Waikato at Rangiriri	88.26	88.26	0.00%
Waikato at Tuakau Br	159.59	155.08	-2.83%
Waikato at Huntly-Tainui Br	399.70	399.21	-0.12%
Waikato at Ohaaki*	613.21	613.21	0.00%
Waikato at Ohakuri**	320.15	320.23	0.02%
Waikato at Waipapa**	581.36	581.49	0.02%
Waikato at Whakamaru**	296.90	296.73	-0.06%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 10% horticulture mitigation (t/year)	Overall Change in Load
Waiotapu at Campbell	46.04	46.04	0.00%
Waiotapu at Homestead	250.40	250.40	0.00%
Waipa at Pirongia-Ngutunui Rd Br	753.35	752.58	-0.10%
Waipa at Waingaro Rd Br	124.96	124.54	-0.34%
Waipa at Mangaokewa Rd	16.89	16.89	0.00%
Waipa at Otewa	215.07	215.07	0.00%
Waipa at Otorohanga	184.06	184.06	0.00%
Waipa at SH23 Br Whatawhata	494.95	494.30	-0.13%
Waipapa**	53.52	53.46	-0.10%
Waitawhiriwhiri	25.17	25.17	0.00%
Waitomo at SH31 Otorohanga	42.95	42.95	0.00%
Waitomo at Tumutumu Rd	32.13	32.13	0.00%
Whakapipi	97.45	91.19	-6.43%
Whakauru	24.73	24.73	0.00%
Whangamarino at Island Block Rd	130.48	129.21	-0.98%
Whangamarino at Jefferies Rd Br	123.22	123.03	-0.15%
Whangape	322.04	322.04	0.00%
Whirinaki	8.38	8.38	0.00%

* Calculations of attenuated loads for this site did not match NIWA modelling and therefore the baseline load was used in the calculations for 6 catchments. The overall change in load was changed to be 0%.

** These catchments are likely to have slight overestimations or underestimations due to rounding. These results were left in as the total change for the 6 subcatchments only amounts to 0.02 tonnes of N.

Table A6 Predicted change in N load under a 10% growth in Scenario 3, Case Study 2.

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Awaroa (Rotowaro) at Harris	48.70	48.70	0.00%
Awaroa (Waiuku)	31.84	31.85	0.05%
Awaroa (Rotowaro) at Sansons Br	33.57	33.57	0.00%
Firewood	25.13	25.13	0.00%
Kaniwhaniwha	75.30	75.30	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Karapiro	19.02	19.03	0.02%
Kawaunui	5.23	5.23	0.00%
Kirikiriroa	14.16	14.16	0.00%
Komakorau	403.28	403.28	0.00%
Little Waipa*	154.51	154.51	0.00%
Mangaharakeke**	30.18	30.18	-0.22%
Mangakara	19.95	19.95	0.00%
Mangakino	212.48	212.48	0.00%
Mangakotukutuku	35.61	35.61	0.00%
Mangamingi	195.19	195.19	0.00%
Mangaohoi	1.49	1.49	0.00%
Mangaokewa	158.13	158.13	0.00%
Mangaone	70.64	70.67	0.05%
Mangaonua	80.14	80.17	0.04%
Mangapiko	430.92	430.92	0.00%
Mangapu	251.24	251.24	0.00%
Mangarama	71.89	71.89	0.00%
Mangarapa	71.47	71.47	0.00%
Mangatangi	120.91	120.92	0.00%
Mangatawhiri	20.09	20.09	0.00%
Mangatutu	99.42	99.42	0.00%
Mangauika	4.21	4.22	0.10%
Mangawara	661.36	661.36	0.00%
Mangawhero	34.43	34.44	0.02%
Matahuru	108.02	108.02	0.00%
Moakurarua	200.49	200.49	0.00%
Ohaeroa	19.77	19.83	0.28%
Ohote	34.05	34.05	0.01%
Opuatia	68.26	68.27	0.02%
Otamakokore	48.85	48.85	0.00%
Pokaiwhenua*	115.74	115.74	0.00%
Pueto*	96.75	96.75	0.00%
Puniu at Wharepapa	188.83	188.83	0.00%
Puniu at Bartons Corner Rd Br**	410.42	410.40	-0.01%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Tahunaatara	170.12	170.12	0.00%
Torepatutahi	79.85	79.85	0.00%
Waerenga	5.49	5.49	0.00%
Waikare*	89.10	89.10	0.00%
Waikato at Bridge St Br	60.61	60.62	0.01%
Waikato at Horotiu Br	262.36	262.36	0.00%
Waikato at Karapiro*	811.31	811.31	0.00%
Waikato at Mercer Br	504.64	505.41	0.15%
Waikato at Narrows	269.01	269.06	0.02%
Waikato at Port Waikato	396.84	397.46	0.16%
Waikato at Rangiriri	88.26	88.26	0.00%
Waikato at Tuakau Br	159.59	160.06	0.29%
Waikato at Huntly-Tainui Br	399.70	399.70	0.00%
Waikato at Ohaaki*	613.21	613.21	0.00%
Waikato at Ohakuri**	320.15	320.15	0.02%
Waikato at Waipapa**	581.36	581.36	0.02%
Waikato at Whakamaru**	296.90	296.90	-0.05%
Waiotapu at Campbell	46.04	46.04	0.00%
Waiotapu at Homestead	250.40	250.40	0.00%
Waipa at Pirongia-Ngutunui Rd Br	753.35	753.34	0.00%
Waipa at Waingaro Rd Br	124.96	124.96	0.01%
Waipa at Mangaokewa Rd	16.89	16.89	0.00%
Waipa at Otewa	215.07	215.07	0.00%
Waipa at Otorohanga	184.06	184.06	0.00%
Waipa at SH23 Br Whatawhata	494.95	494.96	0.00%
Waipapa**	53.52	53.51	-0.01%
Waitawhiriwhiri	25.17	25.17	0.00%
Waitomo at SH31 Otorohanga	42.95	42.95	0.00%
Waitomo at Tumutumu Rd	32.13	32.13	0.00%
Whakapipi	97.45	98.08	0.65%
Whakauru	24.73	24.73	0.00%
Whangamarino at Island Block Rd	130.48	130.68	0.15%
Whangamarino at Jefferies Rd Br	123.22	123.25	0.02%
Whangape	322.04	322.04	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Whirinaki	8.38	8.38	0.00%

* Calculations of attenuated loads for this site did not match NIWA modelling and therefore the baseline load was used in the calculations for 6 catchments. The overall change in load was presumed to be 0%.

** These catchments are likely to have slight overestimations or underestimations due to rounding. These results were left in as the total change for the 6 subcatchments only amounts to 0.02 tonnes of N.

Table A7 Predicted change in P load under a 10% growth in Scenario 3, Case Study 2.

