

Closing Planning Statement

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1 Introduction

1. This brief report addresses a range of matters that require a planning response to evidence raised at the hearing or explanation of changes recommended in the final tracked changes version of PC1. This report builds on the Council’s closing legal submissions, and does not repeat material included in those submissions.
2. If a matter is addressed in one of the Section 42A Reports, and the explanation and analysis in one of those reports continues to reflect the Officers’ current opinion on the matter, it is not restated in this report. Similarly, the Officers answered several questions orally or in writing during the hearing process, particularly including the “20-questions” of July 2019, and the answers to those questions are not repeated here. Abbreviations and acronyms used here are the same as used in the s42A reporting¹.
3. This report is structured to loosely follow the order of the provisions in PC1, so starts with the PC1 introduction, moves through objectives, policies, rules, schedules and definitions, and finishes with the consequential changes to the wider WRP.
4. In the final tracked changes version of PC1, a number of the changes recommended are self-explanatory in nature, are simply grammatical or wording improvements or make minor corrections. These changes are not further explained here.
5. While the likely further amendments to the NPS-FM and possibly a new NES may result from the Government's Freshwater programme, this has not influenced any recommendations made here.

¹ S42A Block 1 Report [para 1.2], Block 2 Report [para 1.3] & Block 3 Report [para 1.3]

2 PC1 Introduction

6. In addition to the changes recommended in the Section 42A Reports, there are a number of additional minor changes recommended to the introductory statements in PC1. The Officers note that the introduction section is largely descriptive of what is included in new Chapter 3.11, and therefore the Hearing Panel will need to make further changes to align the introduction with the Panel's final recommendations.
7. Officers have not recommended any changes to the Te Reo translations. Some changes will be necessary to align with the revised wording of the English text. Council is happy to arrange for those translations, but in the interests of efficiency, suggest that this can either be done when the Hearing Panel has arrived at the final text needing translation, or the Hearing Panel can instruct Council to do this prior to making a decision.² In addition, the Council can arrange a check of all Te Reo spelling and place name macrons prior to a decision being made.
8. The most significant matter that arose in relation to the introduction section was in relation to the usefulness of the section of PC1 describing the "values and uses". The Section 42A Report raised this matter, and while recognising that the values and uses are a part of the NPS-FM process, questioned whether they needed to be included in PC1.³ The Hearing Panel asked a number of submitters whether the values and uses essentially meant "all things to all people", and appeared to lack prioritisation between competing values and uses. A number of submitters agreed, and this was further highlighted by other requests for further specific additions to the lists of values and uses.
9. Officers are of the opinion that while the NPS-FM sets values and uses as the start point for then assigning freshwater objectives and limits on targets, PC1 is slightly different in that Te Ture Whaimana o Te Awa o Waikato (Te Ture Whaimana/the Vision and Strategy) provides an overall, and overriding, commentary on the values and uses and some elements of the freshwater objectives.
10. On this basis, the Officers have firmed in their view that the values and uses, while an important part of the NPS-FM process, are somewhat less important for PC1 and should be considered to be secondary to Te Ture Whaimana in relation to the subsequent plan provisions. Officers therefore recommend that the values and uses be deleted in their entirety from PC1, and recorded within the Section 32AA Report, if that was considered necessary.
11. In relation to the whole of PC1, it was noted that the Director-General for Conservation (**DoC**) is seeking that all references to "diffuse discharges of nitrogen, phosphorus, microbial contaminants and sediment" be simply "diffuse discharges".⁴ As the Officers understand it, this is related to DoC's request that PC1 is not constrained to those 'four contaminants'. In line with the WRC's view as to the scope of PC1⁵, this change is not recommended to be made. However, dependent on the outcome of the Hearing Panel's consideration of the scope issues, and the merits of including other contaminants, this may essentially be a consequential change, if it needs to be made.

² Jenni Somerville is the appropriate WRC contact for this.

³ Section 42A Block 1 Report section B2.4 [para 165]

⁴ Deborah Kissick Block 1 hearings evidence for Plan Change 1 [Para 246]

⁵ Waikato Regional Council as submitter Closing Statement [Para 9]

3 Objectives

3.1 Objective 1

12. Throughout the hearing process there has been considerable debate about the 80-year targets and the appropriateness of specifying these with a degree of precision that may not reflect the reality of their indicative nature. This is further reflected in the considerable debates as to the content of related Table 3.11-1. In the Officers' view, maintaining the 80-year numeric values is preferable, but will definitely be subject to change, better information and legislative processes over the course of the 80-year timeframe. On this basis, it is recommended that the reference to these 80-year values is retained, but be stated in less absolute terms, in recognition of this likely change in science and understanding. Other minor changes are recommended to improve the structure of the Objective.
13. Dr Mitchell⁶ helpfully drew attention to this by suggesting that if we were to look back in time by 80-years, and suggest that in the 1940s there was science and understanding available to accurately define what the water quality state should be now, we would recognise the folly of this exercise. While possibly an oversimplification, the point was appropriately made that that over this long-term, change is inevitable.

3.2 Objective 2

14. Officers cautiously remain of the view that Objective 2 is broadly appropriate, but recommend further minor changes to delete the repetition of economic outcomes. Following questions from the Panel, Officers now agree that it is in the long term that these social, economic and cultural outcomes will be able to be achieved, but that in the short term, or at other phases during the 80-year transition, there is likely to be periods where un-restrained economic outcomes may not be able to be met.

3.3 Objective 3

15. Further changes in response to evidence given are recommended to Objective 3, primarily to identify this clearly as the "freshwater objective" in terms of the NPS-FM and, critically, to recognise that the implementation of this Objective is to occur over a 10 year period from PC1 becoming operative, rather than by 2026. While Officers are uncomfortable with this extension of the implementation time period, it essentially reflects reality that not all actions will be able to be undertaken by 2026. Officers noted the position of the River Iwi, who also reluctantly recognised this change as appropriate, given the time spent in RMA planning processes⁷.
16. Officers recommend continuing to call the numeric outcomes in the revised Table 3.11-1 "attribute states", rather than targets or limits. Officers consider that Objective 3 is a narrative description of the freshwater outcome with a link to Table 3.11-1. Table 3.11-1 contains, in the short-term attribute state columns, the numeric freshwater objectives.
17. The recommended deletion of references to a 2026 date reflects the reality that in a regional planning context, most actions are not triggered until 6 months after a regional plan becomes operative. This means that while the plan was notified in 2016, that is not the date at which actions can realistically be expected to commence. Therefore, 2026, as a 10-year period from the date of notification, is effectively halved by the time taken to complete the planning process,

⁶ Dr Phil Mitchell - Oji Fibre Solutions Ltd Block 3 hearings evidence for Plan Change 1 [para 8.3 to 8.6]

⁷ Waikato and Waipa River Iwi Block 3 Legal Submissions [Para18]

including resolution of any appeals. Given the very diverse views as to what PC1 should or should not require, it is realistic to expect the undertaking of actions will occur from when the plan is made operative, and through the ensuing 10 years, rather than by 2026.

18. It is also noted that the wording of Objective 3 is that actions are put in place that will result in the achievement of the 10-year water quality state, rather than specifically that that water quality state will be achieved. That is a subtle, but important, difference which has been maintained in Objective 3, and throughout the PC1 process. Given lag times in water quality improvement and the timeframe by which actions will become effective, actual water quality may not have improved to the short-term water quality state within 10 years.⁸
19. Federated farmers have raised the potential for “overshoot” identified in the Doole⁹ report. In the Officers’ experience, overshoot in a water quality sense typically does not happen, and should not, in the Officers’ opinion, be a reason to have lesser requirements in PC1. - If anything, it will mean that the 10 year water quality state may be achieved within a shorter timeframe, but still very behind the original 2026 target date, and only a step toward the 80-year goal.

3.4 Objectives 4 and 6

20. As indicated in the Section 42A Report, and after hearing evidence from other parties, Officers recommend the deletion of Objective 4. This is for reasons as set out in the Section 42A Report¹⁰. Similarly, Officers recommend deletion of Objective 6, as on reflection, it does not add any value beyond that covered by other objectives. This is also in light of further adjustment to the regime relating to wetlands in general that will be undertaken through the full review of the regional plan.

4 Table 3.11-1

21. Table 3.11-1 has been the subject of considerable evidence, several science caucusing sessions and a specific hearing day. It is clear, from the Joint Witness Statement¹¹ and responses to Hearing Panel questions on the Joint Witness Statement hearing day, that while some matters are generally agreed, there is a significant level of disagreement about the content of Table 3.11-1. As the Hearing Panel will be aware, Table 3.11-1 is an important component of PC1, in that it provides a long-term “where are we going” and a short-term step in that direction.
22. WRC scientists have further considered the evidence of the various parties, and the Joint Witness Statement, and have arrived at a recommended set of values to be included in Table 3.11-1. The changes recommended fall into four categories:
 1. The inclusion of “current state” values, based on the most relevant available data at the time of notification of PC1. These values provide helpful context to the other values in the Table.
 2. Additional or changed attribute values to reflect the NPS-FM 2017. This particularly relates to *E.coli*.
 3. Corrections to a range of data points, particularly where these contain minor errors or in relation to a recalculation of ammonia values.

⁸ Doole GJ Quinn JM Wilcock BJ Hudson N 2016b. Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process. Document 6551310

⁹ Doole GJ Quinn JM Wilcock BJ Hudson N 2016b. Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process. Document 6551310

¹⁰ Section 42A Block 1 Report, section B4.3.4.3 [Para 417]

¹¹ Joint Witness Statement – Expert Conferencing – Table 3.11-1 (2019)

4. The adoption of Option 2 from the attached memo, which reflects the majority viewpoint on TN and TP from the joint witness statement.
23. Importantly, primarily for reasons discussed in the legal submissions, additional attributes are not recommended.
24. WRC scientists have prepared a brief summary of the changes and reasons for those changes, which is attached as Appendix A. It is important to note that the scientists put forward three options for changes to Table 3.11-1 nitrogen and phosphorus values. One option has been selected for inclusion in the tracked changes version of PC1. However, the WRC scientists note this does not reflect the 'community view' adopted during the CSG process.

5 Freshwater Management Unit Scale

25. In Hearing Block 1, there was evidence presented by a number of parties seeking changes to the scale of FMUs in PC1. Some parties sought an additional FMU specific to their area of concern, such as for Whangamarino wetland or in relation to the Upper Waikato¹². Other parties sought that the sub-catchments become FMUs¹³.
26. Officers have further considered that evidence, and remain of the view that the four river FMUs are at an appropriate scale. FMUs are important in relation to NPS-FM processes, but it is recognised that the majority of the emphasis of PC1 is at a sub-catchment scale.
27. Some submitters have suggested that there should be a single monitoring point at the "bottom" of each FMU, to determine whether it is achieving the water quality outcomes. While seemingly attractive, that does not necessarily paint a picture of what is occurring within the wider FMU. This is where the sub-catchment-based monitoring network is helpful in assessing the FMU water quality at a finer degree of detail, and ensuring that good water quality is being maintained, and, where it is degraded, it is improving across the FMU. Officers note that WRC has recently expanded the monitoring network, including the water quality parameters measured, to enable better reporting, and in the Officers' opinion these monitoring sites are appropriately located in the FMUs. Officers also note the considerable additional requirements for monitoring and reporting if each sub-catchment became an FMU.
28. Overall, Officers are of the view that the River FMUs are at an appropriate scale, with sub-catchment and sub-catchment monitoring points providing an important refinement of scale for the purposes of ensuring water quality is maintained where it is good or improved where it is degraded throughout the FMUs.
29. There was comparatively little evidence presented on the lake FMUs, which also reflects the limited number of submissions on these. Officers note that lake FMUs do not feature particularly strongly in the policy or rule framework, notwithstanding the importance of management of lake sub-catchments, particularly for those lakes with severely degraded water quality. Given the general lack of substantive submissions or evidence on this, no further recommendations are made.

¹² Dr Hugh Robertson – Director-General of Conservation Block 1 hearings evidence for Plan Change 1 [para 27]

¹³ Jude Addenbrooke - Miraka Limited Block 1 hearings evidence for Plan Change 1 [para 5.10]

6 Farming – Policies 1, 2 and Rules (excluding CVP)

30. The Officers consider that one of the underlying purposes of PC1 is to encourage changes in on-farm actions, so that water quality is improved. In this, Officers recognise that some farmers have already made considerable steps towards improving practices and reducing losses of the four contaminants. The Officers are of the opinion that PC1 can compel some progress, but needs to be implemented alongside other, non-regulatory, actions and input from industry bodies as well as individual farmers in order to achieve, in the long-term, Te Ture Whaimana. Many submitters have criticised PC1 for going too far, or not far enough, often on the basis of reliance on these non-regulatory actions. Officers consider that the Te Ture Whaimana will not be achieved without significant regulatory and non-regulatory actions together, neither being adequate alone.
31. Many farmers have understandably questioned what is intended to happen after 2026, and have sought greater certainty about the future direction of water quality planning. Similarly, DoC and several other organisations have sought certainty past 2026, or some further specification of requirements beyond the short-term. Officers agree that this may be desirable, but, beyond changing the 2026 date to a 10 year plan life-cycle timeframe discussed above, do not support adding a further set of targets. In part this is because these additional targets were not notified, and there has been little evidence or debate as to what those targets should be, including through the Table 3.11-1 conferencing. Further, any certainty that may arise may in fact be illusory, given (a) there is no ability to direct the outcomes of future planning processes and (b) a revision of the national direction under the NPS-FM underway. These processes would likely change those numbers or expectations, rendering any perception of certainty given at this time erroneous.

