IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Plan Change 1: Waikato and Waipā River Catchments to the Waikato Regional Plan

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STATEMENT OF EVIDENCE OF BRYCE COOPER

On behalf of the Waikato Regional Council

DATED 15TH February 2019

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INTRODUCTION

1. My name is Bryce Cooper. I am the General Manager – Strategy at the National Institute of Water and Atmosphere (NIWA).

2. I hold the academic qualifications of a B.Sc. (Double Major in Biology and Earth Sciences), Master of Science (1st Class Hons), and Ph.D. from the University of Waikato.

3. I have forty years' experience working in environmental science. This experience has encompassed research on freshwaters (including land use and riparian management, effects on streams, the fate of nitrogen in the environment, and catchment water quality modelling), and providing technical input to land and water policy development at national and regional levels.

4. My role within NIWA is to lead the development of organisational strategy, including developing science programmes across freshwater, marine and climate domains that respond to the priority needs of stakeholders. My role in Plan Change 1 has been as the Chair of the Technical Leaders Group (TLG), which was established to provide impartial technical information to support the deliberations of the Collaborative Stakeholder Group (CSG). The role and membership of the TLG is explained further in the Statement of Evidence of Tracey May.

5. I confirm that I am familiar with the Code of Conduct for Expert Witnesses as set out in the Environment Court Practice Note 2014. I have read and agree to comply with the Code. Except where I state that I am relying upon the specified evidence or advice of another person, my evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

6. My evidence is given on behalf of Waikato Regional Council ('**WRC**') and is in support of Proposed Plan Change 1: Waikato and Waipā River Catchments (PC1).

7. The purpose of my evidence is to:

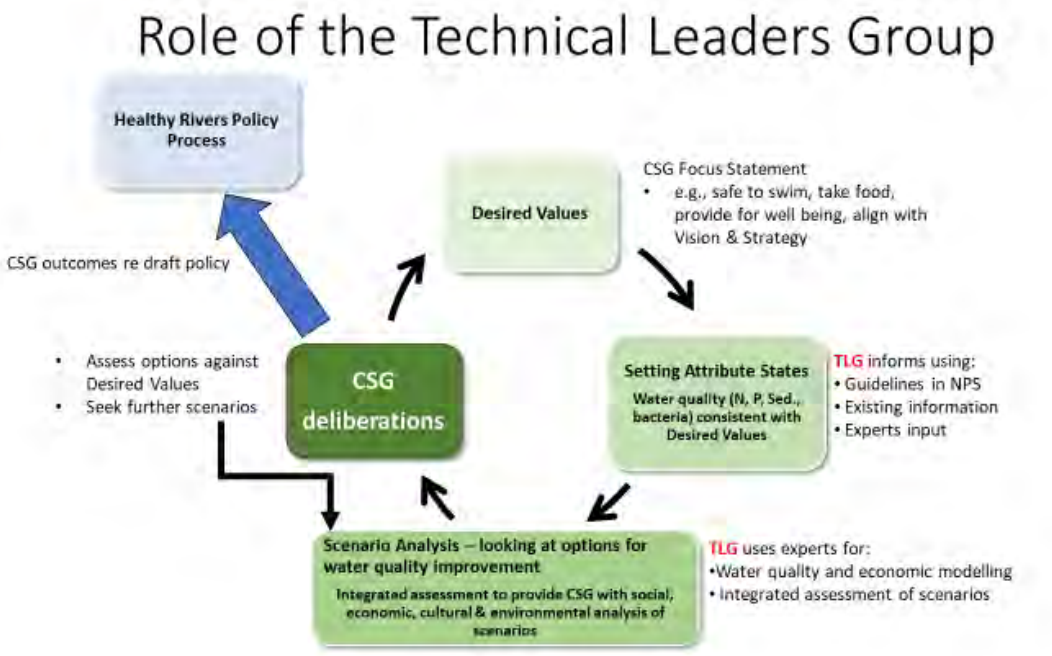
- Briefly explain the role of the Technical Leaders Group in the Plan Change 1 process.
- Provide an overview of the technical information that underpins the plan change.