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Awaroa (Rotowaro) at Harris	3.28	3.28	0.00%
Awaroa (Waiuku)	1.83	1.83	0.05%
Awaroa (Rotowaro) at Sansons Br	3.49	3.49	0.00%
Firewood	2.39	2.39	0.00%
Kaniwhaniwha	7.51	7.51	0.00%
Karapiro	5.43	5.43	0.02%
Kawaunui	1.85	1.85	0.00%
Kirikiriroa	0.77	0.77	0.00%
Komakorau	11.47	11.47	0.01%
Little Waipa	15.27	15.27	0.00%
Mangaharakek	2.83	2.83	0.00%
Mangakara	1.63	1.63	0.00%
Mangakino	15.86	15.86	0.00%
Mangakotukutuku	1.56	1.56	0.00%
Mangamingi	12.52	12.52	0.00%
Mangaohoi	0.19	0.19	0.00%
Mangaokewa	12.80	12.80	0.00%
Mangaone	4.66	4.66	0.07%
Mangaonua	6.25	6.25	0.04%
Mangapiko	31.16	31.16	0.01%
Mangapu	17.28	17.28	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Mangarama	5.94	5.94	0.00%
Mangarapa	5.98	5.98	0.00%
Mangatangi	12.57	12.57	0.00%
Mangatawhiri	3.05	3.05	0.00%
Mangatutu	7.14	7.14	0.00%
Mangauika	0.42	0.42	0.00%
Mangawara	24.66	24.66	0.00%
Mangawhero	4.12	4.12	0.03%
Matahuru	8.66	8.66	0.00%
Moakurarua	16.37	16.37	0.00%
Ohaeroa	1.50	1.50	0.31%
Ohote	2.94	2.94	0.01%
Opuatia	6.51	6.52	0.10%
Otamakokore	4.30	4.30	0.00%
Pokaiwhenua	31.94	31.94	0.00%
Pueto	10.15	10.15	0.00%
Puniu at Wharepapa	10.90	10.90	0.00%
Puniu at Bartons Corner Rd Br	16.12	16.13	0.10%
Tahunaatara	17.87	17.87	0.00%
Torepatutahi	14.06	14.06	0.00%
Waerenga	1.52	1.52	0.00%
Waikare	6.05	6.05	-0.08%
Waikato at Bridge St Br	3.61	3.62	0.25%
Waikato at Horotiu Br	77.31	77.31	0.00%
Waikato at Karapiro	43.99	43.98	-0.01%
Waikato at Mercer Br	37.21	37.25	0.11%
Waikato at Narrows	18.38	18.39	0.02%
Waikato at Port Waikato	40.72	40.76	0.09%
Waikato at Rangiriri	9.02	9.02	0.00%
Waikato at Tuakau Br	9.74	9.77	0.26%
Waikato at Huntly-Tainui Br	26.09	26.09	0.02%
Waikato at Ohaaki	46.05	46.05	0.00%
Waikato at Ohakuri	47.81	47.81	0.00%
Waikato at Waipapa	64.18	64.18	0.00%

Site	Supplied Attenuated Baseline Load (t/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Waikato at Whakamaru	28.64	28.64	0.00%
Waiotapu at Campbell	3.10	3.10	0.00%
Waiotapu at Homestead	13.72	13.72	0.00%
Waipa at Pirongia-Ngutunui Rd Br	31.70	31.71	0.03%
Waipa at Waingaro Rd Br	10.08	10.09	0.07%
Waipa at Mangaokewa Rd	1.58	1.58	0.00%
Waipa at Otewa	16.54	16.54	0.00%
Waipa at Otorohanga	9.80	9.80	0.00%
Waipa at SH23 Br Whatawhata	17.99	18.00	0.05%
Waipapa	8.82	8.82	-0.02%
Waitawhiriwhiri	1.44	1.44	0.00%
Waitomo at SH31 Otorohanga	3.22	3.22	0.00%
Waitomo at Tumutumu Rd	2.86	2.86	0.00%
Whakapipi	3.76	3.79	0.94%
Whakauru	5.40	5.40	0.00%
Whangamarino at Island Block Rd	9.53	9.54	0.11%
Whangamarino at Jefferies Rd Br	6.19	6.19	0.02%
Whangape	30.01	30.01	0.00%
Whirinaki	0.83	0.83	0.00%

Table A8 Predicted change in *E. coli* load under a 10% growth in Scenario 3, Case Study 2.

Site	Supplied Attenuated Baseline Load (10^{15} organisms/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (10^{15} organisms/year)	Overall Change in Load
Awaroa (Rotowaro) at Harris	0.13	0.13	0.00%
Awaroa (Waiuku)	0.18	0.18	-0.24%
Awaroa (Rotowaro) at Sansons Br	0.53	0.53	0.00%
Firewood	0.37	0.37	0.00%
Kaniwhaniwha	1.22	1.22	-0.01%
Karapiro	0.57	0.57	-0.02%
Kawaunui	0.09	0.09	0.00%

Site	Supplied Attenuated Baseline Load (10^{15} organisms/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (10^{15} organisms/year)	Overall Change in Load
Kirikiriroa	0.18	0.18	-0.04%
Komakorau	2.58	2.58	-0.01%
Little Waipa	0.77	0.77	0.00%
Mangaharakek	0.12	0.12	0.00%
Mangakara	0.06	0.06	0.00%
Mangakino	0.81	0.81	-0.02%
Mangakotukutuku	0.38	0.38	0.00%
Mangamingi	0.41	0.41	0.00%
Mangaohoi	0.01	0.01	0.00%
Mangaokewa	2.62	2.62	0.00%
Mangaone	0.37	0.37	-0.20%
Mangaonua	0.90	0.90	-0.11%
Mangapiko	2.93	2.93	-0.01%
Mangapu	3.27	3.27	0.00%
Mangarama	1.38	1.38	0.00%
Mangarapa	0.77	0.77	0.00%
Mangatangi	1.26	1.26	-0.01%
Mangatawhiri	0.13	0.13	-0.01%
Mangatutu	0.81	0.81	-0.20%
Mangauika	0.04	0.04	0.00%
Mangawara	4.29	4.29	-0.02%
Mangawhero	0.55	0.55	-0.12%
Matahuru	0.96	0.96	0.00%
Moakurarua	3.63	3.63	0.00%
Ohaeroa	0.11	0.11	-0.61%
Ohote	0.50	0.50	-0.04%
Opuatia	1.24	1.23	-0.06%
Otamakokore	0.28	0.28	0.00%
Pokaiwhenua	1.46	1.46	-0.07%
Pueto	0.34	0.34	-0.01%
Puniu at Wharepapa	1.87	1.87	0.00%
Puniu at Bartons Corner Rd Br	2.14	2.14	-0.10%
Tahunaatara	0.69	0.69	0.00%