6.1 Farming Policies and Rules

32. A wide range of evidence was presented on farming matters in all three hearing blocks. This evidence ranged from submitters who considered that PC1 should essentially be withdrawn¹⁴, through to those who considered that it needed considerable strengthening and change to “do more, sooner”¹⁵. The majority of these issues were traversed in detail in the three Section 42A Reports and, at the outset, Officers reconfirm their position on a wide range of matters. This is evident in the final tracked changes version of PC1, where a range of further adjustments are recommended, but many fundamental recommendations are largely unchanged.
33. The basic framework of the final PC1 tracked changes version of PC1 includes revised versions of Policy 1 relating to all farming activities, Policy 2 relating to farm environment plans, and Policy 3 relating to commercial vegetable production. The rule framework is adjusted, to include:
 - A permitted activity rule, subject to standards, for small or low intensity farming;
 - An interim permitted activity rule to stage the required resource consents over an eight year period with approximately 700 being required each year;
 - A controlled activity rule for the majority of farming other than commercial vegetable production, with a requirement for a farm environment plan, amongst other standards;

¹⁴ Such as Rick Burke – Farmers 4 Positive Change Block 1 hearings evidence for Plan Change 1 [Paras 74 to 83]

¹⁵ Helen Marr – Auckland/Waikato and Eastern region Fish and Game Councils Block 1 hearings evidence for Plan Change 1 [Para 119], Deborah Kissick – Director-General of Conservation Block 1 hearings evidence for Plan Change 1 [para 232 to 247], Philip Mitchell – Oji Fibre Solutions Limited Block 1 hearings evidence for Plan Change 1 [Para 7.1 to 7.7]

- A restricted discretionary activity rule, subject to standards, for commercial vegetable production, provided it does not expand in area;
 - A discretionary activity “default rule”; and
 - Retaining a non-complying activity rule for significant land use change, such as dairy conversion and additional commercial vegetable production.
34. The revised rule framework has a large number of changes to the provisions from the notified PC1 and the changes recommended in the s42A Report. Officers noted the considerable evidence about certainty and simplicity of the rule framework, and the many questions asked by the Hearing Panel of submitters. Officers are confident that there is scope in the submissions to make the recommended changes.
35. A slightly revised farm environment plan framework is proposed, but, in substance the revised framework retains the same ‘outcomes and principles’ approach of the Block 3 Section 42A Report, and Officers are firmly of the view that this needs to be implemented through a resource consent framework.
36. That farm environment plan, and its certification process, will be required to demonstrate how losses of contaminants are decreasing. While Overseer and a nitrogen reference point are recommended to be continued, it is through the farm environment plan and the certification process that all four contaminants will be required to be managed.
37. The approach in the revised rules no longer explicitly provides an alternative of a stocking rate. This does not mean that Officers do not support the use of stocking rates, more that given the revised wording, it is not necessary to specify as an option in the rule. Through the altered wording, there would be no barrier to setting stocking rate within a farm environment plan as one of the mechanisms by which the prevention of increase in contaminant losses could be evidenced. In order to provide some certainty, a revised definition of stocking rate is included in the final tracked changes version of PC1, that reflects the Officers’ responses to the July “20 Questions”. Officers do not support a concept of “winter carrying capacity”¹⁶ as it introduces a significant degree of uncertainty and represents an approach that is likely to be applicable to only a limited range of drystock properties, given modern farming arrangements.
38. There was considerable evidence given about finding resources to prepare and process the number of resource consents likely to be generated in the three priority tranches of earlier versions of PC1.¹⁷ Officers have considered this further, and discussed at length with Council’s implementation team, Officers now recommend the spreading of the resource consent load over a longer period (eight years) through a revised Table 3.11-2. This has the effect of ‘annual’ tranches of consents being required, rather than three with up to several thousand in each of the three blocks. Table 3.11-2 prioritises all dairy farming over the 75th percentile nitrogen leaching in the first tranche, commercial vegetable production and some high priority catchments in the second tranche and then uses the same ranking mechanism as contained in the notified PC1 - using the significance of the water quality improvement required as the ranking criteria. An alternative ranking is attached as Appendix B, which prioritises Whangamarino and other lakes. There are advantages and disadvantages of each approach.¹⁸

¹⁶ Oral responses to Hearing Panel questions from some hill country farmers regarding ‘July stock carrying capacity’.

¹⁷ Brent Sinclair – WRC Block 2 hearings evidence for Plan change 1 [Para 54] and Grant Eccles - Federated Farmers Block 2 hearings evidence for Plan Change 1 [Para 22 to 29]

¹⁸ The version of the table included in the tracked changes version of PC1 is ordered on the size of the gap between current water quality and desired water quality, whereas the version appended is a more subjective assessment prioritising the lakes and wetland catchments first. Further, many submitters from the Whangamarino catchment appeared at the hearing, and the Hearing Panel will be aware of the diverse views and approaches already underway in those sub-catchments – staggering those sub-catchments and some additional time to allow non-regulatory approaches to progress in these particular sub-catchments may be beneficial.

39. The issues with enforcement, the relationship between the resource consent and the farm environment plan and the appropriateness of the activity status proposed is set out in the Council's closing legal submissions.
40. There was considerable evidence presented in relation to the nitrogen reference point and the use of Overseer. These issues were fully addressed in the Block 2 Section 42A Report.¹⁹ While the recommendations of the Officers have been further adjusted, Officers still fundamentally support the use of a nitrogen reference point and Overseer but continue to have reservations about its use within an enforcement context or 'farming to a number'. Fonterra put forward their nitrogen risk scorecard, and HortNZ had various ideas around a "proxy" system. Officers are conscious that neither of these frameworks are tested or were available for thorough examination through the hearing. Officers do not recommend these alternatives, but continue to suggest that the alternatives could be approved for use, subject to the clearer criteria included in Schedule B.
41. The issue of multiple property consents and enterprises arose a number of times, particularly in the evidence of HortNZ and Beef and Lamb. As is discussed further below in relation to Policy 9A, Officers recommend that a new policy be introduced to support resource consents for multiple properties, but overall consider that there are complexities and risks involved with farming operations spread across multiple properties, or multiple properties coming under the same resource consent, such that a controlled activity status is not considered appropriate or sufficiently precautionary.
42. Officers continue to support both the 75th percentile reductions and the non-complying activity status for significant land use change. It is the Officers understanding that considerable improvements to water quality are required in the Waikato and Waipā River catchments, and simply improving farm practices is insufficient to achieve this. Certainly, farm environment plans and good farming practice will make some worthwhile and likely short-term improvements. However, getting the farming activities with the highest losses of nitrogen to reduce intensity or otherwise reduce their losses, and to prevent other significant increases in contaminant loss, is critical to achieving PC1 outcomes and Te Ture Whaimana. Officers are aligned with the CSG view that there needs to be a requirement for everyone to improve practices, and inequitable to expect some to reduce to enable others to increase their losses, for this first stage of the 80-year programme to achieve Te Ture Whaimana.

6.2 Farm Environment Plans

43. An issue discussed in evidence was the degree to which the farm environment plan Schedule 1 should adopt a "standards" or an "objectives and principles" based approach²⁰.
44. Officers noted that a number of parties who put forward standards-based approaches were advancing material that would require considerable subjective judgement within a permitted activity framework²¹, were very lengthy and complex²², or had significant issues with certainty²³. Further, some of the standards proposed were, in the Officers' opinion, unrealistically low such that the vast majority of existing farming activities would be able to comply and hence take no

¹⁹ Section 42A Block 2 Report section C.1.1 [pg. 8 to 38]

²⁰ Grant Eccles – Federated Farmers Block 3 hearings evidence for Plan Change 1 [Annexure GE2], Gerard Willis – Fonterra Limited Block 3 hearings evidence for Plan Change 1 [Attachment A pg. 15], Miraka Limited Closing Statement [Appendix 1 pg. 10]

²¹ Kim Hardy – Miraka Limited Block 3 hearings evidence for Plan Change 1 [Section 6]

²² Grant Eccles – Federated Farmers Block 3 hearings evidence for Plan Change 1 [Annexure GE1 & Annexure GE2], Miraka Limited Closing Statement [Appendix 1 pg. 10]

²³ Gerard Willis – Fonterra Limited Block 3 hearings evidence for Plan Change 1 [Attachment A pg. 15], Grant Eccles – Federated Farmers Block 3 hearings evidence for Plan Change 1 [Annexure GE1 & Annexure GE2], Miraka Limited Closing Statement [Appendix 1 pg. 10]

further action²⁴. As outlined in the Officers' opening of the Block 3 hearing, one of the difficulties of a standards-based approach is trying to set a level of standards that trigger improvements for those who need to improve and permit those who already are exhibiting good practices. If those standards are set too low, while it may generate few resource consents, improvements in water quality cannot be expected. To the Officers, it appeared that some proposals were promoted as being efficient, but lost sight of whether they were effective.

45. Officers remain of the view that that the objectives and principles approach to farm environment plans is more appropriate to deliver bespoke farm environment plans on individual farms. Officers consider that using the objectives and principles as performance standards in a resource consent, supported by farm environment plans that describe the individual specific actions that will be adopted to meet those performance standards, is the best approach to achieve widespread farmer adoption. The expert-led review process, guided by Council's proposed review manual and moderation process, and the ability to review consent conditions to apply farm specific standards if required, provides sufficient certainty that improved farming practices will be adopted. As a result, the overall approach recommended by Officers in the revised schedule, now retitled "Schedule D" remains the same.
46. A number of submitters provided helpful suggestions that Officers consider will strengthen and make the Schedule easier to use, and these changes have been incorporated into the final strikethrough version attached. These changes have been drawn from the evidence and/or closing submissions of Miraka, Fish and Game, Federated Farmers, Theland Group, Southern Pastures, Ata Rangi and DoC.
47. Several of these submitters suggested the addition of a purpose statement, which Officers agree is a helpful addition. Officers have drafted a shortened version that incorporates the key concepts proposed by the submitters.
48. Federated Farmers and Miraka raised a concern that the term "minimise" used in the objectives and principles created an unreasonable expectation of the amount of risk reduction required for on farm mitigations, and proposed to amend "minimise" to "reduce". Officers consider that "reduce" is not sufficiently stringent, and may undermine the achievement of good farming practice. In the longer-term, Officers consider "minimise", even if it means the dictionary definition of "to reduce to the smallest degree possible" is appropriate, in the context of giving effect to Te Ture Whaimana.
49. The submitters also suggested helpful amendments that improve the clarity and specificity of section C describing the content requirements for farm environment plans, which Officers recommend are adopted.
50. Concern was also raised during the hearing that the use of the word "objectives" in the Schedule could be confused with the Plan "objectives" set out in section 3.11.2 of PC1.²⁵ Officers have therefore adjusted the Schedule to use the term "goals" in place of "objectives", which is arguably a more technically correct description in any event.

6.3 The Beef and Lamb proposal

51. Beef and Lamb presented a comprehensive case for a LUC/natural capital-based approach to the management of nitrogen in the catchment. While it was the focus of the Beef and Lamb evidence, there were many other helpful aspects raised by the submitter.

²⁴ Gerard Willis – Fonterra Block 3 hearings evidence for Plan Change 1 [Attachment A pg 15]

²⁵ Miraka Limited Closing Statement [para 3.5(b)(ii)]

52. The crux of a LUC approach is to identify the “productive capability” of land, based on soil type, rainfall and slope, among other matters, and assign an allowable leaching rate for nitrogen to each category of land. Broadscale mapping of the land classes already exists, but proper application is likely to benefit from farm-scale mapping of the different land classes.
53. Many other submitters raised the benefits of such an approach, but often disagreed with respect to detail or whether enough information was available at present to develop such a system. This included DoC and Fish and Game, who both supported the approach, but had differing views as to whether it was able to be implemented at this point in time.²⁶
54. After considering this evidence, the overall Council position is that while such an approach may be able to be used in the future, at present there is insufficient information to justify, or implement an LUC-based allocation approach. In particular, Council is of the view that there is insufficient information about transition costs and timeframes, and uncertainty as to the allocation mechanism required to achieve PC1 outcomes.
55. In particular, the Beef and Lamb approach is not supported for three fundamental reasons:
 1. the Beef and Lamb modelling is based on a less constraining outcome, compared to Table 3.11-1 in PC1. This is particularly evident when the Beef and Lamb stocking rate option is considered, where it would appear that the LUC mechanism would provide for considerable increases in stocking rates in many areas of the catchment. Overall, it would appear that the Beef and Lamb approach is based on a fundamentally different outcome.
 2. There is a lack of clarity in the Beef and Lamb evidence of how high emitters are expected to operate under the more constrained nutrient output levels, or the timeframe to transition to these loss levels. This has shown itself to be a particular issue in the Horizons One Plan area, where high emitters, such as the commercial vegetable production sector are simply unable to comply with the caps on losses, and need to be granted resource consent to exceed these loss rates or are presumably unable to continue.
 3. In answers to questions from the Panel, the Beef and Lamb witnesses advised the Panel that they did not consider it necessary for the high emitters to reduce before the low emitters could be enabled to increase to the levels anticipated in the Beef and Lamb proposal. On this basis, for some interim period it is realistic to expect that water quality would decline rather than improve, which would appear to be contrary to the NPS-FM and Te Ture Whaimana.

6.4 Certified Industry Schemes

56. In the Block 2 Section 42A Report the appropriateness and efficacy of certified industry schemes was questioned.²⁷ Further evidence to the Hearing Panel and responses to questions asked of submitters have led the Officers to further question the usefulness of certified industry schemes within the PC1 provisions.²⁸ Overall, it appeared that those organisations that may be interested in setting up a certified industry scheme did not consider a resource consent framework for the scheme itself to be appropriate and it became apparent that it is difficult to justify a different activity status simply based on membership of a scheme.
57. Certified industry schemes may be useful in a non-regulatory context, in terms of providing support to the members for resource consent applications and farm environment plans, but

²⁶ Director-General of Conservation Block 3 Legal Submissions for Plan Change 1 [para 13], Auckland/Waikato and Eastern region Fish and Game Councils Block 2 Legal Submissions [Section 2 para 2.1 to 2.13]

²⁷ Section 42A Block 2 Report section C.3 [pg. 126 to 136]

²⁸ Gerard Willis – Fonterra Block 2 hearings evidence for Plan Change 1 [Section 6 pg. 8 to 20], Federated Farmers Closing Statement for Plan Change 1 [Annexure A – pg. 3 to 5]

overall it appeared that including them in a regulatory sense would likely involve a difficult to manage mixture of roles. After some further consideration, Officers now recommend that certified industry schemes be deleted in their entirety, including the suggested new policy, the various rules, definitions and Schedule 2. This will not stop an industry body or company setting up a 'scheme' in a way that can assist members to fulfil their RMA obligations, and applying for resource consent in a normal way.

6.5 Commercial Vegetable Production

58. Both HortNZ and a range of growers, largely represented by the Pukekohe Vegetable Growers Association, sought a more permissive activity status and a specific inclusion of an allowance for growth in commercial vegetable production in some parts of the catchment.²⁹ The justification for this was largely a wider community benefit from increased availability of affordable fresh fruit and vegetables, and population growth.³⁰
59. In the Section 42A Report officers briefly discuss this issue and did not support that approach.³¹ Officers have also noted the clarification provided by River Iwi that they also do not support this approach, and consider it contrary to Te Ture Whaimana.³²
60. On this basis, Officers have made some adjustments to the recommended framework from the Block 3 Section 42A Report, but the fundamental components are largely unchanged. Importantly, Officers note that the growers and HortNZ did not put forward a proposal that aligns with Te Mana O Te Wai³³ and Te Ture Whaimana. This does leave the Hearing Panel in somewhat of a binary position, where on the one hand the evidence presented suggested the rule framework would be relatively onerous for the commercial vegetable production sector, but would ensure the environment is adequately protected, or alternatively the view of the growers and HortNZ, where the Hearing Panel is invited to consider the small scale of the commercial vegetable production sector and recognise that a small amount of growth is unlikely to lead to significant consequences in the wider catchment.³⁴ However, the difficulty then arises with similar claims being made by other sectors, organisations or individuals and the difficulty in refusing such approaches.
61. An option considered by Officers is to specifically enable expansion at a policy level and possibly through a discretionary activity rule that would require offsetting of losses through reduction in other farming activities. The Officers recommended Policy 3.c1 identifies that this is supported, but could be made more explicit, along with the inclusion of an appropriate rule, if the Hearing Panel considered this a useful approach. Given the location-specific effects that could occur with moving commercial vegetable production around, along with potential growth, Officers recommend an activity status that enables more discretion than a controlled activity, the retention of an ability to consider specific parties potentially affected, and suggest that the Hearing Panel should confirm that there is adequate policy direction for the various permutations that could occur under this rule framework.
62. HortNZ raised issues in relation to fruit production and other low intensity horticulture, and suggested a permitted activity was appropriate.³⁵ Officers agree that this was an unintended consequence of the Officers' Section 42A Report rule regime. Accordingly, low intensity horticulture is recommended to be a permitted activity under Rule 3.11.5.1, with an associated definition.