BACKGROUND

8. The TLG was established in May 2014 and was formed as an impartial, advisory group of specialists to provide technical information to the CSG. The seven-member TLG called upon other technical experts, known collectively as the Technical Alliance, as required. These technical experts collated, analysed, summarised and presented environmental, social, cultural and economic information about the rivers and lakes and their catchments and the predicted consequences of different land management scenarios.

9. The TLG held experts' workshops to help identify the information required to support the CSG's deliberations and the gaps in that information. They then described the work required to address the gaps and identified experts to carry out the work. Areas of work that were within areas of expertise held by TLG members were sometimes picked up and progressed by those members.

10. The role of the TLG in the CSG's policy development deliberations is depicted below.



- The CSG's Focus Statement includes the values of safe to swim in, take food from and provide for well-being. There was a need to give effect to both the National Policy Statement for Freshwater 2014 (NPS-FM) and the objectives of the Vision & Strategy (the latter having primacy).
- The scope of PC1 is restricted to managing the four contaminants nitrogen (N), phosphorus (P), sediment and microbial pathogens. With technical information from the TLG, the CSG set the water quality attribute states for these contaminants that are consistent with the desired values (or movement towards them) using the National Objectives Framework within the NPS-FM , existing science and expert input.
- Scenario analyses looked at future options for achieving different degrees of water quality improvement through a mix of interventions to reduce point source and non-point source discharges of contaminants. As well as predictions of future water quality, scenario analyses included predictions of the economic costs and where they would fall, and the effects on cultural and social values using a suite of indicators.
- The CSG used the scenario analyses as *one* of the inputs to their deliberations. Outputs from early scenario runs were used by the CSG to inform their requests for further runs as they iteratively explored alternative policy options.

11. In addition to technical reports, the TLG and other technical experts often presented their findings at CSG meetings and answered queries from CSG members. Upon request, TLG members also supported the CSG at other forums (e.g., stakeholder forums, Waikato Regional Council meetings, Healthy Rivers/Wai Ora Co-Governance Committee meetings).