Site	Supplied Attenuated Baseline Load (10^{15} organisms/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (10^{15} organisms/year)	Overall Change in Load
Torepatutahi	0.45	0.45	-0.09%
Waerenga	0.17	0.17	0.00%
Waikare	0.11	0.11	-0.12%
Waikato at Bridge St Br	0.40	0.40	-0.64%
Waikato at Horotiu Br	1.40	1.40	0.00%
Waikato at Karapiro	3.54	3.53	-0.05%
Waikato at Mercer Br	4.19	4.19	-0.22%
Waikato at Narrows	1.26	1.26	-0.13%
Waikato at Port Waikato	2.50	2.49	-0.62%
Waikato at Rangiriri	0.51	0.51	0.00%
Waikato at Tuakau Br	0.83	0.82	-0.98%
Waikato at Huntly-Tainui Br	2.08	2.07	-0.05%
Waikato at Ohaaki	0.81	0.81	-0.08%
Waikato at Ohakuri	0.24	0.24	-0.01%
Waikato at Waipapa	1.12	1.12	0.00%
Waikato at Whakamaru	0.39	0.39	-0.01%
Waiotapu at Campbell	0.16	0.16	0.00%
Waiotapu at Homestead	0.98	0.98	-0.02%
Waipa at Pirongia-Ngutunui Rd Br	6.74	6.73	-0.03%
Waipa at Waingaro Rd Br	1.73	1.73	-0.09%
Waipa at Mangaokewa Rd	0.28	0.28	0.00%
Waipa at Otewa	2.62	2.62	0.00%
Waipa at Otorohanga	1.81	1.81	-0.01%
Waipa at SH23 Br Whatawhata	4.20	4.19	-0.04%
Waipapa	0.43	0.43	-0.03%
Waitawhiriwhiri	0.32	0.32	0.00%
Waitomo at SH31 Otorohanga	0.65	0.65	0.00%
Waitomo at Tumutumu Rd	0.68	0.68	0.00%
Whakapipi	0.34	0.34	-0.63%
Whakauru	0.27	0.27	0.00%
Whangamarino at Island Block Rd	0.82	0.82	-0.18%
Whangamarino at Jefferies Rd Br	1.10	1.09	-0.04%
Whangape	2.10	2.10	0.00%

Site	Supplied Attenuated Baseline Load (10^{15} organisms/year)	Calculated Attenuated Load after 5% mitigation and 10% horticulture growth (10^{15} organisms/year)	Overall Change in Load
Whirinaki	0.06	0.06	0.00%

Table A9 Predicted change in Sediment load under a 10% growth in Scenario 3, Case Study 2.

Site	New Baseline Load (t/year)	Calculated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Awaroa (Rotowaro) at Harris/Te Ohaki Br	3273	3273	0.00%
Awaroa (Rotowaro) at Sansons Br*	16601	33755	97%
Awaroa (Waiuku)	3521	3521	0.00%
Firewood	8905	8905	0.00%
Kaniwhaniwha	35517	35517	0.00%
Karapiro	16124	16124	0.00%
Kawaunui	1490	1490	0.00%
Kirikiriroa	1093	1093	0.00%
Komakorau	7869	7869	0.00%
Little Waipa	6935	6935	0.00%
Mangaharakeke	2015	2015	0.00%
Mangakara	2084	2084	0.00%
Mangakino	23884	23884	0.00%
Mangakotukutuku	2994	2994	0.00%
Mangamingi	4151	4151	0.00%
Mangaohoi	81	81	0.00%
Mangaokewa	63933	63933	0.00%
Mangaone	16301	16301	0.00%
Mangaonua	18121	18121	0.00%
Mangapiko	33894	33894	0.00%
Mangapu	74633	74633	0.00%
Mangarama	105770	105770	0.00%
Mangarapa	95101	95101	0.00%
Mangatangi	27558	27558	0.00%
Mangatawhiri	7200	7200	0.00%

Site	New Baseline Load (t/year)	Calculated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Mangatutu	24413	24413	0.00%
Mangauika	355	355	0.00%
Mangawara	41128	41128	0.00%
Mangawhero	9830	9830	0.00%
Matahuru	30258	30258	0.00%
Moakurarua	67786	67786	0.00%
Ohaeroa	10215	10215	0.00%
Ohote	4242	4242	0.00%
Opuatia*	56360	73683	325%
Otamakokore	3881	3881	0.00%
Pokaiwhenua	29677	29677	0.00%
Pueto	12173	12173	0.00%
Puniu at Bartons Corner Rd Br	42228	42228	0.00%
Puniu at Wharepapa	14927	14927	0.00%
Tahunaatara	17135	17135	0.00%
Torepatutahi	18396	18396	0.00%
Waerenga*	5693	13890	69%
Waikare	12908	12908	0.00%
Waikato at Bridge St Br	20085	20085	0.00%
Waikato at Horotiu Br	4803	4803	0.00%
Waikato at Huntly-Tainui Br	24495	24495	0.00%
Waikato at Karapiro	63430	63430	0.00%
Waikato at Mercer Br	331790	331790	0.00%
Waikato at Narrows	22487	22487	0.00%
Waikato at Ohaaki	29104	29104	0.00%
Waikato at Ohakuri	55145	55145	0.00%
Waikato at Port Waikato	94860	94860	0.00%
Waikato at Rangiriri	8557	8557	0.00%
Waikato at Tuakau Br	75153	75153	0.00%
Waikato at Waipapa	59497	59497	0.00%
Waikato at Whakamaru	37627	37627	0.00%
Waiotapu at Campbell	3278	3278	0.00%
Waiotapu at Homestead	9524	9524	0.00%
Waipa at Mangaokewa Rd	2111	2111	0.00%
Waipa at Otewa	32417	32417	0.00%

Site	New Baseline Load (t/year)	Calculated Load after 5% mitigation and 10% horticulture growth (t/year)	Overall Change in Load
Waipa at Otorohanga	16668	16668	0.00%
Waipa at Pirongia-Ngutunui Rd Br	60806	60806	0.00%
Waipa at SH23 Br Whatawhata	63841	63841	0.00%
Waipa at Wainaro Rd Br	45509	45509	0.00%
Waipapa	14233	14233	0.00%
Waitawhiriwhiri	293	293	0.00%
Waitomo at SH31 Otorohanga	8622	8622	0.00%
Waitomo at Tumutumu Rd	8199	8199	0.00%
Whakapipi	34446	34446	0.00%
Whakauru	3640	3640	0.00%
Whangamarino at Island Block Rd	23235	23235	0.00%
Whangamarino at Jefferies Rd Br	18133	18133	0.00%
Whangape	222243	222243	0.00%
Whirinaki	929	929	0.00%

* To simplify modelling, the expansion of horticulture took place in 3 catchments only. The area of horticulture remained the same in all other catchments, however the total expansion across the Waikato region of horticulture was 10%.