²⁹ Vance Hodgson – HortNZ Block 3 hearings evidence for Plan Change 1 [para 50 to 75]

³⁰ Michelle Sands – HortNZ Block 3 hearings evidence for Plan Change 1 [Para 71]

³¹ Section 42A Block 3 Report section C1. [Para 96 to 99]

³² Waikato and Waipa River Iwi Closing Legal Submissions for Plan Change 1 [para 11 to 16]

³³ As set out in the NPS-FM 2014 (Revised 2017) Objective AA

³⁴ Chris Keenan – HortNZ Block 3 hearings evidence for Plan Change 1 [Para 58 to 60]

³⁵ Vance Hodgson – HortNZ Block 3 hearings evidence for Plan Change 1 [Para 86 to 89]

7 Policies

7.1 Policy 4 - Consent duration

63. PC1 includes two policies (Policies 4 and 13) that provide specific direction on consent durations for future discharge reductions for all farming activities and point sources. The existing WRP contains a general policy relating to consent durations (Policy 6 in Chapter 1, Section 1.2.5) and a different (and less relevant for PC1) policy in relation to consent duration for the taking of water. Policy 6 of the operative WRP states:
64. *Policy 6: Consent Duration*
When determining consent duration, there will be a presumption for the duration applied for unless an analysis of the case indicates that a different duration is more appropriate having had regard to case law, good practice guidelines, the potential environmental risks and any uncertainty in granting the consent.
65. Officers note that the existing WRP Policy 6 is relatively general in nature, and is not particularly aligned with either Policy 4 or Policy 13 of PC1. On this basis, there is a need for clarity that Policies 4 and 13 apply to discharges of the four contaminants in the Waikato and Waipa catchments.
66. It would also be a fair assessment that there was a diversity of opinions expressed about the duration of resource consents for farming activities envisaged by Policy 4A. Many individuals or farming bodies sought a duration in the order of 25 years³⁶, while others sought a considerably shorter duration or a duration that was aligned with planning cycles³⁷. Officers also noted the desirability of an explicit statement as to duration, and certainty regarding any potential exceptions to that indicated duration. Officers generally agree that a duration that aligns with planning cycles is most appropriate, for the reasons set out in the Section 42A Report. Officers are recommending the shortening of Policy 4A to remove some less relevant material, and to make the Policy considerably more explicit. A common expiry date for each sub-catchment is an option, but Officers prefer a slightly more flexible “same expiry year”, which enables further spreading of workloads for consent renewals.
67. In relation to point source discharges and Policy 13, Officers recommend minor further adjustment, to improve certainty and clarity that Policy 13 prevails over the more general Policy 6 of the WRP, and greater certainty about the durations that may extend beyond this planning cycle.

7.2 Policy 7

68. In the Section 42A Report, the Officers recommended that Policy 7 be deleted, as it is more of a statement of intent for future planning processes³⁸. The Officers also recommended that the Implementation Methods, including *Method 3.11.4.7 – Information needs to support any future allocation* be deleted. Submissions received on Policy 7 were split in favour or opposing the Policy, with those in favour, recognising that research is a necessary and important step towards improving water quality, and that future allocation decisions should take advantage of new data and knowledge. Those opposing Policy 7 were concerned with the wording of the policy, and the uncertainty it creates in terms of future implications (including economic reasons),

³⁶ Grant Eccles - Federated Farmers Block 2 hearings evidence for Plan Change 1 [Para 174 to 175], Dwayne McKay - Wairakei Pastoral Block 2 hearings evidence for Plan Change 1 [Para 191]

³⁷ Deborah Kissick – Director-General of Conservation Block 2 hearings evidence for Plan Change 1 [Para 218], Helen Marr – Auckland/Waikato and Eastern region Fish and Game Councils Block 2 hearings evidence for Plan Change 1 [section 5]

³⁸ Section 42A Block 3 Report section C4.3.8 [Para 482]

particularly when these would be based on a grandparenting approach and the use of Overseer. Submitters also questioned the appropriateness of Policy 7 as a policy. This mix of views featured in evidence presented to the Hearing Panel and in responses to questions.

69. There is some overlap between Policy 7 and Implementation Method 3.11.4.7, with both seeking to encourage research and information gathering to support future allocation. Dr Mitchell³⁹ and others proposed amending Policy 7 so that it focuses on gathering information relevant to future policy development requirements, but not directing what the future policy direction should be. The Officers now recommend changes to the policy to focus it on gathering information and undertaking research, so that the data is available to inform future water management decisions. This recognises that ways of managing water resources are constantly changing and that research can be useful for future decision making, not only for future water allocation methods.

7.3 Policy 9 and new Policy 9A – Sub-catchment planning

70. It was identified in the Section 42A Report that many parties had raised “sub-catchment planning”, but had different views as to what it incorporated or how it might be implemented⁴⁰. The Hearing Panel questioned many parties who raised this option and appeared to receive a diversity of responses⁴¹. The Hearing Panel characterised the ways that PC1 could respond to sub-catchment planning as being: discouraging, neutral, supportive or compelling.⁴² Most parties seemed to suggest “supportive” was the appropriate approach, but (other than Beef and Lamb)⁴³ were not particularly clear on exactly how it would work.
71. The Section 42A Report position was “neutral” with respect to sub-catchment planning processes, by which farmers could group together to advance common, local actions. The Section 42A Report recommendation provided neither policy direction, nor a specific rule. After considering the evidence, Officers now consider there is potential to be more supportive of these processes, but given the residual uncertainty as to what they entail it is clear that a ‘permissive’ activity status is not appropriate. The evidence would suggest that some sub-catchment planning processes will be of a non-regulatory nature and others may entail group consenting, group FEPs or shared mitigations. This appeared to be the approach of the Beef and Lamb proposal, which, while outwardly attractive, did highlight that there are a number of risks to the participants and the Council⁴⁴. This appeared to include a requirement for the formation of an incorporated society with specific rules to address individual compliance.
72. Overall, given the residual risks and uncertainties, an additional policy (Policy 9A) is recommended to provide a greater level of policy support for joint consenting, joint FEPs or mitigation actions, or sub-catchment planning, provided risks can be minimised. Given the residual uncertainty as to the form and function of these approaches, a discretionary activity status continues to be recommended.

³⁹ Dr Phil Mitchell - Oji Fibre Solutions Ltd Block 3 hearings evidence for Plan Change 1 [Para 7.2 to 7.2]

⁴⁰ Section 42A Block 3 Report section C2.3 [Para 133]

⁴¹ Farmers for Positive Change, Upper Maire Sub-Catchment Group, Hill Country Farmers Group, Matira Sub-Catchment Group, King Country River Care

⁴² A paraphrasing of Commissioner Hill’s description in questions put to submitters

⁴³ Corina Jordan – Beef and Lamb Block 3 hearings evidence for Plan Change 1 [Para 28, 33, 52]

⁴⁴ Corina Jordan – Beef and Lamb Block 3 hearings evidence for Plan Change 1 [pg 6-12] and oral responses of Corina Jordan to Hearing Panel questions.

7.4 Policies 10-13 (Point Source)

73. There were a significant number of submissions, both for and against, the point source discharge policies 10-13. The analysis in the Section 42A Report recommended some minor adjustments to the policies, but largely left them as notified.
74. Relatively significant evidence in relation to point source discharges was lodged by a small number of parties, particularly the territorial authority group (WARTA) and Watercare Services. As noted in Council's closing legal submissions, the WARTA interpretation of Te Ture Whaimana differs from that of the River Iwi and the Council. Officers do not agree that there should be some form of preferential provisions for point-source discharges.
75. Policy 10 was questioned by the hearing panel in the July "20 questions". Officers now confirm that their tentative response to the question of the appropriateness of Policy 10 is now recommended to be adopted in Policy 10.
76. Policy 11, in relation to best practicable option and offsetting, raised concerns with a number of parties, who understandably, struggled to see the relationship between these two concepts. In the tracked changes version, Officers have recommended that this Policy be split into two, to separate and clarify the application of these concepts.
77. Policy 13, in relation to the duration of point source discharge permits has been discussed earlier in relation to Policy 4.
78. A small number of submitters, such as Oji and WARTA raised difficulties resulting from not having a specific policy that enabled new discharges and highlighted the barrier to gaining approval for a new point source discharge.⁴⁵ Officers have further considered that, but consider that such a new policy would be difficult to justify, particularly in light of Objective H of Te Ture Whaimana which states: *The recognition that the Waikato River is degraded and should not be required to absorb further degradation as a result of human activities.*

7.5 Policy 14A

79. In the recent Bay of Plenty plan change 10 decision of the Environment Court, the introduction of contaminants into the Rotorua catchment through groundwater that drains from the PC1 area was noted.⁴⁶ Consequently, Bay of Plenty and Waikato Regional Councils have entered into a memoranda of understanding about management of this issue. While not raised in evidence by any party, the WRC submission raises this cross-boundary issue, and the recent Environment Court decision would suggest that PC1 ought to recognise and enable better management of this issue. On this basis, a new Policy 14A is recommended to be added, which encourages recognition and responding to cross-boundary issues.

7.6 Policy 15

80. Policy 15 seeks to protect and to make progress towards restoration of Whangamarino Wetland by reducing discharges of the four contaminants in the sub-catchments that flow into the wetland. The Officers recommended that Policy 15 be retained with no amendments.

⁴⁵ Dr Philip Mitchell – Oji Fibre Solutions Limited Block 2 hearings evidence for Plan Change 1 [para 5.8], Mary O'Callahan – WARTA Block 2 hearings evidence for Plan Change 1 [Para 2.8]

⁴⁶ Bay of Plenty Plan Change 10 decision of the Environment Court [para 76]

Implementation Method 3.11.4.4. – Lakes and Whangamarino Wetland is recommended to be deleted in the Section 42A Report.

81. Submissions on Policy 15 generally supported the Policy in full, or subject to amendments. Several submitters state that the current wording of Policy 15 is too ambiguous and does not provide enough direction. Greater emphasis on the restoration of wetlands and avoiding further degradation is also a common theme throughout the submissions and evidence presented on this Policy.
82. In particular, DoC considers that PC1 already has a very narrow focus in terms of wetland management and does not recognise all the important wetland values and the complex nature of Whangamarino Wetland. DoC seek Policy 15 be strengthened by setting specific environmental targets for wetland restoration over both the short and long term. DoC seeks changes to Policy 15 so that the Policy aims to achieve the natural succession of the wetland system, acknowledges the relationship between water quality and contamination and wetland hydrology, and seeks specific actions to address the high rate of sediment deposition and nutrients.⁴⁷ Ms Kissick raises similar issues and suggests specific amendments.⁴⁸
83. Upon further consideration, the Officers recommend amending Policy 15 so that it is strengthened in terms of recognising the role wetlands play in improving water quality. Officers are satisfied that there is appropriate linkage to Objectives 1, 3 and 5, such that the recommended deletion of Objective 6 does not leave this Policy ‘hanging’. The Officers consider that the Policy could be amended so that it better protects wetland habitats, including reducing further losses to the bog ecosystem. However, the complex nature of the existing consent regime, the changed hydrology of the system, including drainage works, and pest fish make the management of diffuse discharges only a part of the equation. More emphasis on support for wetland research and restoration is recommended to be included from Implementation Method 3.11.4.4 and from the evidence of Dr Robertson and Ms Kissick.

7.7 Policy 16

84. Officers noted that very little evidence was given with respect to Policy 16. On this basis, Officers recommend that it be retained as notified, with only minor changes as a consequence of other recommendations.

7.8 Policy 17

85. There was limited, but focused, discussion during the hearing regarding Policy 17 and the various interpretations of it. Officers noted the considerable differences of opinion as to what circumstances it applied to, concerns about how it could potentially be misused, and how it appeared to have an internal conflict in terms of referring to matters outside the scope of Chapter 3.11 (and hence PC1 itself).⁴⁹
86. Overall, Officers consider that the intent behind Policy 17 is a useful and appropriate policy direction, but agree that the wording is in need of improvement. Officers recommend changes to narrow the focus of Policy 17 so that the concerns of submitters regarding its potential for

⁴⁷ Dr Hugh Robertson – Director-General of Conservation Block 3 hearings evidence for Plan Change 1 [Para 15]

⁴⁸ Deborah Kissick – Director-General of Conservation Block 3 hearings evidence for Plan Change 1 [Para 168 to 184 & pg 38 of Appendix 1]

⁴⁹ Grant Eccles – Federated Farmers Block 2 hearings evidence for Plan Change 1 [para 9.2 & 9.3], Chris Scrafton – Watercare Services Limited Block 3 hearings evidence for Plan Change 1[Section 3 pg. 3 to 6]

misuse are addressed, and the internal conflict regarding the scope of Chapter 3.11 is removed. In other respects, the intent of Policy 17 is retained.

8 Schedules

8.1 Schedule A (Registration)

87. A small number of further adjustments to Schedule A, which addresses the registration process, are recommended.
88. The most significant change is the deletion of the date range by which registration must be completed. Under the revised structure of the rules, registration will be required as a condition of the interim permitted activity rule and other rules that require a resource consent. This means that while registration is still legally required to occur, deletion of a date range negates the risk of an unintended consequence whereby all those properties that do not comply with the date range become fully discretionary activities. Officers consider that such a consequence is unlikely to increase compliance with the rule, but will lead to a significantly increased administrative burden for both applicants and the councils, with no environmental benefit.

8.2 Schedule B (NRP)

89. Schedule B, which relates to the nitrogen reference point, was significantly amended in the Block 2 Section 42A Report. A large number of further adjustments are recommended in the final tracked changes version. While the number of wording changes is significant, those changes are generally of a grammatical nature or wording adjustment that improves certainty, clarity and enforceability. For the reasons discussed above in relation to the date range in Schedule A, the wording for the nitrogen reference point data to be submitted is also adjusted, which recognises that in many ways it is going to be realistic that a nitrogen reference point is going to be developed at the time an application is prepared rather than beforehand. The loss of farmer 'awareness' of their contaminant losses in the intervening period, which could be some years, is a regrettable consequence.