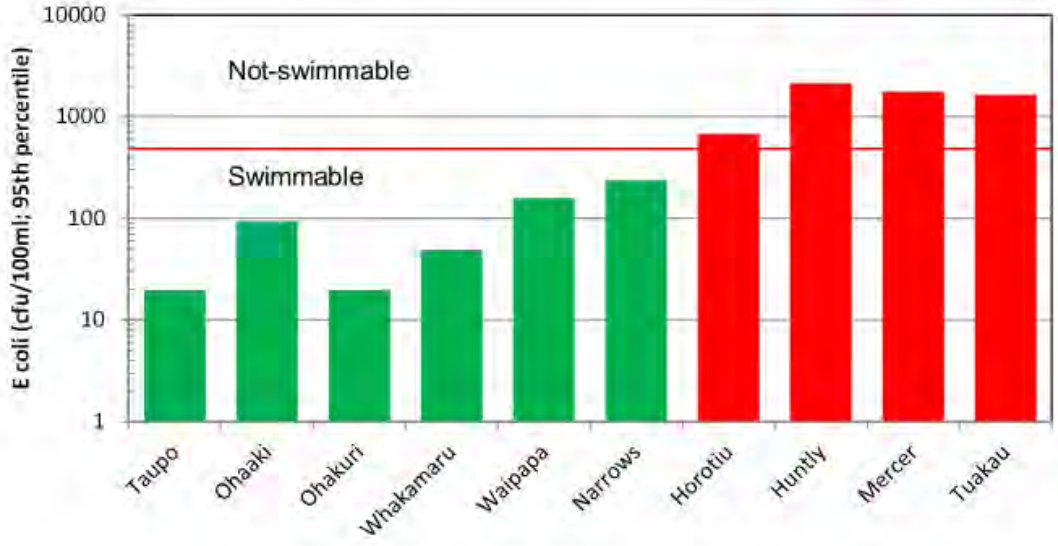
OVERVIEW OF TECHNICAL INFORMATION THAT UNDERPINS PLAN CHANGE 1

12. The technical information provided to support the CSG's deliberations was extensive – over 40 reports from more than 20 organisations and 75 experts, as well as numerous workshops, memos and presentations[1]. The purpose of this statement of evidence is to provide the Hearings Panel with an overview of this technical information – an outline of why it was needed, how it was done, and the key messages that emerged. There is much detail beneath this overview and, while I am comfortable addressing questions that the Hearings Panel may have, very technically-specific questions would be best addressed by the subject matter expert.

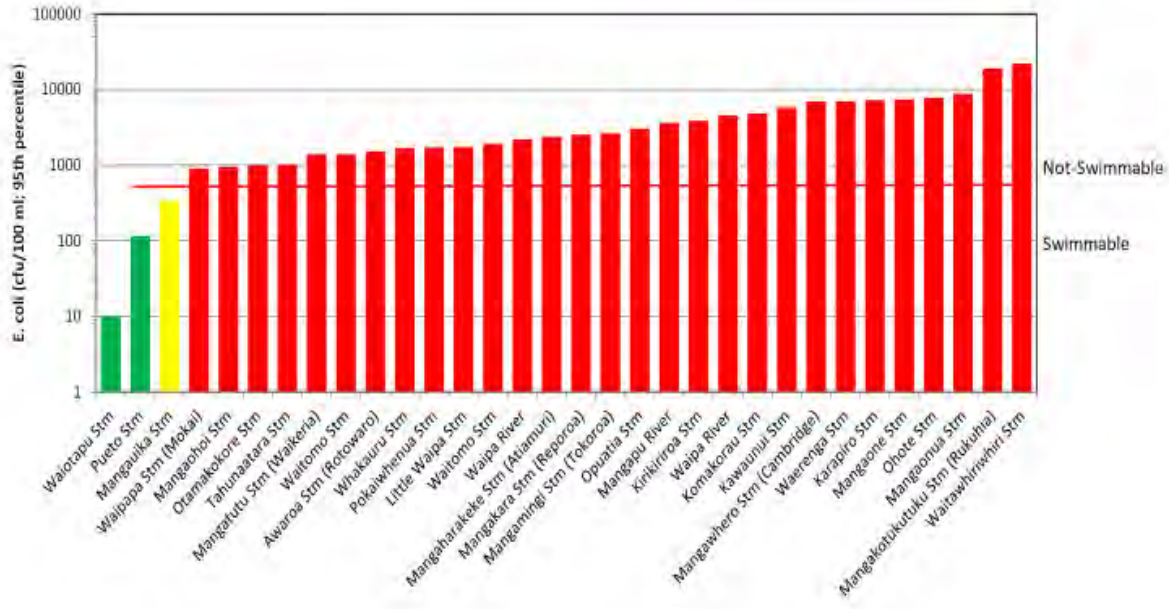
13. Under the requirements of the NPS-FM, the CSG needed to delineate Freshwater Management Units (FMUs) and set freshwater objectives (including relevant water quality attribute states and where they apply) for each FMU. Based upon an options analysis provided by the TLG, the CSG chose eight Freshwater Management Units - four river FMUs (Upper, Middle and Lower Waikato, and Waipa) and four Lakes FMUs (Peat, Riverine, Dune and 'Volcanic').