Table A10 Percentage change with regards to the N subcatchment load under the three scenarios, Case Study 5. * Note that these values are conservative as the 5% mitigation has not been applied to these values.

Subcatchments	Grandparented baseline (kg N)	Scenario 1 Natural capital allocation reduced to match grandparented load Percent change from baseline	Scenario 2 Natural capital allocation with increased allocation for horticulture land Percent change from baseline*	Scenario 3 Natural capital allocation with increased allocation for horticulture land and 10% area increase Percent change from baseline*
Awaroa (Rotowaro) at Harris/Te Ohaki Br	49095	38%	38%	38%
Awaroa (Rotowaro) at Sansons Br	34577	74%	74%	74%
Awaroa (Waiuku)	32297	41%	44%	44%
Firewood	27441	53%	53%	53%

Subcatchments	Grandparented baseline (kg N)	Scenario 1 Natural capital allocation reduced to match grandparented load Percent change from baseline	Scenario 2 Natural capital allocation with increased allocation for horticulture land Percent change from baseline*	Scenario 3 Natural capital allocation with increased allocation for horticulture land and 10% area increase Percent change from baseline*
Kaniwhaniwha	124659	11%	11%	11%
Karapiro	97603	-3%	-1%	-1%
Kawaunui	32294	-15%	-15%	-15%
Kirikiriroa	16816	40%	41%	41%
Komakorau	456276	-13%	-13%	-13%
Little Waipa	319874	-54%	-54%	-54%
Mangaharakeke	47841	48%	48%	48%
Mangakara	24334	0%	0%	0%
Mangakino	232068	3%	4%	4%
Mangakotukutuku	50293	0%	1%	1%
Mangamingi	117943	-33%	-33%	-33%
Mangaohoi	1816	103%	103%	103%
Mangaokewa	167737	25%	25%	25%
Mangaone	107493	56%	61%	61%
Mangaonua	135860	20%	23%	23%
Mangapiko	655627	-19%	-19%	-19%
Mangapu	246448	-4%	-4%	-4%
Mangarama	79312	-5%	-5%	-5%
Mangarapa	79168	-5%	-5%	-5%
Mangatangi	173263	63%	63%	63%
Mangatawhiri	20692	221%	223%	223%
Mangatutu	174367	-9%	-4%	-4%
Mangauika	4651	30%	30%	30%
Mangawara	750185	-7%	-7%	-7%
Mangawhero	100785	20%	22%	22%
Matahuru	112899	47%	47%	47%
Moakurarua	220062	10%	10%	10%

Subcatchments	Grandparented baseline (kg N)	Scenario 1 Natural capital allocation reduced to match grandparented load Percent change from baseline	Scenario 2 Natural capital allocation with increased allocation for horticulture land Percent change from baseline*	Scenario 3 Natural capital allocation with increased allocation for horticulture land and 10% area increase Percent change from baseline*
Ohaeroa	29112	25%	43%	43%
Ohote	55967	45%	46%	46%
Opuatia	71220	33%	39%	39%
Otamakokore	76056	-20%	-20%	-20%
Pokaiwhenua	614805	-29%	-28%	-28%
Pueto	147700	71%	71%	71%
Puniu at Bartons Corner Rd Br	586704	-35%	-32%	-32%
Puniu at Wharepapa	233145	-14%	-14%	-14%
Tahunaatara	307173	-22%	-22%	-22%
Torepatutahi	253222	36%	38%	38%
Waerenga	17422	45%	45%	45%
Waikare	81035	56%	60%	60%
Waikato at Bridge St Br	83734	21%	30%	30%
Waikato at Horotiu Br	55936	28%	28%	28%
Waikato at Huntly-Tainui Br	315209	4%	5%	5%
Waikato at Karapiro	1045219	-28%	-27%	-27%
Waikato at Mercer Br	511229	36%	45%	45%
Waikato at Narrows	204902	37%	39%	39%
Waikato at Ohaaki	295259	37%	39%	39%
Waikato at Ohakuri	854364	-25%	-25%	-25%
Waikato at Port Waikato	352012	14%	26%	29%
Waikato at Rangiriri	69539	39%	39%	39%
Waikato at Tuakau Br	147114	58%	79%	79%
Waikato at Waipapa	747972	4%	4%	4%
Waikato at Whakamaru	504878	4%	4%	4%
Waiotapu at Campbell	47490	54%	54%	54%

Subcatchments	Grandparented baseline (kg N)	Scenario 1 Natural capital allocation reduced to match grandparented load Percent change from baseline	Scenario 2 Natural capital allocation with increased allocation for horticulture land Percent change from baseline*	Scenario 3 Natural capital allocation with increased allocation for horticulture land and 10% area increase Percent change from baseline*
Waiotapu at Homestead	236525	31%	31%	31%
Waipa at Mangaokewa Rd	17379	148%	148%	148%
Waipa at Otewa	233351	28%	28%	28%
Waipa at Otorohanga	325078	-30%	-29%	-29%
Waipa at Pirongia-Ngutunui Rd Br	1058934	-30%	-30%	-30%
Waipa at SH23 Br Whatawhata	612723	0%	1%	1%
Waipa at Wainaro Rd Br	189669	34%	36%	36%
Waipapa	161463	-24%	-23%	-23%
Waitawhiriwhiri	24810	8%	8%	8%
Waitomo at SH31 Otorohanga	46884	28%	28%	28%
Waitomo at Tumutumu Rd	34410	43%	43%	43%
Whakapipi	69027	33%	60%	82%
Whakauru	105426	-24%	-24%	-24%
Whangamarino at Island Block Rd	128980	65%	73%	73%
Whangamarino at Jefferies Rd Br	114033	47%	48%	48%
Whangape	336198	33%	33%	33%
Whirinaki	12847	-8%	-8%	-8%
Total Load (t/yr)	16109930	0%	1.7%	1.9%