8.3 Schedule C – Stock Exclusion and Minimum Standards

8.3.1 Setbacks

90. Schedule C of PC1 sets out the main requirements for stock exclusion. Many submitters, in each of the hearing blocks, have sought clarification on setback distances and have proposed amendments which are either smaller or larger than those provided for in the Section 42A Report recommendations.
91. DoC, Fish and Game and Wairakei Pastoral seek an increase in the setback distances as stated in the Section 42A Report. DoC consider the recommendations are insufficient to address Objectives F and I of the Te Ture Whaimana, which requires a precautionary approach, and to protect and enhance significant sites, fisheries and fauna. In contrast, Federated Farmers, HortNZ and Beef and Lamb NZ consider that there is insufficient evidence in either the Section 42A Report or opposing submitter evidence to increase the setback distance. Indeed, many submitters consider that considerably less fencing should be required.

92. As covered in the Section 42A Report and more particularly in the Federated Farmers evidence, fencing of waterbodies and the associated water reticulation may involve significant cost.⁵⁰ However, the Officers are of the view that these costs are required to achieve the outcomes sought by the Te Ture Whaimana and PC1.
93. The Officers note the substantial additional evidence that was not considered in the Section 32 or Section 42A Reports from DoC, and Fish and Game⁵¹ in relation to wetlands and riparian buffers. As previously outlined in the Section 42A Report, riparian planting options were not represented in the model produced by Doole 2015, due to the difficulty of representing the period of transition as the introduced vegetation establishes and grows. The Officers acknowledge that while a specified distance does not provide the same benefits everywhere, in principle there appears to be strong scientific evidence⁵² that there are benefits from having a wider buffer between farming activities and a waterway than previously notified and considered in the Section 32 evaluation, in part because provides additional filtering and absorption potential and it facilitates the establishment of riparian planting.

8.3.2 Intermittent and ephemeral rivers

94. A number of parties raised issues with respect to intermittent and ephemeral rivers, particularly in relation to fencing requirements. The Hearing Panel made a suggestion that the Auckland Unitary Plan definitions should be considered, and Officers undertook to obtain further advice from Council's science team. Council's science team supports the use of those definitions.
95. This has enabled further clarification of the fencing requirements, which are recommended to apply to intermittent, but not ephemeral water bodies. Due to the potential difficulties caused by introducing a definition of river and intermittent river into the WRP through this process, it is recommended that the application of fencing requirements to these kinds of rivers be described in the schedule, rather than by introduction of a new definition.

8.3.3 Wetlands

96. The protection of wetlands is addressed in the wider WRP, primarily in Chapter 3.7, and provisions of PC1 which relate to wetlands are limited to Whangamarino wetland and contained Policy 15. The Officers acknowledge there is a narrow focus for wetlands in PC1, which does not fully recognise the important values and the complex nature of wetlands. Therefore, the Officers have recommended a series of minor amendments to widen setbacks for stock exclusion and to improve the protection of listed wetlands in line with the operative WRP.
97. Officers reiterate that the review of the wider WRP will address wetlands more cohesively across the whole region.

8.3.4 Protection of inanga spawning areas

98. Inanga spawning was the subject of considerable evidence from DoC,⁵³ and a response by the Officers to a question from the Panel.
99. The proper protection of inanga spawning habitat is likely to require changes to other parts of the WRP, particularly in relation to protection of riparian areas from other activities. This may include things such as drain, roadside and stop-bank management, so that vegetation trimming and management is limited before and during the spawning season. Essentially, the stock

⁵⁰ Paul Le Miere – Federated Farmers Block 3 hearings evidence for Plan Change 1 [para 8 to 40]

⁵¹ Appendix 2 – S32AA Analysis regarding setbacks from waterbodies, page 55 of the Director-General of Conservation – Deborah Kissick Block 3 hearings evidence for Plan Change 1, Auckland/Waikato and Eastern region Fish and Game Councils – Rebecca Eivers Block 2 hearings evidence for Plan Change 1

⁵² Dr Adam Daniel – Auckland/Waikato and Eastern region Fish and game Councils Block 2 hearings evidence for Plan Change 1 [Para 3.5], Dr Simon Stewart – Director-General of Conservation Block 2 hearings evidence for Plan Change 1 [Para 43 to 51]

⁵³ Ref – Kate McArthur – Director-General of Conservation Block 2 hearings evidence for Plan Change 1 [para 22 & 23], Kate McArthur – Director-General of Conservation Block 3 Further Supplementary hearings evidence for Plan Change 1 [para 6 to 17]

exclusion sought by DoC is a useful start, but there are many parts of the lower catchment where stock exclusion is unlikely to be the primary issue.

100. Overall, the key response in PC1 would be greater setbacks from water bodies in the lower parts of the catchment, so that rank grass and other vegetation is protected from grazing. The Officers are supportive of this approach, subject to the Hearing Panel being satisfied that there is scope within the DoC submission to include the mapping required, and remain concerned that this issue extends beyond the scope of the “four contaminants”. On this basis, a bracketed amendment to the stock exclusion requirements is included in the tracked changes version of PC1 for the Hearing Panel to consider.⁵⁴

8.4 Extension to Minimum Standards

101. At the hearing for Block 3, there was considerable discussion of “minimum standards” of environmental performance for farming, and some limited identification of what these might entail. The use of minimum standards in PC1 was seen by submitters as either an adjunct to farm environment plans, or in some cases, effectively an alternative.⁵⁵ Officers consider minimum standards to be a means of balancing community desire for greater certainty and the achievement of improvements on-farm sooner, sitting alongside the more comprehensive and flexible farm environment plan framework.
102. Whilst there is a recognised need for flexibility within the farm environment plan process, it is acknowledged that it will take some time to develop farm environment plans with the level of rigour and consistency required, and these requirements may be delayed by many years through the implementation phase. It is also acknowledged that there are some relatively common practices on farm that are sufficiently high risk to warrant the inclusion of minimum standards that ensure a base level of practice is achieved.
103. For clarity, a minimum standard sets a minimally acceptable baseline of acceptable operational practice that good farming practice will be no lesser than, and in many cases will exceed where appropriate. It is for this reason that these baseline requirements are intended to be relatively achievable. Where additional practices are required to meet good farming practices, the timing and transition speed of practices involve a level of judgement and discretion. If a farmer intends to undertake practices that were lesser than these minimum standards they can seek authorisation via an alternative resource consent process.
104. The proposed minimum standards have been adapted from the evidence of various submitters to be more clear, objective, and enforceable. These adaptations are as follows:

Nitrogenous fertiliser application rate.

105. This has been adopted from Fonterra's evidence which states “Nitrogen fertiliser application rates to pasture are no greater than 30 units of N per dressing”⁵⁶.
106. It is well understood that the application of nitrogen fertiliser at rates which exceed plant growth increases the risk of nitrogen being made available to be lost via leaching. Whilst some farmers may already be strategically applying fertiliser at low rates, there are those whom follow a prescribed method of applying fertiliser each year, or have no strategy in place at all. By generally limiting nitrogen application rates farmers will need to consider early on whether their

⁵⁴ Should the Hearing Panel wish to include this restriction and associated maps, the Council can prepare maps based on the information described at the hearing.

⁵⁵ Gerard Willis – Fonterra Block 3 hearings evidence for Plan Change 1 [Attachment A]

⁵⁶ Gerard Willis – Fonterra Block 3 hearings evidence for Plan Change 1 [Attachment A – Part C (1)(d) pg. 17]

current fertiliser management practices are efficient, and whether a greater application rate is necessary or required.

No nitrogenous fertiliser application timing

107. This has been adapted from the evidence of DairyNZ which states “Soil temperature, moisture levels and the weather forecast are assessed before applying fertiliser. No nitrogen fertiliser is applied during [specified months, potentially May-June] no P fertiliser is applied during [specified months, potentially June-July]”.⁵⁷
108. The proposed requirement to assess soil, temperature, and moisture levels are difficult to objectively assess and unlikely to be sufficiently certain to be a minimum standard. However, the requirement to prohibit the application of nitrogenous fertiliser during specified months can be easily understood and assessed.

Maintenance of a vegetated buffer/setback for the grazing of any winter fodder crop and sacrifice paddocks from Schedule C waterways or drains.

109. This minimum standard has been adapted from the evidence of Fonterra in Block 2 which states “No winter grazing of fodder crops (from June 1 to September 1) occurs within 3m of any Schedule C water body. An un-grazed, vegetated buffer of at least 3m is provided between a winter grazed block and any Schedule C water body.”⁵⁸
110. The grazing of winter fodder crops is a recognised high-risk activity with respect to the loss of sediment, bacteria, phosphorus, and nitrogen to water. Historically less widespread, this practice has increased with off-farm dairy grazing where some instances of poor site selection have occurred.

The grazing of any winter forage crop on land with a slope greater than 15 degrees

111. Slope is known to exacerbate the risk of contaminant run-off, particularly during periods of high rainfall and when soils are saturated and infiltration capacity is low. Given the high risk of contaminant loss associated with the grazing of winter crops, it was considered appropriate to limit the slope of the land used for this activity.

Cultivation setback to Schedule C waterbodies

112. This minimum standard was contained in Schedule 1 as notified. Cultivation increases the risk of sediment run-off during heavy rainfall events. Therefore, it is important that a minimum setback is specified that also recognises the lower risk associated with this activity where livestock are not grazed (typically a summer cut and carry crop such as maize).

9 Forestry

9.1 Setbacks

113. Fish and Game and DoC presented evidence on increased setbacks to waterbodies for vegetation clearance of plantation forests. Much of Fish and Game’s evidence relied on the fact

⁵⁷ Justine Young – DairyNZ Block 3 hearings evidence for Plan Change 1 [Attachment – Schedule 1A pg. 18]

⁵⁸ Gerard Willis – Fonterra Block 3 hearings evidence for Plan Change 1 [Attachment A – Part C (5)(c) pg. 19]

that plantation forestry rules are able to be more stringent than the NES-PF, when a rule gives effect to an objective developed to give effect to the NPS-FM.⁵⁹

114. Throughout the CSG process it was determined that the forestry provisions in the WRP were sufficient to control the effects of contaminant loss to water over the life of the forestry rotation, therefore giving effect to the Te Ture Whaimana.⁶⁰ The setbacks in the WRP are similar to the setbacks in the NES-PF with the exception of lakes and wetlands smaller than 0.25ha not being included, which, in addition to application to intermittent or ephemeral rivers, is the issue identified in Fish and Game's evidence.
115. While the position of Fish and Game and DoC may be justified, Officers note the comments on the scope of PC1 in the Council's closing legal submissions and make no recommendation.

9.2 Harvest Plan

116. Fish and Game have also recommended that a rule be included to ensure all water bodies are identified within the forestry harvest plan when required to have one in place under the NES-PF. Fish and Game's reasoning is that the NES-PF is less stringent than the PC1 harvest plan provisions. However, there are a number of provisions in the NES-PF harvest plan that make the NES-PF harvest plan more stringent as a whole. Officers maintain their position set out in the Section 42A Report that while generally supported, the advantage of reliance on the universal application of the NES-PF outweighs the benefits of having bespoke provisions in PC1.

10 Miscellaneous

10.1 Koi Carp

117. There has been a large amount of evidence from farmers and landowners that koi carp are a major problem in the Waikato, and that either (a) this issue should be dealt with in PC1, or (b) farmers should not be required to take action until the koi carp issue is addressed.⁶¹ Conversely, evidence from DoC and Fish and Game suggest that koi carp exacerbate water quality issues, but are not the primary cause, and that water quality would still be poor if koi carp were removed. DoC noted that a study modelling Lake Ohinewai concluded that integrated catchment management would be required to restore lake water quality to mesotrophic conditions that may enable the re-establishment of macrophytes. It also concluded that koi carp removal alone would not be sufficient to achieve lake water quality restoration in Lake Ohinewai.
118. Considerable evidence was also presented by submitters, particularly through photographs that showed the significant impact that Koi carp can have in small streams, resulting in sedimentation and undermining of banks, and associated issues with repairing planting and fencing. Officers understood that there was a general consensus that PC1 would not have a significant effect, of itself, on the population or management of Koi carp, but rather the question arose as to what should PC1 require of farmers, should the ongoing presence of Koi carp be accepted.
119. Officers understand DoC is responsible for incursion management, surveillance, control and eradication of brown bullhead catfish, gambusia and koi carp. Management of perch, rudd and

⁵⁹ Helen Marr – Auckland/Waikato and Eastern region Fish and Game Councils Block 3 hearings evidence for Plan Change 1 [para 7.14]

⁶¹ Graeme Gleeson – Farmers 4 Positive Change Block 1 hearings evidence for Plan Change 1 [para 213]

tench are under the jurisdiction of Fish & Game. The Ministry for Primary Industries is the lead agency for pest fish new to the Region. WRC is required to provide support for these functions.

120. WRC implement the Regional Pest Management Plan which describes why and how various plant and animal pests will be controlled in the Waikato region. To guide priorities for pest fish management in the Waikato region, WRC and DoC jointly funded the production of the Pest Fish Management in the Waikato Region Implementation Plan. The plan was adopted by WRC on 6 June 2018. Following adoption of the plan, the regional council and DoC jointly committed to co-fund a regional pest fish coordinator to implement the work streams emanating from the Plan. This commitment was confirmed in the WRC's 2018-2028 Long Term Plan and became effective in 2018.
121. Given the roles and responsibilities of various agencies in the management and control of koi carp, the Officers maintain their view that PC1 should not directly respond to the issue of koi carp.

10.2 Beef and Lamb dairy cattle numbers

122. The Beef and Lamb evidence (Dewes, Chrystal, Cox and Burt) has advanced a range of different historic increases or decreases in dairy cattle numbers. While the following paragraphs are not material to the Officer's recommendations, they are included to provide some clarity on the matter, given some seemingly contrary reporting on dairy conversions.⁶²
123. At the outset, it should be noted that there are various sources of data on stock numbers, and depending on the methodology used to compile them, and the standard of reporting by stockholders, they may show different patterns. Given this, care is required in interpreting numbers, as it may be draw different conclusions depending on the data selected. This is one of the reasons why PC1 places some emphasis on information gathering, FEPs and registration – to gain better information for future planning processes.
124. Statistics NZ data shows that there can be considerable variance in dairy cow numbers from year to year. While the average annual change in dairy cattle numbers from 2003 to 2018 (last 15 years) is a 0.6 percent increase, the largest single change over that period was an 8 percent fall from 2014 to 2015. Dairy cattle numbers in the Waikato region reached a high in 2014 at 1.91 million, and in the latest data available was 5 percent lower, at 1.81 million.
125. Fluctuations in dairy cattle numbers are driven by various factors including weather and cost and availability of importing feed. Farmers also respond to market signals, increasing farmed area and production in response to higher returns, and reducing stock numbers (and costs) when milk prices are low (or are expected to be low). More recently, the outbreak of *Mycoplasma bovis* has highlighted how biosecurity concerns may also affect stock numbers. The slaughtering of infected animals, plus restrictions on stock movements may lead to changes in cattle numbers.
126. Overall, the Officers suggest caution in making firm conclusions about dairy cattle numbers or implying trends for contaminants. Again, the usefulness of the registration and consenting processes for gathering quality information are noted.