14. Water quality data from the Waikato Regional Council's monitoring network was used to provide the CSG with an analysis of current water quality (2010-2014 inclusive) within the FMUs compared to the A, B, C, and D attribute bands within the NPS-FM (or, where not available in the NPS-FM, attribute bands specifically developed by a group of experts pulled together by the TLG). Key findings were:
    - The Upper Waikato River has high water quality (Attribute bands A or B) reflecting the high quality of its source, Lake Taupō.
    - As one moves downstream, observed water quality in the river declines, primarily reflecting the influence of tributary inputs of poor water quality but also contributed to by direct point source inputs. By the time the river reaches the Lower Waikato FMU, water quality attributes are in C or D bands (D being below the national bottom-line) and it does not meet the *E.coli* swimmable criteria of the NPS-FM.
    - An example of these points is provided below using the *E.coli* attribute (note the log scale on the y-axis). Note that *E. coli* current state data covered the period 2009-2014 (i.e. 6 years as compared to the remainder of water quality attributes where five years' data (2010-14) were used).

State: Waikato River (main-stem) *E.coli*



State: Tributaries *E.coli*



- Much of the Waipā River (which joins the Lower Waikato River at Ngāruawāhia) has, and many of its tributaries have, low water clarity and high *E.coli* levels that fail to meet swimmable criteria.

- Lakes are generally of poor water quality, with most peat and riverine lakes having D band attribute states for Total N, Total P and chlorophyll a (i.e., below the national bottom line). There is a paucity of data for some lakes (e.g., Dune and 'Volcanic' lakes) and some attributes (e.g., *E.coli*).

15. The CSG used this analysis of current state, their Policy Selection Criteria and the requirements of the NPS-FM and the Vision & Strategy to help them develop several possible future water quality states they wished to explore through scenario modelling. During these deliberations, the CSG identified principles on how certain matters should be represented in the scenario modelling, including two of particular importance:
    - Improving water quality in the tributaries is important, and therefore an integral part of the scenario analysis is producing model outputs and assessing achievement of relevant water quality attribute states for each FMU at this scale (i.e., within tributaries), not just for the main stems of the Waikato and Waipā Rivers or for just the most downstream location of the FMU.
    - Water quality is to be maintained or improved - there is to be no decline in water quality from the current state (notwithstanding expected increases in nitrogen concentrations associated with groundwater lags). This means that where water quality is already better than the future state being modelled (including in the tributaries), it must remain at least at that water quality or improve. Or, put another way, there is no 'headroom' for increasing contaminant losses created through the scenario setting process.

16. Scenario analysis utilised a model specially developed for the purpose, building upon an existing model that had been used for one of the four contaminants (N) in a part of the catchment and as part of a national study led by the Ministry for Environment. Initial expert workshops decided on the model structure, identified existing information available for model inputs, and gaps in data and knowledge that would need to be filled. The model structure, inputs, assumptions and strengths and weaknesses have been detailed in the relevant peer-reviewed reports[1]. Scenario modelling brings together:
    - Spatial data on land use, soil, topography, rainfall, and point source discharges.
    - Data on the spatial distribution of different farm systems and farm costs and profit, largely provided by the sectors.
    - Data on mitigation options, their efficacy, and their costs.

- Spatial estimates of groundwater age, nitrogen attenuation and lag-times.
- Catchment models developed for N, P, sediment, and *E.coli* loss to streams and their routing and attenuation through their travel downstream.
- Models that link algal levels in the river (measured as chlorophyll a) with nutrients (N & P) and their ratios.
- Models that link water clarity with sediment and chlorophyll a levels.

17. The scenario model can be run in two modes: *optimisation* and *simulation*. In *optimisation* mode the model searches for the mix of mitigations that will achieve the specified future water quality states at the least catchment-wide cost (this mode can include any specified constraints to that optimisation, including the extent to which land use can change). In *simulation* mode the model is given a specified set of mitigations and then estimates the water quality states and cost of implementing them. All model runs were in *optimisation* mode until the point described in paragraph 4.14 of this evidence.