Appendix B. Figures

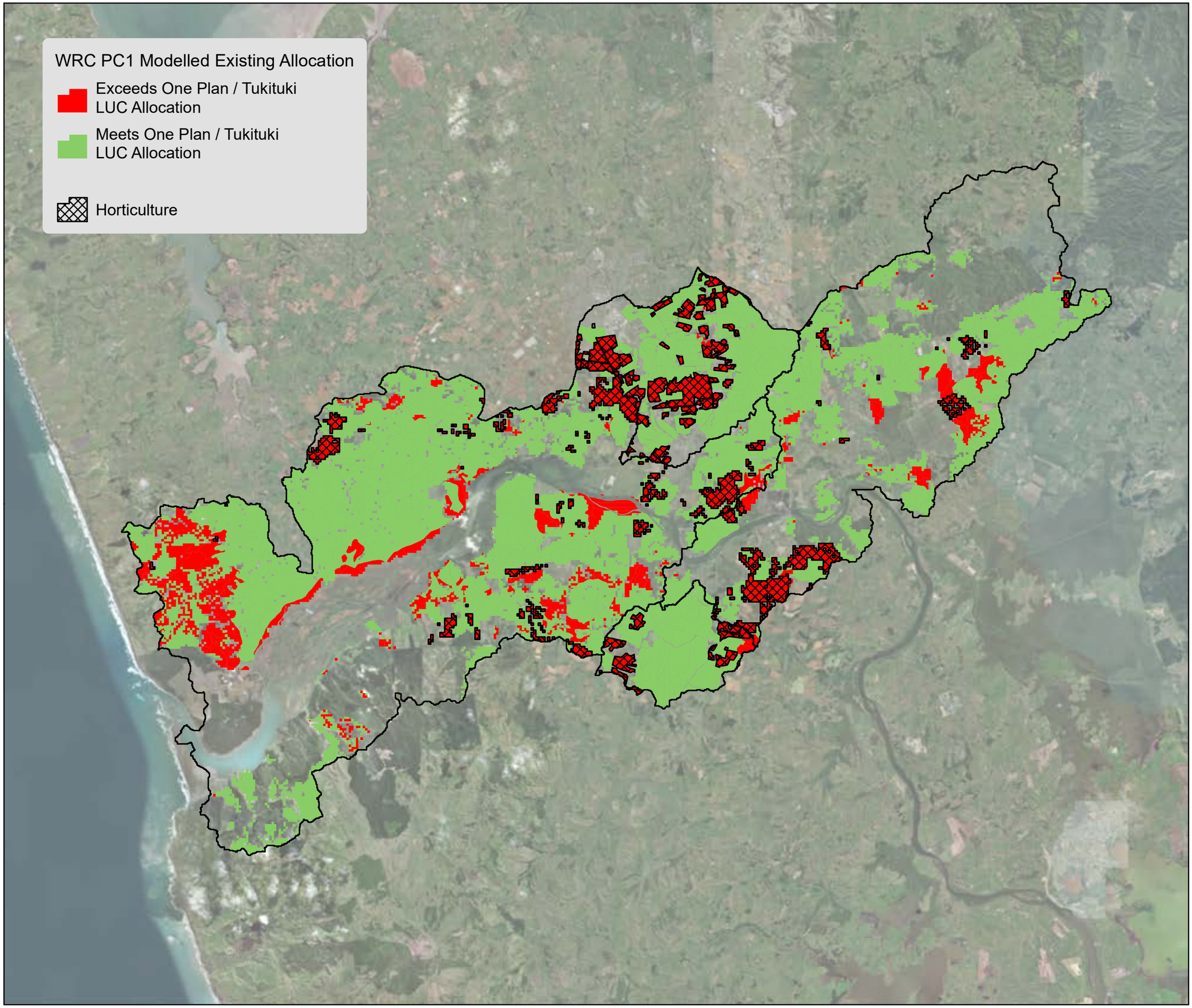

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Figure 3: Compliance to Horizons One Plan - Lower Waikato (using detailed land use mapping and Horizons Overseer v5.2.6 allocation.

1:150,000

0 1 2 3 4 5 6 Km

Printed on: 10/09/2018

N W E S

JACOBS

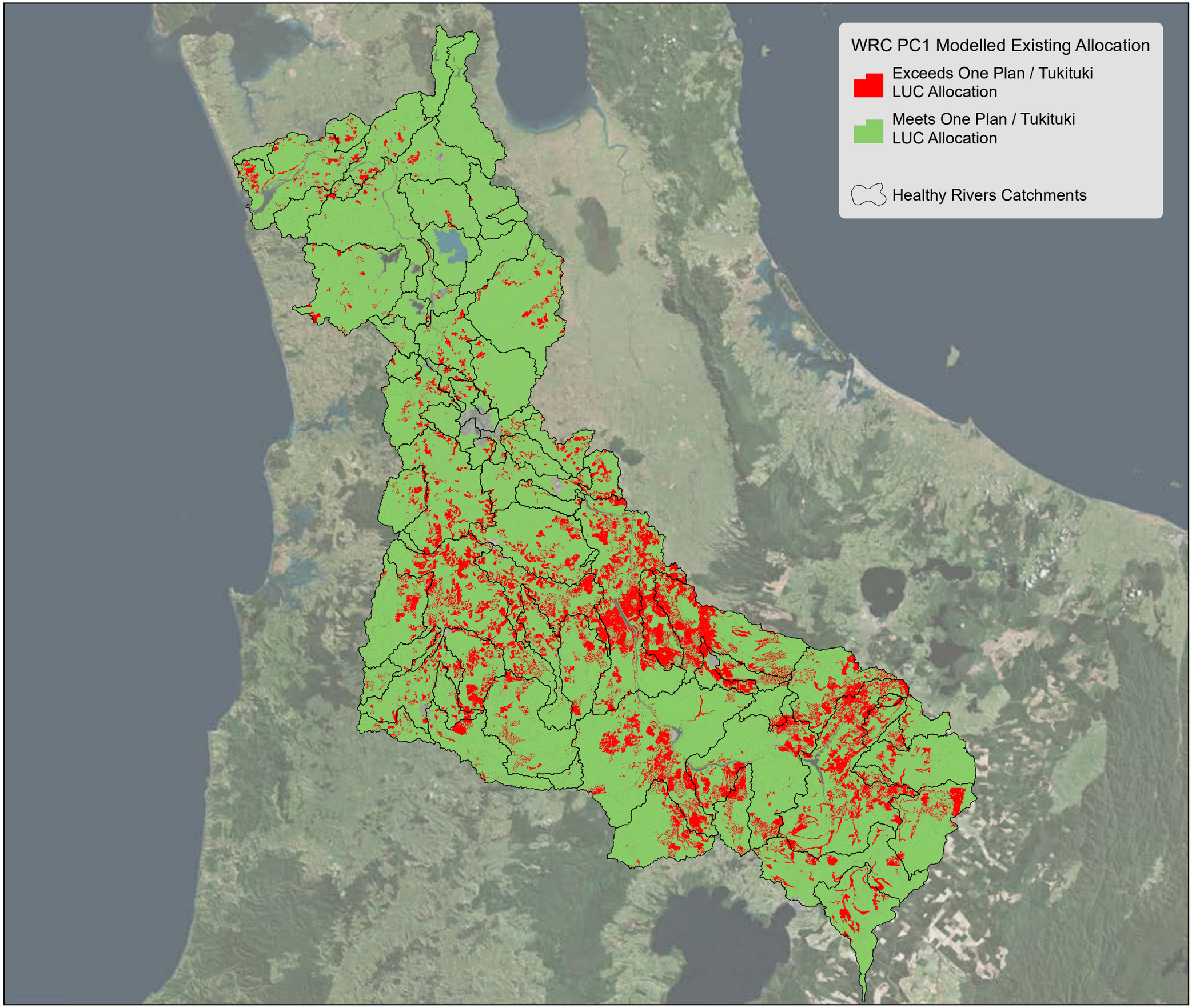

Figure 4: Compliance to Horizons One Plan using Horizons Overseer v6.2.3 allocation.