⁶² Alison Dewes – Beef and Lamb New Zealand Block 2 hearings evidence for Plan Change 1 [para 122 to 125], Jane Chrystal – Beef and Lamb New Zealand Block 2 hearings evidence for Plan Change 1 [Figure 3 pg. 16], Tim Cox – Beef and Lamb New Zealand Block 1 hearings evidence for Plan Change 1 [para 32], Andrew Burt – Beef and Lamb New Zealand Block 1 hearings evidence for Plan Change 1 [Para 37 & 38]

10.3 Definition of property

127. Officers acknowledged, in response to questions, the need for further refinement of the definition of 'property' in order to provide clarity with respect to properties that straddle the defined area to which PC1 applies. Essentially, PC1 applies to the area up to boundaries, and if a property straddles that boundary either with another part of the Waikato region or into another region, only part of that property will be covered by the PC1 rules. A minor adjustment to the definition has been made to clarify this point.

10.4 Certified Farm Environment Planners

128. Officers have further considered the evidence of submitters in relation to who should be certified to carry out advisory and audit activities under the PC1 framework. There was varied evidence presented as to the level of experience and capability that should be required, and particularly the commercial vegetable production sector seeking acceptance of the NZGAP audit framework.⁶³ Officers are concerned that the NZGAP auditors, while being fully accredited and adhering to a robust program, assess compliance with a farm environment plan only. Schedule D of PC1 anticipates that the auditors will consider the adequacy of the farm environment plan itself, the efficacy of mitigation actions and whether they are implemented. As Officers understand it, the NZGAP audit framework will not cover all of these aspects and therefore is not recommended to be adopted.
129. Officers have reconsidered the education and qualification element of the definition and now consider that the simplest process is to adopt the certified nutrient management advisor program, which includes both training as well as professional development criteria, and a code of ethics.

⁶³ Damien Farrelly – HortNZ Block 3 hearings evidence for Plan Change 1 [para 36]

Appendix A – Waikato Regional Council Revision of Table 3.11-1 (Plan Change 1)

Mike Scarsbrook (WRC), Bill Vant (WRC), Bevan Jenkins (WRC) and Bryce Cooper (NIWA)⁶⁴

7 October 2019

Purpose

Provide a revised Table 3.11-1 that incorporates corrections and considers results of technical caucusing as summarised in the PC1: Joint Witness Statement – Expert Conferencing – Table 3.11-1 (17 June 2019).

Style and format

In the current version of the Excel table we have colour-coded (in yellow) those cells where changes have been made to the notified version.

We recommend splitting Table 3.11-1 into several panels, with *E. coli* and Clarity merged together, mainstem TN, TP and Chlorophyll a as another panel, and dissolved nutrients (NO₃, NH₄ and DRP) in a third. The existing lakes table would form a fourth panel.

We could also present (if requested) a more simplified version that shows maintaining vs improving requirements and gives A-D bands rather than numbers.

Addition of new attributes

A wide range of additional attributes were discussed and debated throughout technical caucusing. Of these, only nutrients, *E. coli*, clarity and ‘lakes’ had unanimous support for inclusion in Table 3.11-1 (see Table 1 of the Joint Witness Statement). All of these attributes are already included in the notified version of Table 3.11-1.

The Joint Witness Statement indicated majority support for two additional numeric attributes. These were Macroinvertebrates (10 for inclusion: 4 against) and Whangamarino (6:5).

The Macroinvertebrate attribute recommended in the Joint Witness Statement is described at the FMU scale (i.e. % of stream length in ‘Poor’ condition), so does not lend itself to inclusion in Table 3.11-1. Furthermore, the main drivers of macroinvertebrate community health in Waikato streams are riparian and habitat condition and levels of fine sediment⁶⁵, so the match between scope of PC1 (N, P, sediment and *E. coli*) and a Macroinvertebrate attribute remains debatable. Nevertheless, the 2017 amendment to the NPS-FM (2014) added requirements for inclusion of Macroinvertebrates as a monitoring measure. This is consistent with previous advice from the Technical Leaders Group⁶⁶.

In relation to Whangamarino, we recognise the split in opinion and have not considered additional numeric attributes any further.

There was also support for addition of several narrative attributes:

⁶⁴ Dr Cooper was the Chair of the Technical Leaders group during development of PC1.

⁶⁵ Pingram, M.A., Collier, K.J., Hamer, M.P., David, B.O., Catlin, A.K. and Smith, J.P., (2019). Improving region-wide ecological condition of wadeable streams: Risk analyses highlight key stressors for policy and management. *Environmental Science & Policy*, 92, pp.170-181.

⁶⁶ Scarsbrook, M. (2016). Water quality attributes for Healthy Rivers: Wai Ora Plan Change. Waikato Regional Council Technical Report 2018/66.

- Deposited sediment (unanimous support for inclusion as narrative objective)
- Dissolved oxygen (unanimous support for inclusion as narrative objective)
- Periphyton (unanimous support for inclusion as narrative objective)
- Whangamarino (majority support (6:2) for inclusion as narrative objective)
- Other wetlands (majority support (8:2) for inclusion as narrative objective)

These narrative attributes would necessarily sit outside Table 3.11-1., so we have not considered them further in our revision of the Table.

The exclusion of Periphyton from PC1, despite it being a compulsory Attribute, will need to be addressed, with one option being adoption of a risk-based monitoring requirement and a narrative objective identifying targets for periphyton, particularly in any high-risk sites that might breach the national bottom line of 200 mg/m².

Following our review and further discussion, we are not recommending any new attributes be added to Table 3.11-1., with one exception. We propose including current state Dissolved Reactive Phosphorus (DRP; medians) for tributary sites, with short and long-term target states also set at current state (i.e. maintain). This is done for completeness, as the omission of DRP at the tributary scale appears to be an oversight and is not consistent with the scope of PC1.

Inclusion of current state information in the Table

We have added current state data (2010-2014⁶⁷) to Table 3.11-1. This current state data differs from that contained within a revised Table 3.11-1 presented to the Hearing Panel in the statement of evidence of Scarsbrook (11 March 2019; Table 3B), but it is consistent, and largely unchanged from, a corrected 2010-14 current state dataset presented in Attachment 1 of that same Statement of Evidence. We have gone with the 2010-14 period for the current state, rather than the 2014-2018 current state as previously requested by the Panel, as the earlier period is consistent with the period used to calculate short-term target values and long-term 'maintain' values in the notified version of Plan Change 1.

Waikato Regional Council are currently working to complete a full current state report. This will outline the methods used to generate the current state information and will set out procedures for any future 'current' state assessments. This will ensure that water quality state can be tracked through time in a consistent manner.

Human health (E. coli)

We have aligned the values in Table 3.11-1 with the *E. coli* attribute table in NPS-FM (2014, amended 2017).

We present 95%iles as notified (but corrected where necessary) and have derived targets for the other three 2017 measures as necessary to achieve the lowest level of average infection risk. The net effect of this is that targets attribute state for all PC1 locations equates to Band A from the NPS-FM (2014; amended 2017).

Note that many of the values in the spreadsheet for *E. coli* attributes are italicised. This reflects low sample size as described in Attachment 1 of the evidence of Scarsbrook (11 March 2019).

Clarity

We present two options for clarity. The first is based on median values (as per notified version, but with corrections where required), whereas the second option uses an alternative method proposed during the technical caucusing process. This alternative approach has the same

⁶⁷ With the exception of *E. coli* that uses data from 2009-2014.

Minimum Acceptable State for swimming (i.e. 1m), but uses the 10th percentile as the reporting statistic versus medians (50th percentile). The rationale for this more stringent statistic is that meeting the Minimum Acceptable State (i.e. 1m) for only 50% of the time does not reflect the swimming value.

The consequences of adopting Option 2 (10th percentile) would be to grade more sites as failing to achieve the Minimum Acceptable State (53 sites would fail under Option 2 versus 33 sites under Option 1; see pages 60-68 of Joint Witness Statement).

Waikato River Trophic State (Chlorophyll a, TP and TN)

The notified version of Table 3.11-1 included three lake trophic state attributes (Chlorophyll a, TN and TP) from the NPS-FM (2014) that were applied to mainstem Waikato River sites. In addition, the TN attribute, which is split into Seasonally Stratified and Polymictic values, was applied using the lower Seasonally Stratified values.

Over the course of the Technical Caucusing on Table 3.11-1 and in our more recent discussions, the derivation of TN and TP values along the Waikato River mainstem was hotly-debated.

In contrast, there is a level of comfort with notified targets for Chlorophyll a along the river. We consider this was also the majority view during Technical Caucusing. As a result, we do not recommend any changes to the Chlorophyll a attribute values at mainstem sites, although some corrections have been made in the revised Table.

Given our collective knowledge and experience of the Waikato River we consider there to be several important points to raise in relation to managing nitrogen and phosphorus along the mainstem of the river for the purpose of achieving defined phytoplankton biomass outcomes:

1. The Waikato River is comprised of riverine reaches, interspersed with hydroelectric reservoirs that function to varying extents as lacustrine habitats
2. It is more appropriate to describe the Waikato River as polymictic, rather than seasonally stratified
3. Hydraulic retention time is an important factor controlling phytoplankton growth patterns along the river
4. In comparison to New Zealand lakes, and more specifically the lakes dataset used to identify the attribute thresholds in the NPSFM (2014), the Waikato River mainstem is likely to accumulate lower levels of phytoplankton biomass for given levels of nutrients due to reduced retention times through the hydrolakes, greatly reduced retention times below Karapiro and the incremental input of nutrients down the river's length.
5. There is clear evidence of significant phytoplankton inputs to the lower Waikato River associated with connected hypertrophic, shallow lakes (e.g. Waikare). These inputs mask the phytoplankton growth patterns within the lower river
6. Available scientific evidence indicates that phosphorus currently tends to play a stronger role in controlling phytoplankton biomass along the river than nitrogen, although there are likely to be times when nitrogen is the main limiting factor

Based on these observations we conclude that application of TN and TP target values as per the NPS-FM attribute tables are very likely to be overly-conservative in achieving chlorophyll a outcomes when applied to Waikato River mainstem sites and it is likely that defining TP target values will be of greater importance than TN.

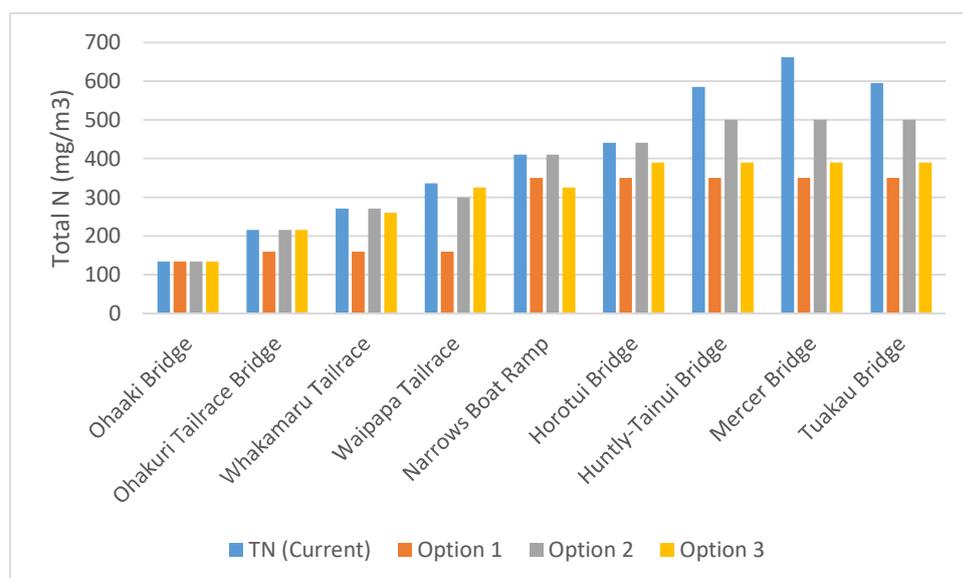
During Technical Caucusing, a lot of work went into developing a range of approaches to deriving TN and TP target values. Included in this was an assessment of locally-appropriate TN

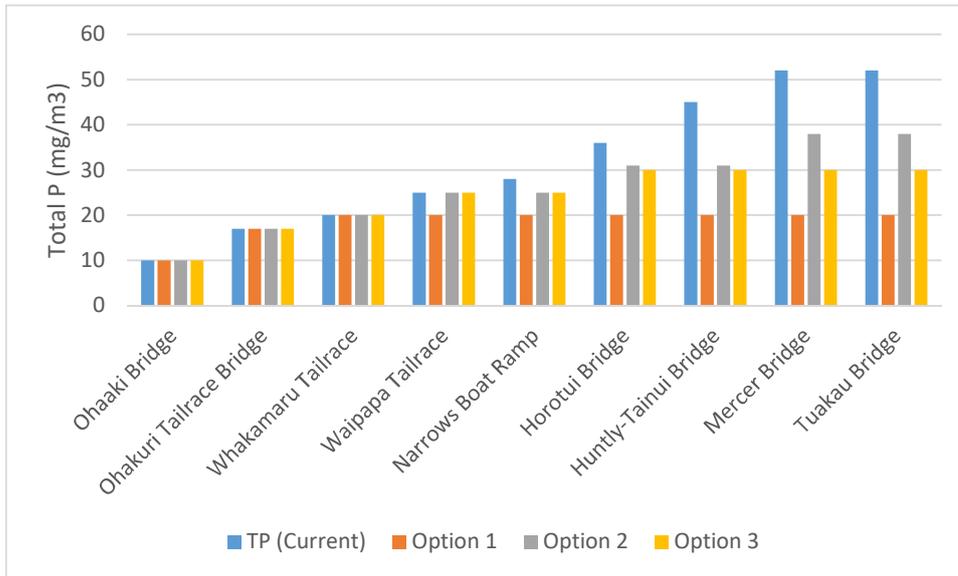
and TP values to achieve desired Chlorophyll a objectives. We were linked into this work and have taken it into account in our further discussions.

In the revised Table 3.11-1 we present three Options for TN and TP values:

1. Option 1 involved corrections to a number of errors in the current state as notified in the s32 report. For main-stem Waikato River sites such errors affected the short and long-term targets in Table 3.11-1, and these have also been corrected (Note: this option equates to Approach 1A in the Joint Witness Statement. It is the option with the least change from the notified version).
2. Option 2 promulgates Option 1C for TN and Option 2C for TP from the Joint Witness Statement. Of the 17 freshwater scientists engaged in technical caucusing, thirteen of 17 scientists supported changes to the TP values in Table 3.11-1 to reflect our current understanding of nutrient controls on phytoplankton along the river and the effects of phytoplankton inputs from shallow lakes to the lower Waikato (Option 2C). 14 supported a change in TN to reflect a polymictic versus seasonally stratified status (Options 1B or 1C) and 12 supported further changes to TN levels at Ohakuri (Option 1C).
3. Option 3 reflects additional analysis and conversations by the authors of this memo following conclusion of technical caucusing and also subsequent to presentation of the Joint Witness Statement to the Hearings Panel. The approach we took was to recognise the importance of reduced retention time along the Waikato River mainstem and derive TP values that reflected local conditions (see points 1-6 above). This resulted in values of TP similar to those of Option 2C from Technical Caucusing. Values of TN were then calculated to maintain an N:P ratio of 13:1 (average of current state N:P at nine river sites). This option uses local expert knowledge and monitoring data. Should this option be adopted, further work will be needed to document and test this option.