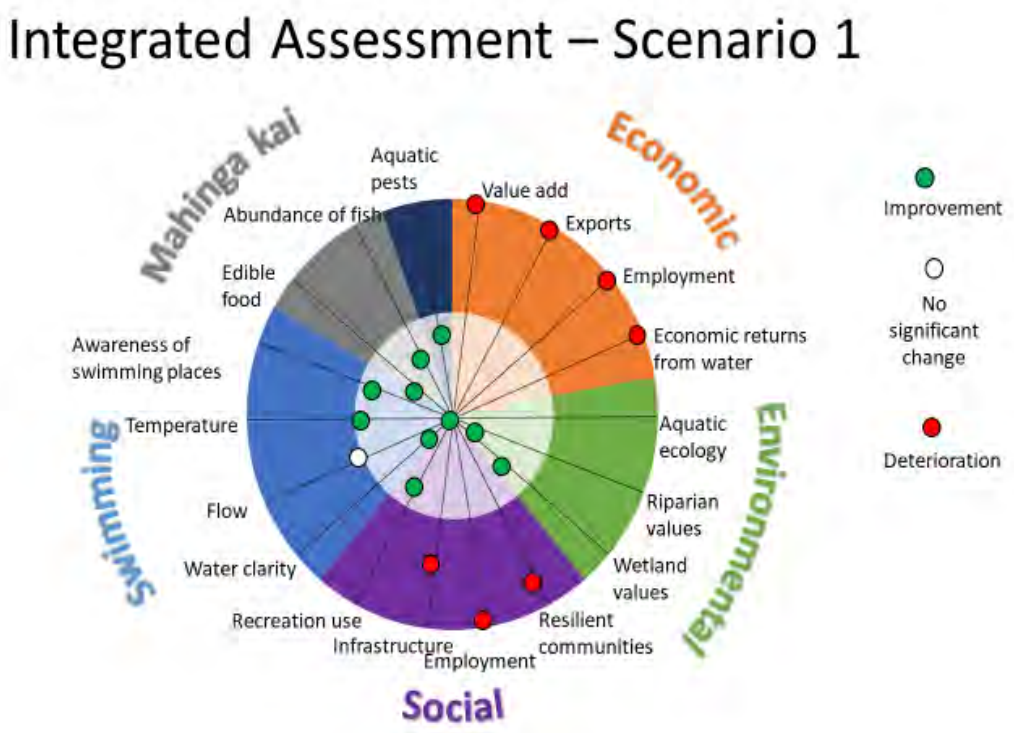
18. The scenario model outputs include estimates of water quality for 74 locations (62 of which coincide with WRC's monitoring sites) and estimates of catchment costs (as described by reductions in catchment profit), that can be broken down by sector or FMU. These catchment costs are passed to a Regional Model to determine flow-on effects to the rest of the economy and both models inform the Integrated Assessment, along with a suite of social and mātauranga Māori indicators.

19. After initially exploring the outputs from four different scenarios of future water quality[2], CSG resolved that 'Scenario 1' best met their Policy Selection Criteria, was consistent with the NPS-FM, and best aligned with the Vision & Strategy.

20. In general, achieving 'Scenario 1' water quality requires a significant improvement from current water quality. By way of illustration, achieving 'Scenario 1' water quality at the most downstream monitoring site on the main-stem of the Waikato River at Tuakau will require contaminant concentrations to reduce to between 30 to 60% of current observed concentrations, depending on contaminant.

21. Achieving 'Scenario 1' water quality (or as close to it as current mitigations allow) is predicted to require significant changes in the way land is used and managed in the catchment, with flow-on negative impacts on most economic and social indicators and

positive effects on most mātauranga Māori and environmental indicators[3] – see the Integrated Assessment wheel depiction of that below.



22. Given the large scale of changes required, the CSG determined that the estimated economic and social impacts (and the practicality) of undertaking all 'Scenario 1' interventions within the 10-year plan period were too high. They therefore sought further scenario modelling to evaluate the impacts of achieving percent increments towards 'Scenario 1'[4,5]. An output from that scenario modelling is shown below.