1:750,000

0 7 14 21 28 35 42 Km

Printed on: 11/09/2018

N W E S

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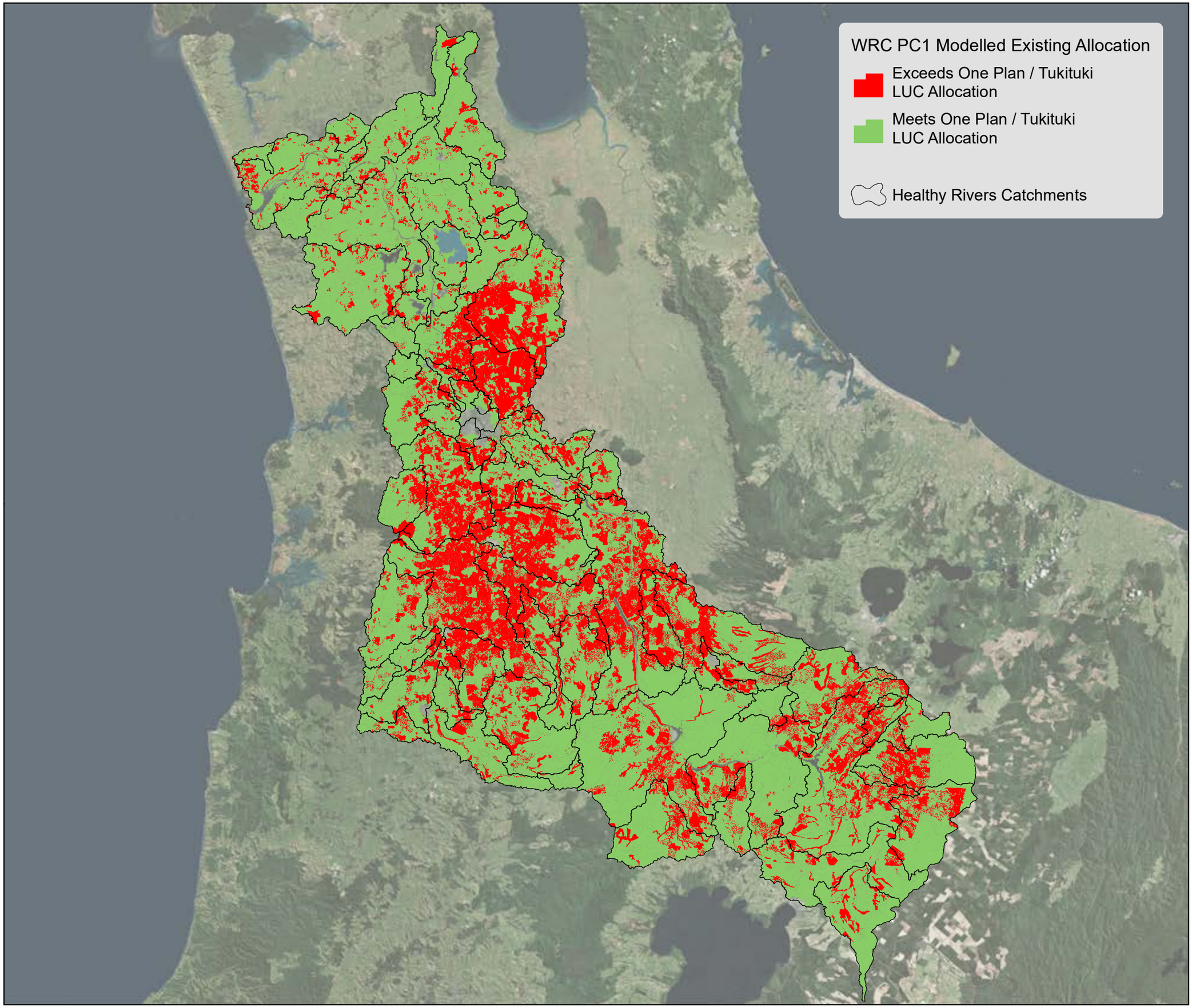

Figure 5: Compliance to Horizons One Plan using Horizons Overseer v5.2.6 allocation.