Differences in the numeric values for the three options relative to current state are presented below.





Option 1 (“as notified”) requires the greatest nutrient reductions particularly in the lower river, whereas Option 2 (“majority view”) sets less stringent TN and TP thresholds. Option 3 (“WRC”) has similar or more stringent TP thresholds to Option 2 and is more stringent with regard to TN than Option 2.

It is our view that Option 1 is not supported by our current understanding of phytoplankton dynamics in the Waikato River. In contrast, Options 2 and 3 both reflect derivation of nutrient thresholds that are based on local information and collective (but incomplete) scientific understanding of processes occurring along the Waikato River mainstem. We recognise that on-going monitoring and further research into phytoplankton and nutrient dynamics along the Waikato River will almost certainly result in further refinements of the nutrient thresholds recommendations for the river. In particular, we endorse the recommendations of the TLG and others that a dynamic river model be developed.

WRC will carry out research over the next twelve months to test and develop Options 2 and 3, with an expectation that any future revision of nutrient thresholds in the river can be informed by improved scientific understanding and evidence.

Nitrate and Ammonia

As notified, Table 3.11-1 contained several “perverse” results for nitrate and ammonia targets. In these instances the 80-year targets for median values were larger than the targets for 95th percentile or maximum. For example, Kawaunui Stream at SH5 bridge had a notified median Nitrate target of 2.4 mg/L, whereas the target for the 95th percentile was 1.5 mg/L. To address these perverse results, we’ve identified the 80-year targets for the six affected sites as “poorer of the two measures up one band (to B), other measure maintained at current concentration (in Band B)”.

We now realize there appears to have been a systematic error in the calculation of the notified values of 95th percentile nitrate (but not medians). As a result, all current state values have been updated.

Alternative options considered for TN and TP

	Median Total Nitrogen (mg/m3)							Median Total Phosphorus (mg/m3)				
	Current	Option 1 (Notified-corrected)		Option 2 (NOF TN polymictic)		Option 3 (Site-specific objectives)		Current	Option 1 and Option 2 (Notified-corrected)		Option 3 (Site-specific objectives)	
		Short	80-year	Short	80-year	Short	80-year		Short	80-year	Short	80-year
Upper Waikato FMU												
Waikato River Ohaaki Br	134	134	134	134	134	134	134	10	10	10	10	10
Waikato River Ohakuri Tailrace Br	216	210	160	216	216	216	216	17	17	17	17	17
Waikato River Whakamaru Tailrace	271	260	160	271	271	270	260	20	20	20	20	20
Waikato River Waipapa Tailrace	336	318	160	332	300	335	325	25	25	20	25	25
Pueto Stm Broadlands Rd Br	540							93				
Torepatutahi Stm Vaile Rd Br	625							96				
Waiotapu Stm Homestead Rd Br	1860							100				
Mangakara Stm (Reporoa) SH5	1580							74				
Kawaunui Stm SH5 Br	2990							82				
Waiotapu Stm Campbell Rd Br	1955							72				
Otamakokore Stm Hossack Rd	990							144				
Whirinaki Stm Corbett Rd	810							62				
Tahunaatara Stm Ohakuri Rd	780							44				
Mangaharakeke Stm SH30	685							48				
Waipapa Stm (Mokai) Tirohanga Rd	1355							95				
Mangakino Stm Sandel Rd	760							47				
Whakauru Stm SH1 Br	470							42				
Mangamingi Stm Paraonui Rd	3495							325				
Pokaiwhenua Stm Arapuni - Putaruru	2010							106				

Little Waipa Stm Arapuni - Putaruru	1780							68				
Middle Waikato FMU												
Waikato River Narrows Boat Ramp	410	404	350	410	410	402	325	28	27	20	28	25
Waikato River Horotiu Br	441	432	350	441	441	436	390	36	34	20	35	30
Karapiro Stm Hickey Rd Bridge	860							86				
Mangawhero Stm Cambridge-Ohaupo	2930							163				
Mangaonua Stm Hoeka Rd	1905							52				
Mangaone Stm Annebrooke Rd Br	3060							118				
Mangakotukutuku Stm Peacockes Rd	1875							415				
Waitawhiriwhiri Stm Edgecumbe Street	2110							91				
Kirikiroa Stm Tauhara Dr	1490							63				
Lower Waikato FMU												
Waikato River Huntly-Tainui Br	585	562	350	577	500	566	390	45	43	20	44	30
Waikato River Mercer Br	662	631	350	646	500	635	390	52	49	20	50	30
Waikato River Tuakau Br	595	571	350	586	500	575	390	52	49	20	50	30
Komakorau Stm Henry Rd	2900							90				
Mangawara Stm Rutherford Rd Br	1890							210				
Awaroa Stm (Rotowaro) Sansons Br	990							12				
Matahuru Stm Waiterimu Road	1310							98				
Whangape Stm Rangiriri-Glen Murray Rd	2116							122				
Waerenga Stm SH2 Maramarua	1115							46				
Whangamarino River Jefferies Rd Br	1085							88				
Mangatangi River SH2 Maramarua	493							72				
Mangatawhiri River Lyons Rd Buckingham Br	181							23				

Whangamarino River Island Block Rd	1831							152				
Whakapipi Stm SH22 Br	3875							51				
Ohaeroa Stm SH22 Br	1825							26				
Opuatia Stm Ponganui Rd	1070							31				
Awaroa River (Waiuku) Otaua Rd Br Moseley	2095							46				
Waipa River FMU												
Waipa River Mangaokewa Rd	585							16				
Waipa River at Otewa	366							20				
Waipa River SH3 Otorohanga	600							22				
Waipa River Pirongia-Ngutunui Rd br	860							48				
Waipa River at Whatawhata Bridge	912							70				
Ohote Stm Whatawhata/Horotiu Rd	1320							76				
Kaniwhaniwha Stm Wright Rd	590							29				
Mangapiko Bowman Rd Stm	2095							240				
Mangaohoi Stm South Branch Maru Rd	365							52				
Mangauika Stm Te Awamutu Borough W/S	275							8				
Puniu River Bartons Corner Rd Br	910							48				
Mangatutu Stm Walker Rd Br	510							20				
Waitomo Stm SH31 Otorohanga	755							30				
Mangapu River Otorohanga	1240							60				
Waitomo Stm Tumutumu Rd	765							22				
Mangaokewa Stm Lawrence Street Br	775							36				

Appendix B – Alternative Table 3.11-2 Ranking

This alternative Table 3.11-2 ranking, prioritises Whangamarino and lower Waikato lakes sub-catchments ahead of other higher priority sub-catchments.

Year	Sub-catchment identifier	Sub-catchment number
1	75th Percentile N loss Farms	N/A
2	Commercial Vegetable Production	N/A
2	Awaroa (Rotowaro) at Harris/Te Ohaki Br	18
2	Mangatangi	2
2	Matahuru	14
2	Waerenga	12
2	Waikare	13
2	Whangamarino at Island Block Rd	10
2	Whangamarino at Jefferies Rd Br	8
3	Kirikiroa	23
3	Little Waipa	44
3	Mangakotukutuku	30
3	Mangamingi	48
3	Mangapu	53
3	Mangarama	61
3	Mangarapa	55
3	Mangawara	17
3	Mangawhero	35
3	Pokaiwhenua	45
3	Waikato at Bridge St Br	27
3	Waikato at Horotiu Br	25
3	Waipapa	70
3	Waitawhiriwhiri	28
4	Mangaharakeke	57
4	Moakuraru	42
4	Opuatia	11
4	Torepatutahi	72
4	Waikato at Waipapa	64
4	Waipa at Otorohanga	51
4	Waipa at SH23 Br Whatawhata	34
4	Waitomo at Tumutumu Rd	52
4	Whangape	16
5	Awaroa (Rotowaro) at Sansons Br	19
5	Mangaokewa	63
5	Waikato at Huntly-Tainui Br	20
5	Waikato at Narrows	33
5	Waikato at Ohaaki	73
5	Waikato at Port Waikato	6
5	Waikato at Rangiriri	15
5	Waiotapu at Campbell	58
5	Waiotapu at Homestead	65
5	Waipa at Mangaokewa Rd	68

Year	Sub-catchment identifier	Sub-catchment number
5	Whakapipi	3
6	Kaniwhaniwha	36
6	Kawaunui	62
6	Komakorau	22
6	Mangakara	69
6	Mangakino	71
6	Mangaone	31
6	Mangapiko	38
6	Otamakokore	59
6	Tahunaatara	54
6	Waikato at Tuakau Br	4
6	Waipa at Waingaro Rd Br	24
6	Waitomo at SH31 Otorohanga	46
6	Whakauru	49
7	Firewood	21
7	Karapiro	32
7	Mangaonua	29
7	Ohote	26
7	Puniu at Bartons Corner Rd Br	40
7	Puniu at Wharepapa	50
7	Waikato at Whakamaru	67
7	Waipa at Otewa	60
7	Waipa at Pirongia-Ngutunui Rd Br	43
8	Awaroa (Waiuku)	5
8	Mangaohoi	39
8	Mangatawhiri	1
8	Mangatutu	47
8	Mangauika	37
8	Ohaeroa	7
8	Pueto	74
8	Waikato at Karapiro	41
8	Waikato at Mercer Br	9
8	Waikato at Ohakuri	66
8	Whirinaki	56

Appendix C – Response to Hearing Panel Questions of 07 October 2019

The Hearing Panel’s minute of 7 October 2019 requested additional information from WRC on the current state of the water quality of the Waikato and Waipa Rivers, as follows:

- For 2010–14 and 2012–16,⁶⁸ all four of the *E. coli* statistics listed in the 2017 NPS
- For 2010–14 and 2012–16, median concentration of dissolved reactive phosphorus (DRP)
- For 2010–14 and 2012–16, 10-percentile water clarity

The Panel also asked that four *E. coli* statistics be determined for “filtered” datasets as well, namely for results obtained when river flows were lower than three times the median flow for the relevant site (i.e. results obtained when river flows were high were to be excluded).⁶⁹

The water quality results for the routine monitoring sites in the Waikato and Waipa catchments have been retrieved from the WRC database, and are summarized in the attached tables. Note that for completeness, Tables 1 and 2 include summary results for all the other attributes in Table 3.11-1— even though the Panel did not specifically request these.

Table 1 shows the results for 2010–14. It contains the information from Dr Scarbrook’s Attachment 1 (March 2019), plus the information on the three additional *E. coli* statistics, the median DRP concentrations and the 10-percentile clarity. Table 2 shows the corresponding results for 2012–16.

Table 3 shows the four *E. coli* statistics for 2010–14 for (1) all samples, and (2) samples collected at flows lower than three times the median flow. Table 4 shows the corresponding information for 2012–16.

Bevan Jenkins and Bill Vant
8 October 2019

⁶⁸ Including available results from 2009 and 2011, respectively, to help increase the number of *E. coli* samples considered in each period.

⁶⁹ Note that these statistics for the filtered datasets should not be directly compared with the criteria for the 2017 NPS Attribute States for *E. coli*, as the NPS specifies that samples should be “collected on a regular basis regardless of weather and flow conditions”.

Table 1: Current state of water quality in the Waikato and Waipa River catchment, 2010–14, revised following the 11 March 2019 evidence of Dr Scarsbrook. Note that where possible, *E. coli* results obtained in 2009 were included to help ensure a sample size of 60; even so, in many cases the sample size was lower than this (in the range 22–39): these values are shown in italics. In calculating the median clarity (but not the 10-percentile clarity), results obtained at river flows higher than the 90-percentile flow were ignored. Note ammonia is pH-adjusted to pH 8 as specified in the National Objectives Framework and the ammonia maximum is the average of 5 annual maxima. “Med”, median; “Max”, maximum; “95%ile”, 95-percentile; “10%ile”, 10-percentile; “N”, nitrogen; “P”, phosphorus; “DRP”, dissolved reactive P.

	Med Chla (mg/m ³)	Max Chla (mg/m ³)	Med total N (mg/m ³)	Med total P (mg/m ³)	Med nitrate (mg/L)	95%ile nitrate (mg/L)	Med ammonia (mg/L)	Max ammonia (mg/L)	Med DRP (mg/L)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Med clarity (m)	10%ile clarity (m)
Upper Waikato FMU															
Waikato River Ohaaki Br	1.5	13	134	10	0.039	0.076	0.002	0.013	0.006	14	80	0	0	3.8	2.59
Waikato River Ohakuri Tailrace Br	3.1	11	216	17	0.086	0.177	0.003	0.017	0.009	2	16	0	0	2.25	1.37
Waikato River Whakamaru Tailrace			271	20	0.101	0.251	0.003	0.01	0.008	8	60	0	2	1.87	1.12
Waikato River Waipapa Tailrace	4	25	336	25	0.164	0.32	0.007	0.016	0.016	8	140	0	2	1.86	1.11
Pueto Stm Broadlands Rd Br			540	93	0.45	0.536	0.003	0.009	0.074	21	92	0	0	1.64	0.85
Torepatutahi Stm Vaile Rd Br			625	96	0.5	0.825	0.002	0.011	0.082	54	215	0	4		
Waiotapu Stm Homestead Rd Br			1860	100	1.285	1.665	0.121	0.19	0.034	110	280	0	9		
Mangakara Stm (Reporoa) SH5			1580	74	1.3	1.675	0.008	0.063	0.048	140	1700	13	26	0.86	0.52
Kawaunui Stm SH5 Br			2990	82	2.6	3.1	0.006	0.083	0.054	200	2535	18	33	1.33	0.52
Waiotapu Stm Campbell Rd Br			1955	72	0.915	1.135	0.301	0.349	0.002	2	18	0	0	1.17	0.75
Otamakokore Stm Hossack Rd			990	144	0.74	1.36	0.006	0.025	0.153	220	696	8	31	1.1	0.61
Whirinaki Stm Corbett Rd			810	62	0.77	0.885	0.002	0.013	0.061	16	98	0	0		
Tahunaatara Stm Ohakuri Rd			780	44	0.555	0.845	0.003	0.015	0.031	110	810	10	13	1.25	0.72
Mangaharakeke Stm SH30			685	48	0.525	0.795	0.003	0.015	0.031	170	700	10	26	1.02	0.62
Waipapa Stm (Mokai) Tirohanga Rd			1355	95	1.21	1.555	0.003	0.005	0.086	100	1215	5	10	1.11	0.5
Mangakino Stm Sandel Rd			760	47	0.65	0.875	0.003	0.012	0.039	40	250	0	4	1.63	0.67
Whakauru Stm SH1 Br			470	42	0.26	0.461	0.003	0.033	0.019	480	2280	42	87	0.75	0.39
Mangamingi Stm Paraonui Rd			3495	325	2.8	3.4	0.098	0.323	0.290	580	2330	51	79	0.82	0.4
Pokaiwhenua Stm Arapuni - Putaruru			2010	106	1.755	2.2	0.002	0.02	0.087	150	1455	13	23	1.26	0.57
Little Waipa Stm Arapuni - Putaruru			1780	68	1.58	2.15	0.002	0.089	0.051	110	1470	8	21	1.53	0.7
Middle Waikato FMU															
Waikato River Narrows Boat Ramp	5.5	23	410	28	0.235	0.545	0.01	0.018	0.015	39	265	2	5	1.6	0.98
Waikato River Horotiu Br	6	23	441	36	0.26	0.55	0.007	0.029	0.019	90	650	5	10	1.35	0.85
Karapiro Stm Hickey Rd Bridge			860	86	0.52	1.76	0.008	0.031	0.042	295	4960	26	53	0.93	0.28
Mangawhero Stm Cambridge-Ohaupo			2930	163	2.1	2.72	0.042	0.074	0.040	590	3185	51	89	0.26	0.13
Mangaonua Stm Hoeka Rd			1905	52	1.505	2.1	0.037	0.051	0.012	1500	7020	87	97	0.91	0.29
Mangaone Stm Annebrooke Rd Br			3060	118	2.6	3.2	0.009	0.02	0.063	800	2220	71	92	0.95	0.48
Mangakotukutuku Stm Peacockes Rd			1875	415	0.8	2.35	0.082	0.141	0.213	500	13025	46	95	0.41	0.21
Waitawhiriwhiri Stm Edgecumbe Street			2110	91	0.88	1.265	0.258	0.346	0.031	605	6520	55	87	0.38	0.25
Kirikiroa Stm Tauhara Dr			1490	63	0.815	1.975	0.104	0.198	0.014	570	3620	53	87	0.4	0.23