23. Because the scenario modelling was conducted using a cost optimisation approach, the most cost-effective mitigations are used first and are sufficient to achieve the 10% and 25% steps towards 'Scenario 1'. When these mitigations are exhausted, less cost-effective mitigations are required to achieve greater steps towards 'Scenario 1' water quality. The modelling indicated that, under the constraints on the extent of land use change imposed, there are currently insufficient proven mitigations in the toolbox to achieve 'Scenario 1' water quality at all locations.

24. After considering this scenario modelling and other information, the CSG resolved to develop a policy mix for PC1 that reflected a long-term (80 year) aspiration to achieve 'Scenario 1'/Vision & Strategy water quality and the need to take action in the first 10 years that would see at least a 10% step on that journey.

25. Whilst the scenario modelling of the 10% step provided the CSG with some indication of the likely scale and cost of mitigations required, this was done on a pure cost-optimisation basis without considering factors associated with other matters such as policy acceptance and implementation.

26. The CSG then derived a draft policy mix option that better reflected their deliberations on these factors and sought a scenario model run in *simulation* mode to test what degree of water quality improvement would result from this proposed policy mix and how much it would cost. While previous model runs were in *optimisation* mode ("we want this level of water quality improvement, provide the least cost mix of interventions to get us there"), *simulation* mode is the near opposite ("we are thinking of this mix of interventions, tell us the cost and the water quality improvements that would result").

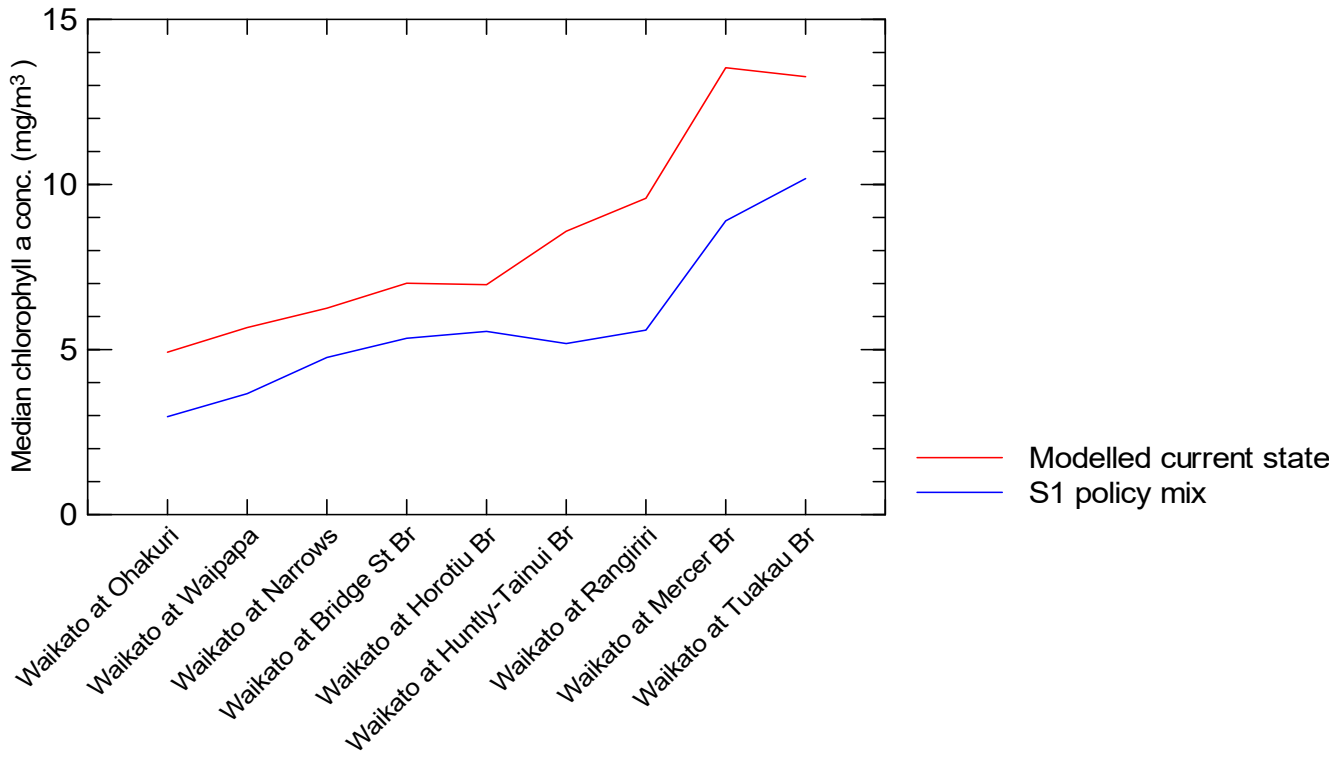
27. The policy mix simulation[6] included representing the following proposed interventions:
    - Nitrogen policy for reducing high leaching farms to the current 75th percentile.
    - Stream fencing requirements.
    - Tailored Farm Environment Plans (FEPs), their staged roll-out and the expected level of their implementation within the plan period. The 3-stage roll-out of FEPs was proposed to cope with capacity issues with respect to qualified farm environment planners. The staging sequence was decided by a set of criteria developed by the CSG, with the key principle being that FEPs will be developed first in those sub-catchments with the greatest gap being current water quality and 'Scenario 1' water quality.
    - Land-use change and intensification restrictions.
    - Notwithstanding the previous bullet point, making provision for iwi land development.