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N W E S

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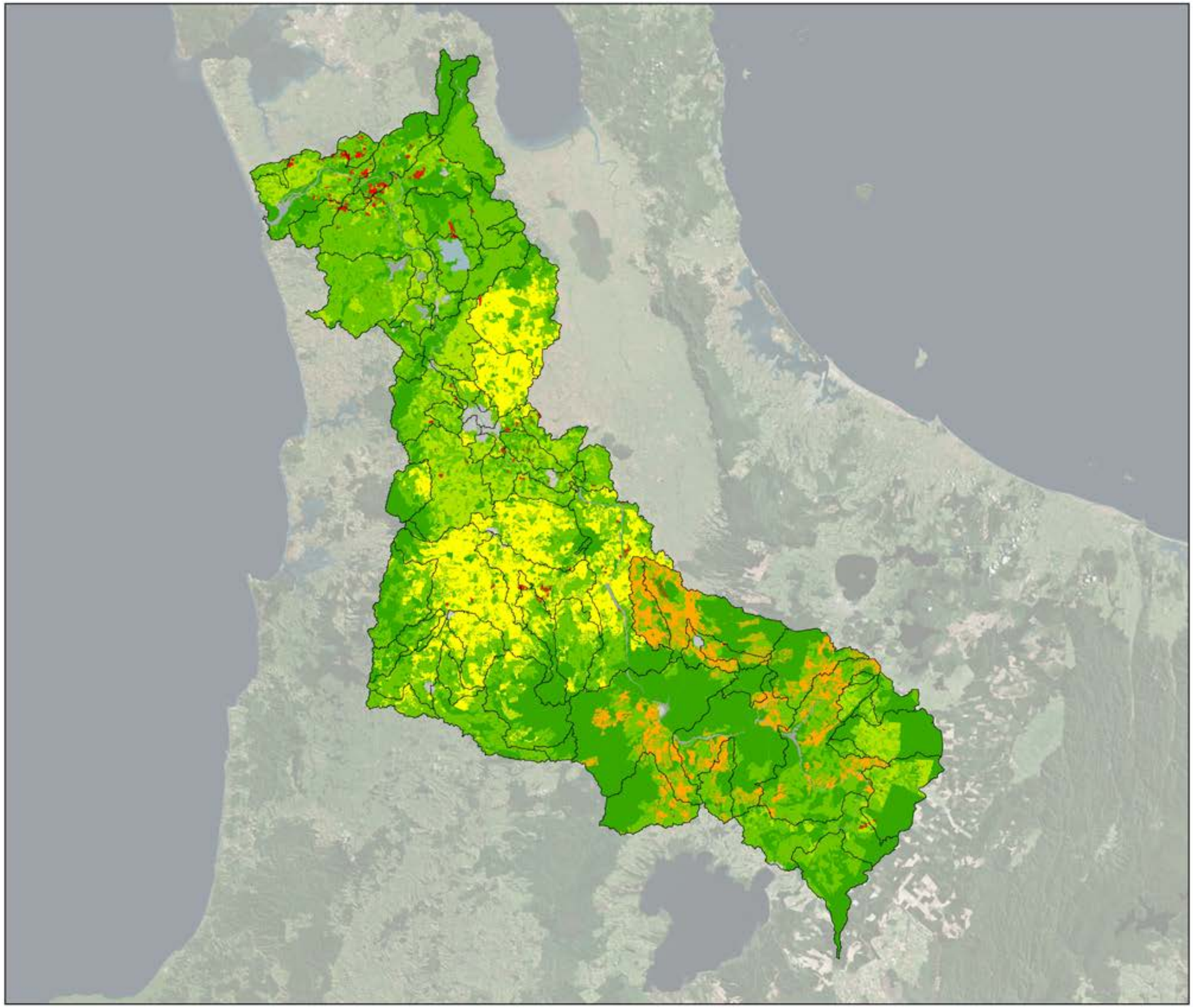
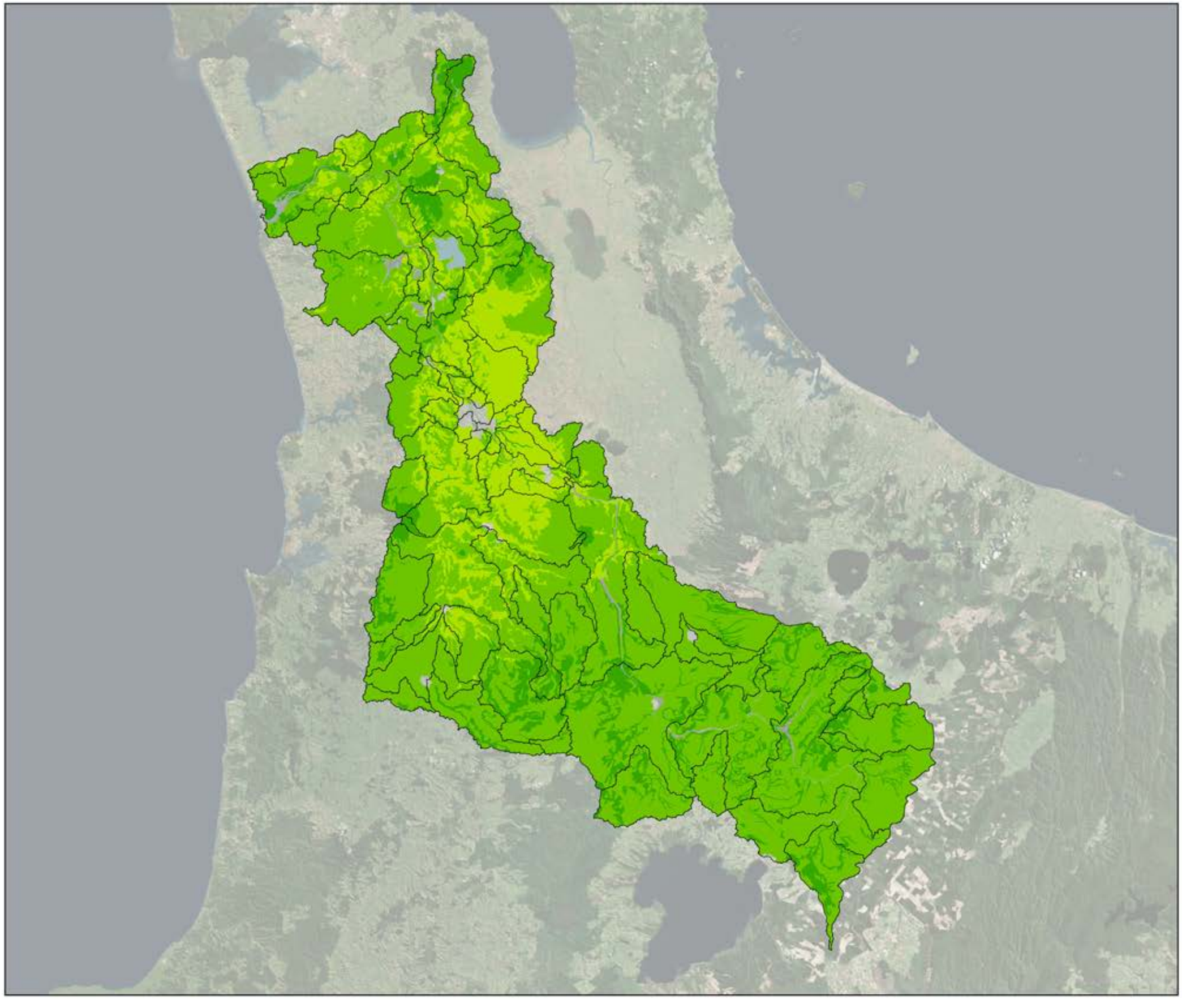


Figure 6: WRC grandparented load and N loss rates.



N Loss - Kg/Ha/Yr

- 3 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60- 70

Healthy River Catchments

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Figure 7: Scenario 1 - New load and N loss rates by area using One Plan numbers, but scaled down to match WRC grandparented load.