	Med Chla (mg/m ³)	Max Chla (mg/m ³)	Med total N (mg/m ³)	Med total P (mg/m ³)	Med nitrate (mg/L)	95%ile nitrate (mg/L)	Med ammonia (mg/L)	Max ammonia (mg/L)	Med DRP (mg/L)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Med clarity (m)	10%ile clarity (m)
Lower Waikato FMU															
Waikato River Huntly-Tainui Br	6	19	585	45	0.365	1.01	0.005	0.015	0.020	125	2000	13	27	0.87	0.4
Waikato River Mercer Br	10.5	30	662	52	0.365	0.895	0.003	0.011	0.016	80	1550	12	20		
Waikato River Tuakau Br	12	38	595	52	0.325	0.89	0.003	0.008	0.014	80	1600	12	18	0.61	0.35
Komakorau Stm Henry Rd			2900	90	1.31	5.3	0.251	0.421	0.010	1100	3800	85	92	0.17	0.09
Mangawara Stm Rutherford Rd Br			1890	210	0.765	3.35	0.111	0.185	0.047	1000	5445	70	91	0.25	0.12
Awaroa Stm (Rotorua) Sansons Br			990	12	0.7	1.39	0.024	0.093	0.002	290	1940	18	62	0.84	0.29
Matahuru Stm Waiterimu Road			1310	98	0.715	1.905	0.017	0.06	0.023	600	6770	65	87	0.31	0.1
Whangape Stm Rangiriri-Glen Murray R			2116	122	0.004	0.795	0.008	0.143	0.002	220	588	9	43	0.17	0.09
Waerenga Stm SH2 Maramarua			1115	46	0.82	1.42	0.005	0.023	0.019	500	5605	38	82	0.83	0.17
Whangamarino River Jefferies Rd Br			1085	88	0.625	2.5	0.011	0.055	0.030	600	5175	57	87	0.49	0.18
Mangatangi River SH2 Maramarua			493	72	0.11	1.29	0.006	0.038	0.021	380	6125	30	83	0.54	0.24
Mangatawhiri River Lyons Rd			181	23	0.013	0.4	0.003	0.011	0.011	190	5615	13	30	1.63	0.27
Whangamarino River Island Block Rd			1831	152	0.075	0.865	0.013	0.158	0.006	180	667	17	39	0.2	0.11
Whakapipi Stm SH22 Br			3875	51	3.5	5.35	0.006	0.084	0.022	320	1910	35	74	1.1	0.33
Ohaeroa Stm SH22 Br			1825	26	1.525	1.915	0.003	0.015	0.008	300	5125	30	52	0.81	0.35
Opuatia Stm Ponganui Rd			1070	31	0.74	1.081	0.005	0.016	0.006	390	3160	34	68	0.53	0.17
Awaroa River (Waiuku) Otatau Rd Br			2095	46	1.41	2.5	0.022	0.144	0.004	240	1070	17	43	0.37	0.17
Waipa River FMU															
Waipa River Mangaokewa Rd			585	16	0.38	0.71	0.003	0.017	0.005	210	2625	22	35	1.51	0.57
Waipa River at Otewa			366	20	0.228	0.504	0.003	0.008	0.008	236	2203	22	43	2.13	0.32
Waipa River SH3 Otorohanga			600	22	0.37	1.15	0.004	0.02	0.008	180	3595	18	36	1.11	0.33
Waipa River Pirongia-Ngutu Rd br			860	48	0.565	1.535	0.008	0.023	0.014	300	4875	36	56	0.63	0.26
Waipa River at Whatawhata Bridge			912	70	0.673	1.587	0.009	0.026	0.018	392	4003	38	57	0.63	0.22
Ohote Stm Whatawhata/Horotiu Rd			1320	76	0.495	1.385	0.023	0.052	0.020	275	2320	16	50	0.55	0.35
Kaniwhaniwha Stm Wright Rd			590	29	0.35	0.995	0.007	0.022	0.007	250	2070	26	43	0.87	0.29
Mangapiko Bowman Rd Stm			2095	240	1.41	2.65	0.022	0.078	0.115	325	7800	27	59	0.61	0.21
Mangaohoi Stm South Branch Maru Rd			365	52	0.23	0.415	0.003	0.008	0.043	70	987	8	18	1.58	0.83
Mangauika Stm Te Awamutu W/S			275	8	0.21	0.286	0.002	0.003	0.002	33	1060	8	13	3.6	1.91
Puniu River Bartons Corner Rd Br			910	48	0.65	1.305	0.007	0.029	0.022	140	3040	23	27	0.94	0.38
Mangatutu Stm Walker Rd Br			510	20	0.38	0.908	0.003	0.012	0.009	160	760	11	24	1.53	0.5
Waitomo Stm SH31 Otorohanga			755	30	0.52	0.925	0.008	0.026	0.006	310	1555	31	59	0.59	0.23
Mangapu River Otorohanga			1240	60	0.86	1.428	0.016	0.064	0.023	480	4700	47	66	0.61	0.25
Waitomo Stm Tumutumu Rd			765	22	0.63	0.825	0.004	0.013	0.010	180	2430	21	38	0.95	0.31
Mangaokewa Stm Lawrence St Br			775	36	0.525	1.06	0.005	0.014	0.014	490	6855	43	83	1.1	0.36

Table 2: Current state of water quality in the Waikato and Waipa River catchment, 2012–16. Note that where possible, *E. coli* results obtained in 2011 were included to help ensure a sample size of 60; even so, in many cases the sample size was lower than this (in the range 46–55): these values are shown in italics. In calculating the median clarity (but not the 10-percentile clarity), results obtained at river flows higher than the 90-percentile flow were ignored. Note ammonia is pH-adjusted to pH 8 as specified in the National Objectives Framework and the ammonia maximum is the average of 5 annual maxima. “Med”, median; “Max”, maximum; “95%ile”, 95-percentile; “10%ile”, 10-percentile; “N”, nitrogen; “P”, phosphorus; “DRP”, dissolved reactive P.

	Med Chla (mg/m ³)	Max Chla (mg/m ³)	Med total N (mg/m ³)	Med total P (mg/m ³)	Med nitrate (mg/L)	95%ile nitrate (mg/L)	Med ammonia (mg/L)	Max ammonia (mg/L)	Med DRP (mg/L)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Med clarity (m)	10%ile clarity (m)
Upper Waikato FMU															
Waikato River Ohaaki Br	1.5	13	123	10	0.036	0.069	0.003	0.012	0.006	14	54	0	0	4.5	3
Waikato River Ohakuri Tailrace Br	3	20	198	18	0.085	0.175	0.003	0.018	0.009	2	15	0	0	2.41	1.58
Waikato River Whakamaru Tailrace			254	21	0.097	0.22	0.003	0.013	0.008	8	80	0	2	2.3	1.5
Waikato River Waipapa Tailrace	5	18	331	26	0.175	0.325	0.007	0.015	0.016	5	54	0	2	2.12	1.36
Pueto Stm Broadlands Rd Br			550	89	0.45	0.545	0.003	0.009	0.072	26	106	0	0	1.81	0.87
Torepatutahi Stm Vaile Rd Br			590	96	0.475	0.64	0.003	0.009	0.084	54	177	0	2		
Waiotapu Stm Homestead Rd Br			1870	98	1.33	1.546	0.112	0.198	0.034	130	490	2	13		
Mangakara Stm (Reporoa) SH5			1540	72	1.29	1.505	0.011	0.059	0.048	180	1100	13	29	0.9	0.58
Kawaunui Stm SH5 Br			2980	76	2.6	3	0.006	0.061	0.052	150	1800	13	24	1.47	0.65
Waiotapu Stm Campbell Rd Br			2060	69	0.93	1.136	0.339	0.376	0.002	1	13	0	0	1.2	0.79
Otamakokore Stm Hossack Rd			985	148	0.74	1.24	0.007	0.054	0.152	230	938	9	38	1.3	0.68
Whirinaki Stm Corbett Rd			830	63	0.78	0.895	0.002	0.013	0.061	32	233	2	4		
Tahunaatara Stm Ohakuri Rd			815	48	0.57	0.96	0.003	0.016	0.034	120	1750	15	18	1.38	0.54
Mangaharakeke Stm SH30			690	50	0.51	0.815	0.003	0.011	0.032	200	1275	16	42	0.98	0.48
Waipapa Stm (Mokai) Tirohanga Rd			1355	95	1.205	1.54	0.003	0.006	0.089	100	438	2	5	1.24	0.62
Mangakino Stm Sandel Rd			765	48	0.66	0.845	0.003	0.007	0.038	42	430	4	11	1.76	0.79
Whakauru Stm SH1 Br			620	50	0.37	0.92	0.003	0.018	0.025	600	2075	55	93	0.71	0.28
Mangamingi Stm Paraonui Rd			3380	320	2.6	3.3	0.133	0.425	0.265	510	3125	49	80	0.82	0.3
Pokaiwhenua Stm Arapuni - Putaruru			2065	110	1.765	2.35	0.003	0.049	0.092	200	1475	18	31	1.15	0.53
Little Waipa Stm Arapuni - Putaruru			1825	71	1.62	2.3	0.005	0.107	0.056	170	1875	16	35	1.6	0.61
Middle Waikato FMU															
Waikato River Narrows Boat Ramp	5	83	430	29	0.265	0.53	0.008	0.02	0.016	38	350	2	5	1.89	1.15
Waikato River Horotiu Br	6	24	455	34	0.275	0.54	0.005	0.016	0.02	80	600	5	8	1.6	0.95
Karapiro Stm Hickey Rd Bridge			820	87	0.52	1.79	0.008	0.033	0.049	220	1800	19	35	0.93	0.3
Mangawhero Stm Cambridge-Ohaupo			2890	150	1.985	2.7	0.044	0.08	0.037	560	3360	50	89	0.24	0.13
Mangaonua Stm Hoeka Rd			1805	51	1.46	2.09	0.034	0.052	0.013	1100	6820	80	91	1.1	0.61
Mangaone Stm Annebrooke Rd Br			2880	108	2.5	3	0.008	0.017	0.063	585	1780	54	94	1.2	0.58
Mangakotukutuku Stm Peacockes Rd			1750	395	0.805	2.015	0.076	0.137	0.169	430	15600	37	83	0.51	0.25
Waitawhiriwhiri Stm Edgecumbe Street			2040	86	0.84	1.26	0.254	0.355	0.025	700	5160	61	89	0.42	0.26
Kirikiriroa Stm Tauhara Dr			1355	60	0.74	2.3	0.106	0.193	0.012	570	5140	52	81	0.44	0.25
Lower Waikato FMU															
Waikato River Huntly-Tainui Br	6	20	595	42	0.405	1.05	0.006	0.015	0.021	105	1750	15	22	1	0.5