28. Additionally, the simulation modelled the effect that groundwater lags (the N load-to-come) will have in 'frustrating' attempts to reduce future surface water N concentrations below the current state.

29. Key outputs from this policy mix simulation were:
    - The policy will impact economic outcomes (catchment annual profit reduced by a predicted 4%). Costs vary between sectors (and will vary within sectors).
    - The policy actions will achieve their intent by improving water quality by greater than the specified 10% across most combinations of sites and attributes, even with the offsetting effects of assumed iwi land development (up to 9,000 ha).
    - The exceptions relate to the legacy effects of N 'load to come' in increasing N concentrations at some Upper Waikato sites despite the implementation of mitigations.

- The report also pointed out that mitigations can take time to be fully effective and be observed in changes in surface water quality. Nevertheless, the authors concluded that water quality improvements can be expected to be seen over the 10-year plan period (especially for clarity and *E.coli*).

30. An example of the predicted water quality improvements through implementation of the policy mix is presented below for chlorophyll a in the Waikato River.



31. The authors concluded: "Overall, the proposed policy mix constitutes an attractive value proposition in terms of the economic and water-quality outcomes that it achieves. However, these results are conditional on achieving rapid and significant levels of adoption of mitigation actions across the catchment. Moreover, nitrogen legacies evident in groundwater in the upper catchment make it difficult to maintain or improve all water-quality outcomes at a number of monitoring sites in this location."

32. This was the policy mix subsequently recommended by the CSG and adopted in PC1.

33. The CSG considered implementation practicality of this policy mix, including the capacity available to develop tailored Farm Environment Plans. This led to the TLG providing information on the size of the gap between desired state ('Scenario 1') and

current state to assist the CSG in developing a staged approach to implementation across the sub-catchments of the Waikato-Waipā that prioritised those sub-catchments with the greatest gap. Results of this prioritised staging approach are given in Table 3.11.2 of Plan Change 1.

CONCLUSION

34. As described at the beginning, the technical work undertaken to inform the development of PC1 was extensive and drew on the expertise of many. I have provided in my evidence an introductory overview of that work, with an emphasis on how it was used in the deliberations of the CSG, rather than detailed specifics of each piece of work. I am happy to answer any questions you may have. Thank you for your time.

REFERENCES REFERRED TO IN THE TEXT

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