1:804,341

0 8 16 24 32 40 48 Km

Printed on: 29/08/2018

N W E S

JACOBS

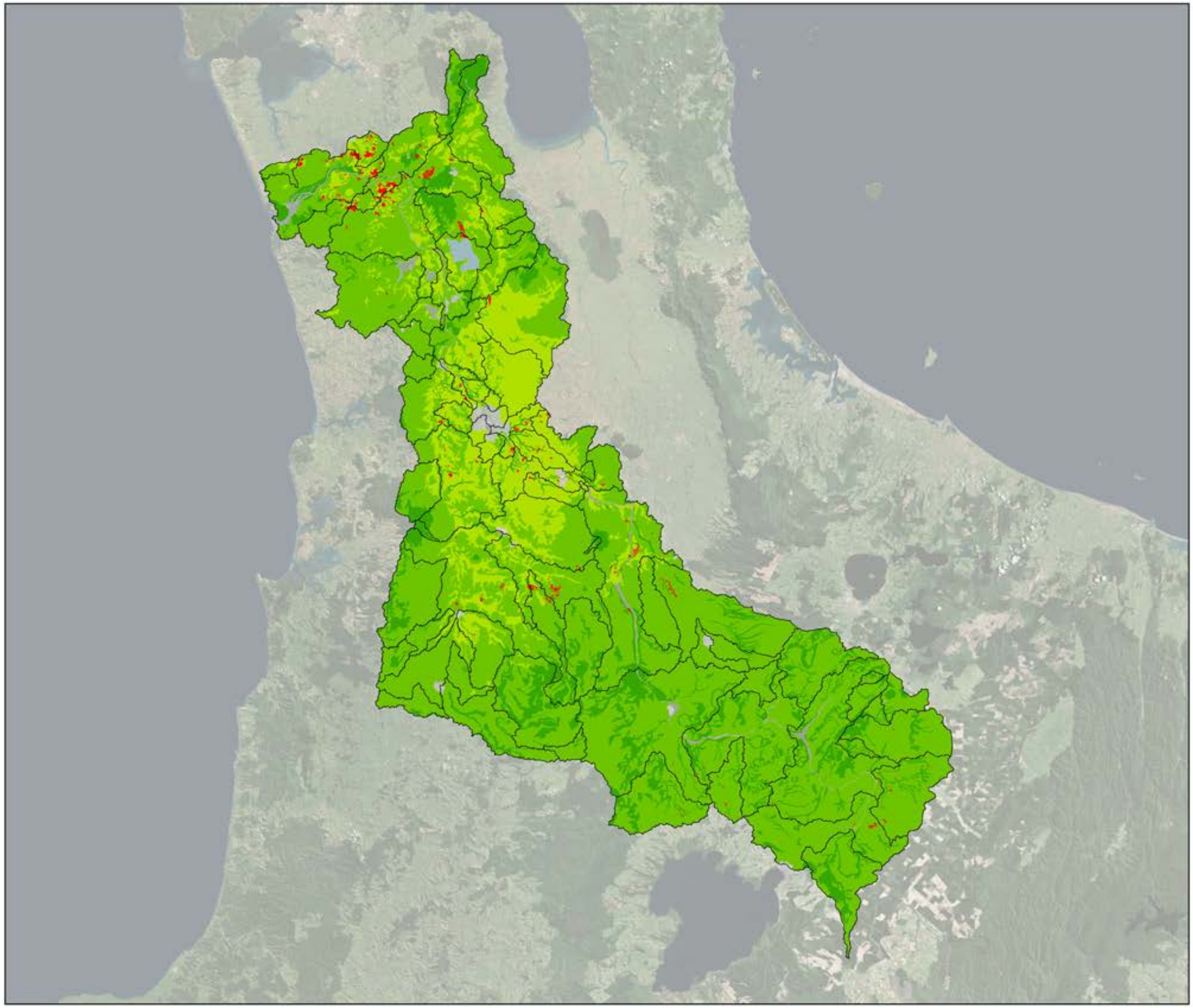

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Figure 8: Scenario 2 - Natural capital allocation with increase allocation for horticulture land.

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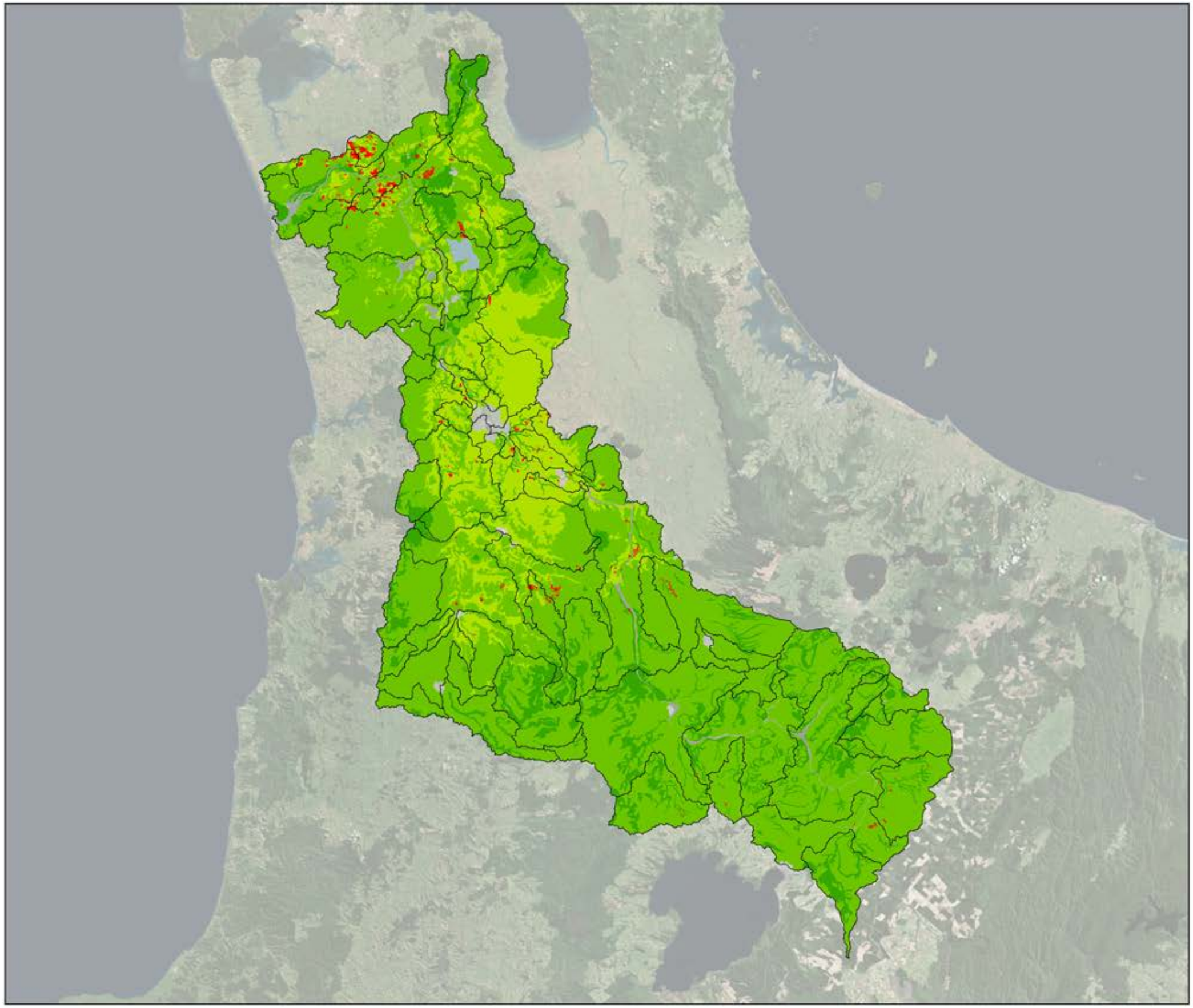

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Figure 9: Scenario 3 - Natural capital allocation with increase allocation for horticulture land and an increase in area of 10%.

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