	Med Chla (mg/m ³)	Max Chla (mg/m ³)	Med total N (mg/m ³)	Med total P (mg/m ³)	Med nitrate (mg/L)	95%ile nitrate (mg/L)	Med ammonia (mg/L)	Max ammonia (mg/L)	Med DRP (mg/L)	Median E. coli (/100 mL)	95%ile E. coli (/100 mL)	E. coli >540 (%)	E. coli >260 (%)	Med clarity (m)	10%ile clarity (m)
Waikato River Mercer Br	9	37	620	46	0.375	0.915	0.003	0.014	0.016	75	1550	12	15		
Waikato River Tuakau Br	10	45	615	50	0.355	0.925	0.003	0.011	0.014	65	1150	8	17	0.67	0.36
Komakorau Stm Henry Rd			3005	90	1.34	4.65	0.267	0.425	0.009	1100	3800	78	93	0.19	0.12
Mangawara Stm Rutherford Rd Br			1885	184	0.79	4.55	0.118	0.191	0.047	1000	5305	72	87	0.3	0.14
Awaroa Stm (Rotowaro) Sansons Br			960	11	0.64	1.155	0.023	0.182	0.002	270	2100	16	51	0.96	0.35
Matahuru Stm Waiterimu Road			1345	92	0.74	1.99	0.021	0.07	0.024	550	4350	51	87	0.33	0.13
Whangape Stm Rangiriri-Glen Murray R			2096	119	0.005	0.85	0.007	0.206	0.002	150	673	9	36	0.18	0.09
Waerenga Stm SH2 Maramarua			1125	45	0.82	1.32	0.006	0.021	0.020	500	6000	36	75	0.92	0.24
Whangamarino River Jefferies Rd Br			1090	85	0.625	2.4	0.013	0.054	0.029	700	5575	62	94	0.47	0.21
Mangatangi River SH2 Maramarua			489	62	0.121	1.215	0.006	0.035	0.021	340	4030	30	66	0.57	0.31
Mangatawhiri River Lyons Rd			199	24	0.033	0.46	0.003	0.012	0.012	210	1295	19	36	1.7	0.32
Whangamarino River Island Block Rd			1985	140	0.13	0.91	0.018	0.125	0.006	110	1015	15	30	0.21	0.11
Whakapipi Stm SH22 Br			3790	54	3.45	5.5	0.005	0.043	0.028	320	2045	26	66	1.48	0.6
Ohaeroa Stm SH22 Br			1835	26	1.535	2.05	0.004	0.012	0.008	340	2245	34	57	0.86	0.47
Opuatia Stm Ponganui Rd			1050	30	0.73	1.06	0.005	0.016	0.006	400	4400	35	65	0.57	0.15
Awaroa River (Waiuku) Otatau Rd Br			1990	40	1.365	2.3	0.021	0.089	0.002	210	1480	15	45	0.39	0.18
Waipa River FMU															
Waipa River Mangaokewa Rd			545	16	0.33	0.57	0.003	0.014	0.006	180	2235	23	36	1.7	0.73
Waipa River at Otewa			404	20	0.252	0.54	0.004	0.017	0.008	226	5542	23	40	1.94	0.33
Waipa River SH3 Otorohanga			635	22	0.41	1.11	0.006	0.022	0.008	160	4300	22	27	1.14	0.38
Waipa River Pirongia-Ngutunui Rd br			930	45	0.65	1.411	0.008	0.024	0.014	295	6620	37	54	0.62	0.14
Waipa River at Whatawhata Bridge			987	66	0.698	1.522	0.01	0.025	0.017	311	4762	37	57	0.61	0.2
Ohote Stm Whatawhata/Horotiu Rd			1180	76	0.455	1.42	0.023	0.057	0.020	225	1080	17	44	0.6	0.34
Kaniwhaniwha Stm Wright Rd			605	26	0.39	0.91	0.008	0.024	0.007	310	4365	32	55	0.95	0.32
Mangapiko Bowman Rd Stm			2090	210	1.5	2.85	0.016	0.059	0.118	365	5400	30	67	0.7	0.24
Mangaohoi Stm South Branch Maru Rd			350	52	0.225	0.4	0.003	0.007	0.041	80	1325	11	25	1.56	1.06
Mangauika Stm Te Awamutu W/S			270	8	0.21	0.27	0.002	0.003	0.002	20	1060	7	13	3.88	1.6
Puniu River Bartons Corner Rd Br			890	47	0.64	1.46	0.006	0.029	0.022	125	3160	26	30	0.99	0.61
Mangatutu Stm Walker Rd Br			510	19	0.38	0.974	0.003	0.013	0.008	140	1200	17	24	1.65	0.5
Waitomo Stm SH31 Otorohanga			740	29	0.53	0.931	0.009	0.032	0.006	330	4400	33	57	0.65	0.18
Mangapu River Otorohanga			1210	47	0.81	1.533	0.014	0.053	0.023	485	5380	48	63	0.65	0.28
Waitomo Stm Tumutumu Rd			755	22	0.61	0.81	0.004	0.02	0.010	180	2550	24	38	1	0.28
Mangaokewa Stm Lawrence St Br			840	36	0.56	1.035	0.006	0.017	0.015	470	9300	40	77	1.01	0.41

Table 3: Statistics for *E. coli* concentrations in the Waikato and Waipa River catchment, 2010–14; results are shown (1) for samples collected at all flows, and (2) for samples collected when flows were less than three times the median value. Note that where possible, *E. coli* results obtained in 2009 were included to help ensure an initial sample size of 60; even so, in many cases the sample size was lower than this (in the range 22–39): these values are shown in italics. “Med”, median; “95%ile”, 95-percentile.

	Using data from all flows				Using data when flow < 3xmedian value			
	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)
Upper Waikato FMU								
Waikato River Ohaaki Br	14	80	0	0	14	80	0	0
Waikato River Ohakuri Tailrace Br	2	16	0	0	2	16	0	0
Waikato River Whakamaru Tailrace	8	60	0	2	8	60	0	2
Waikato River Waipapa Tailrace	8	140	0	2	8	140	0	2
Pueto Stm Broadlands Rd Br	21	92	0	0	21	92	0	0
Torepatutahi Stm Vaile Rd Br	54	215	0	4	54	215	0	4
Waiotapu Stm Homestead Rd Br	110	280	0	9	110	280	0	9
Mangakara Stm (Reporoa) SH5	140	1700	13	26	140	1700	13	26
Kawaunui Stm SH5 Br	200	2535	18	33	200	2535	18	33
Waiotapu Stm Campbell Rd Br	2	18	0	0	2	18	0	0
Otamakokore Stm Hossack Rd	220	696	8	31	220	696	8	31
Whirinaki Stm Corbett Rd	16	98	0	0	16	98	0	0
Tahunaatara Stm Ohakuri Rd	110	810	10	13	110	810	10	13
Mangaharakeke Stm SH30	170	700	10	26	170	700	10	26
Waipapa Stm (Mokai) Tirohanga Rd	100	1215	5	10	100	1215	5	10
Mangakino Stm Sandel Rd	40	250	0	4	40	250	0	4
Whakauru Stm SH1 Br	480	2280	42	87	480	2280	42	87
Mangamingi Stm Paraonui Rd	580	2330	51	79	580	2330	51	79
Pokaiwhenua Stm Arapuni - Putaruru	150	1455	13	23	150	1455	13	23
Little Waipa Stm Arapuni - Putaruru	110	1470	8	21	110	1470	8	21
Middle Waikato FMU								
Waikato River Narrows Boat Ramp	39	265	2	5	39	265	2	5
Waikato River Horotiu Br	90	650	5	10	90	650	5	10
Karapiro Stm Hickey Rd Bridge	295	4960	26	53	295	4960	26	53
Mangawhero Stm Cambridge-Ohaupo	590	3185	51	89	595	3230	53	92
Mangaonua Stm Hoeka Rd	1500	7020	87	97	1500	7040	86	97
Mangaone Stm Annebrooke Rd Br	800	2220	71	92	850	2240	69	92
Mangakotukutuku Stm Peacockes Rd	500	13025	46	95	515	13450	47	94
Waitawhiriwhiri Stm Edgecumbe Street	605	6520	55	87	600	6705	54	86
Kirikiroa Stm Tauhara Dr	570	3620	53	87	570	3740	53	86
Lower Waikato FMU								

	Using data from all flows				Using data when flow < 3xmedian value			
	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)
Waikato River Huntly-Tainui Br	125	2000	13	27	125	2000	13	27
Waikato River Mercer Br	80	1550	12	20	80	1550	12	20
Waikato River Tuakau Br	80	1600	12	18	80	1600	12	18
Komakorau Stm Henry Rd	1100	3800	85	92	1100	3800	85	92
Mangawara Stm Rutherford Rd Br	1000	5445	70	91	1450	5550	80	90
Awaroa Stm (Rotowaro) Sansons Br	290	1940	18	62	290	2220	22	66
Matahuru Stm Waiterimu Road	600	6770	65	87	575	8900	60	85
Whangape Stm Rangiriri-Glen Murray R	220	588	9	43	220	588	9	43
Waerenga Stm SH2 Maramarua	500	5605	38	82	500	3345	33	82
Whangamarino River Jefferies Rd Br	600	5175	57	87	525	4750	50	85
Mangatangi River SH2 Maramarua	380	6125	30	83	365	5950	25	80
Mangatawhiri River Lyons Rd	190	5615	13	30	210	7550	15	30
Whangamarino River Island Block Rd	180	667	17	39	130	625	10	30
Whakapipi Stm SH22 Br	320	1910	35	74	310	1940	26	68
Ohaeroa Stm SH22 Br	300	5125	30	52	260	2365	26	47
Opuatia Stm Ponganui Rd	390	3160	34	68	360	2980	24	64
Awaroa River (Waiuku) Otaua Rd Br	240	1070	17	43	250	1110	21	47
Waipa River FMU								
Waipa River Mangaokewa Rd	210	2625	22	35	210	2975	24	38
Waipa River at Otewa	236	2203	22	43	225	2419	16	37
Waipa River SH3 Otorohanga	180	3595	18	36	180	3820	21	35
Waipa River Pirongia-Ngutunui Rd br	300	4875	36	56	290	5025	36	55
Waipa River at Whatawhata Bridge	392	4003	38	57	238	2452	24	47
Ohote Stm Whatawhata/Horotiu Rd	275	2320	16	50	275	2320	16	50
Kaniwhaniwha Stm Wright Rd	250	2070	26	43	250	1720	23	41
Mangapiko Bowman Rd Stm	325	7800	27	59	285	7500	20	55
Mangaohoi Stm South Branch Maru Rd	70	987	8	18	80	1038	9	20
Mangauika Stm Te Awamutu W/S	33	1060	8	13	27	960	6	11
Puniu River Bartons Corner Rd Br	140	3040	23	27	115	2850	15	20
Mangatutu Stm Walker Rd Br	160	760	11	24	160	760	9	21
Waitomo Stm SH31 Otorohanga	310	1555	31	59	325	1480	29	59
Mangapu River Otorohanga	480	4700	47	66	500	4825	48	64
Waitomo Stm Tumutumu Rd	180	2430	21	38	175	2580	21	35
Mangaokewa Stm Lawrence St Br	490	6855	43	83	490	7185	43	81

Table 4: Statistics for *E. coli* concentrations in the Waikato and Waipa River catchment, 2012–16; results are shown (1) for samples collected at all flows, and (2) for samples collected when flows were less than three times the median value. Note that where possible, *E. coli* results obtained in 2011 were included to help ensure an initial sample size of 60; even so, in many cases the sample size was lower than this (in the range 46–55): these values are shown in italics. “Med”, median; “95%ile”, 95-percentile.

	Using data from all flows				Using data when flow < 3xmedian value			
	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)
Upper Waikato FMU								
Waikato River Ohaaki Br	14	54	0	0	14	54	0	0
Waikato River Ohakuri Tailrace Br	2	15	0	0	2	15	0	0
Waikato River Whakamaru Tailrace	8	80	0	2	8	80	0	2
Waikato River Waipapa Tailrace	5	54	0	2	5	54	0	2
Pueto Stm Broadlands Rd Br	26	106	0	0	26	106	0	0
Torepatutahi Stm Vaile Rd Br	54	177	0	2	54	177	0	2
Waiotapu Stm Homestead Rd Br	130	490	2	13	130	490	2	13
Mangakara Stm (Reporoa) SH5	180	1100	13	29	180	1100	13	29
Kawaunui Stm SH5 Br	150	1800	13	24	150	1800	13	24
Waiotapu Stm Campbell Rd Br	1	13	0	0	1	13	0	0
Otamakokore Stm Hossack Rd	230	938	9	38	230	938	9	38
Whirinaki Stm Corbett Rd	32	233	2	4	32	233	2	4
Tahunaatara Stm Ohakuri Rd	120	1750	15	18	115	980	13	17
Mangaharakeke Stm SH30	200	1275	16	42	195	1200	15	41
Waipapa Stm (Mokai) Tirohanga Rd	100	438	2	5	95	450	2	6
Mangakino Stm Sandel Rd	42	430	4	11	42	430	4	11
Whakauru Stm SH1 Br	600	2075	55	93	590	1960	54	93
Mangamingi Stm Paraonui Rd	510	3125	49	80	505	2500	48	80
Pokaiwhenua Stm Arapuni - Putaruru	200	1475	18	31	195	1360	17	30
Little Waipa Stm Arapuni - Putaruru	170	1875	16	35	170	1740	15	33
Middle Waikato FMU								
Waikato River Narrows Boat Ramp	38	350	2	5	38	350	2	5
Waikato River Horotiu Br	80	600	5	8	80	600	5	8
Karapiro Stm Hickey Rd Bridge	220	1800	19	35	220	1800	19	35
Mangawhero Stm Cambridge-Ohaupo	560	3360	50	89	560	3360	50	89
Mangaonua Stm Hoeka Rd	1100	6820	80	91	1100	6840	79	91
Mangaone Stm Annebrooke Rd Br	585	1780	54	94	570	1785	53	94
Mangakotukutuku Stm Peacockes Rd	430	15600	37	83	430	15600	37	83
Waitawhiriwhiri Stm Edgecumbe Street	700	5160	61	89	700	5160	61	89
Kirikiroa Stm Tauhara Dr	570	5140	52	81	550	5205	51	81
Lower Waikato FMU								

	Using data from all flows				Using data when flow < 3xmedian value			
	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)	Median <i>E. coli</i> (/100 mL)	95%ile <i>E. coli</i> (/100 mL)	<i>E. coli</i> >540 (%)	<i>E. coli</i> >260 (%)
Waikato River Huntly-Tainui Br	105	1750	15	22	105	1750	15	22
Waikato River Mercer Br	75	1550	12	15	75	1550	12	15
Waikato River Tuakau Br	65	1150	8	17	65	1150	8	17
Komakorau Stm Henry Rd	1100	3800	78	93	1100	3800	78	93
Mangawara Stm Rutherford Rd Br	1000	5305	72	87	1250	5550	80	90
Awaroa Stm (Rotowaro) Sansons Br	270	2100	16	51	275	2790	17	52
Matahuru Stm Waiterimu Road	550	4350	51	87	500	5350	49	86
Whangape Stm Rangiriri-Glen Murray R	150	673	9	36	150	673	9	36
Waerenga Stm SH2 Maramarua	500	6000	36	75	500	4040	35	76
Whangamarino River Jefferies Rd Br	700	5575	62	94	660	5675	60	93
Mangatangi River SH2 Maramarua	340	4030	30	66	335	2020	29	67
Mangatawhiri River Lyons Rd	210	1295	19	36	215	1620	19	36
Whangamarino River Island Block Rd	110	1015	15	30	105	1030	11	25
Whakapipi Stm SH22 Br	320	2045	26	66	310	2135	22	66
Ohaeroa Stm SH22 Br	340	2245	34	57	340	1815	34	59
Opuatia Stm Ponganui Rd	400	4400	35	65	360	5220	29	62
Awaroa River (Waiuku) Otaua Rd Br	210	1480	15	45	250	1840	17	49
Waipa River FMU								
Waipa River Mangaokewa Rd	180	2235	23	36	175	2370	23	36
Waipa River at Otewa	226	5542	23	40	225	2376	19	37
Waipa River SH3 Otorohanga	160	4300	22	27	150	3955	22	25
Waipa River Pirongia-Ngutunui Rd br	295	6620	37	54	285	7000	36	52
Waipa River at Whatawhata Bridge	311	4762	37	57	248	2594	27	50
Ohote Stm Whatawhata/Horotiu Rd	225	1080	17	44	225	1080	17	44
Kaniwhaniwha Stm Wright Rd	310	4365	32	55	300	4520	30	54
Mangapiko Bowman Rd Stm	365	5400	30	67	335	4840	26	64
Mangaohoi Stm South Branch Maru Rd	80	1325	11	25	110	1385	12	27
Mangauika Stm Te Awamutu W/S	20	1060	7	13	18	1080	8	13
Puniu River Bartons Corner Rd Br	125	3160	26	30	110	2800	19	24
Mangatutu Stm Walker Rd Br	140	1200	17	24	125	1200	12	18
Waitomo Stm SH31 Otorohanga	330	4400	33	57	310	4025	29	53
Mangapu River Otorohanga	485	5380	48	63	435	5500	46	62
Waitomo Stm Tumutumu Rd	180	2550	24	38	155	2100	22	34
Mangaokewa Stm Lawrence St Br	470	9300	40	77	460	6690	39	75