

## Submission on Proposed Waikato Regional Plan Change 1

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3. I could not gain an advantage in trade competition through this submission.
4. I wish to be heard. I am prepared to consider presenting a joint submission with others making similar submissions.
5. The decisions sought may require consequential changes to other parts of the proposed Plan.

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## **Introduction**

6. I have owned and operated a drystock farm of 124ha at Whitehall, Cambridge in partnership with my wife for the last 31 years. It is a rolling to steep property in the upper reaches of the Karapiro Stream. We graze dairy heifers and farm sheep producing prime lambs and replacements.
7. We were early adapters of riparian fencing, starting some 20 years ago on a voluntary basis. The accumulated experience in building and maintaining the riparian fences and riparian zones has been valuable, particularly in terms of exclusion effectiveness, weed control and flood vulnerability. Unfortunately, almost all of the 3.5km of fencing along the main stream was destroyed in a localised extreme flood last June, along with a water supply intake, extensive culvert damage and streambank erosion. The costs of clean-up, repair and replacement of the riparian fencing have totalled \$31,500 plus \$5,500 other costs.
8. We were part of the Federated Farmers-led FEP pilot project. That estimated a further \$41,000 to implement other mitigations. The capital costs for this property therefore total \$78,000 or \$630/ha. Loss of grazing and maintenance costs are substantial additional costs, as is the cap on nitrogen leaching. I consider these costs (other than the N cap) to be tolerable, but only because we have already made significant progress, and we run a profitable system returning typically \$700/ha earnings (net of management and labour costs) before interest and tax.
9. I am prepared to face these costs for the benefit of improved water quality, on the assumption that those costs can be spread over the next decade or two, and that no further obligations will be imposed in the interim. However, I cannot see any feasible and affordable way of comprehensively reaching the 80 year water quality goal.
10. I have tertiary qualifications in engineering and economics. I hold a B.E. in natural resource engineering and a Grad. Dip. Business Studies in economics. I practiced in professional engineering for 15 years, mainly prior to farming. I have also served on the boards of two Crown regulators – the Electricity Commission and the Environmental Protection Authority. While I have no formal legal qualifications, those roles demanded a close understanding of the nuances of complex law. The Electricity Commission role exposed me to regulatory economics. I have also represented farming interests in numerous RMA submissions, on two RMA Ministerial advisory panels, and in a review of Waikato Regional Council enforcement practice.

## **Wrong basis for CSG deliberations**

11. This section relates to the whole Plan Change (PC1) in relation to the interpretation of the Vision and Strategy (V&S). While not opposing the V&S as such, I oppose the extreme interpretation and application of the V&S in PC1.
12. To give effect to the V&S, the CSG made their deliberations in the belief that the restoration of water quality to enable swimming and the safe taking of food was a mandatory objective. The following is an example of their communications to the public:

*“The Vision and Strategy prevails over the National Policy Statement for Freshwater Management 2014 ... and requires more stringent water quality conditions to be met. It requires the Waikato and Waipa rivers to be swimmable and safe for food collection.”<sup>1</sup>*

13. The “Background and Explanation” to the plan change notes that this objective “has been given particular focus”.
14. This theme has been consistently communicated by Council over time. As recently as 7 December 2016, a press release by the CEO<sup>2</sup> stated that the

*“The National Policy Statement for Freshwater Management and the legally binding Crown-iwi Vision and Strategy for the rivers both outline standards to be met over time. The latter calls for the rivers to be in good health and safe for swimming and food gathering along their entire lengths, including their tributaries... Some people may question whether the guidelines are appropriate targets. That’s their prerogative. But these are the guidelines we need to aim for.”*

15. In Appendix 1, I demonstrate why I believe this interpretation is in error. In summary, this objective is just one of a large number of V&S objectives, some of which are competing. Given that the V&S is implemented through the regional plan, the purpose of which is “to assist a regional council... in order to achieve the purpose of this Act” (RMA s63), then the s5 purpose statement of the RMA should be the decision tool used to weigh the V&S objectives and all the other well-beings of sustainability. Importantly, the V&S objectives do not prevail over the RMA. While the overarching purpose of the river settlement legislation is to “restore and protect the health and wellbeing of the Waikato River for future generations”, the extent to which the river should be restored is mute. As restoration to pristine state is not a feasible possibility with current knowledge, restoration should be to some former state, using RMA s5 as the decision tool.
16. At the same time, I acknowledge that in accordance with RMA s67, the PC1 must “give effect” to the regional policy statement that, for the Waikato River catchment, includes the V&S. PC1 must therefore give effect to the regional policy statement in a way that achieves the purpose of the RMA.

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<sup>1</sup> Healthy Rivers Plan for change Wai Ora (30 September 2015), “Protecting our water Tiakina o tatou wai”

<sup>2</sup> Cambridge Edition (7 December 2017)

17. The proposed plan has a strong theme of setting the end goal in 80 years' time. RMA s79 requires plans to be reviewed every 10 years for good reason, as it is very difficult to predict the socioeconomic conditions, the advancement of science and the evolution of environmental law beyond that timeframe.
18. As a matter of good regulatory practice, the regulation must, amongst other things, be feasible. The Technical Leaders Group (TLG) acknowledges that current knowledge and technology has no solution for the aspirational Objective 1. This objective therefore has no place in the regional plan; as objectives and policies can influence subordinate decisions, such as in regard to resource consents.
19. I acknowledge that the National Policy Statement for Freshwater Management 2014 (NPS-FM) has objectives of overall improvement in water quality; and to restore all rivers and lakes to healthy ecosystems and to conditions that are safe for intermittent human contact.
20. Policy CA2 of this NPS prescribes the process for developing freshwater objectives, including the requirement to consider under (f)(v):  
*“any implications for resource users, people and communities arising from freshwater objectives and associated limits including implications for actions, investments, ongoing management changes and social, cultural or economic implications”*  
This is consistent with RMA s5.
21. I submit that the focus of the CSG on the V&S objective of the River being safe for swimming and taking food substantially affected their recommendations, their misleading communications to the public, the public feedback on their deliberations, and importantly, these submissions to the formal consultation process.
22. The 80 year aspirational goal has left drystock farmers confused and disenchanted as to the future of farming in the Waikato. What is the point of undertaking mitigations to achieve 10% progress towards the 80 year target, when wholesale afforestation of the catchment is forecasted to be required? This would be at a huge economic and social cost, and represents a totally unrealistic weighing of the well-beings of sustainability.
23. Good regulation aspires to deliver investment certainty. While I accept that sustainability is somewhat of a moving feast, a regional plan should seek reasonable outcomes for a 10 year forecast, and not pretend to be able to target an outcome in 80 years' time.
24. **Decisions sought:**
- (a) Carefully consider the legal relationships between the RMA and the river settlement legislation, and
  - (b) View the recommendations of the CSG in light of the identified differences in interpretation.

- (c) Give proper consideration and weighing to all of the well-beings of sustainability as expressed by RMA s5.
- (d) Recognise that the value communities place on water quality vary in time (seasonally and flowrate) and spatially (sub-catchments and river reaches). For example, it would be more realistic to measure swimmability attributes only during the swimming season when the river was not in flood.
- (e) Delete Objective 1, noting and accepting that Objective 3 is central to this plan and makes Objective 1 unnecessary.
- (f) Make minor consequential changes to the other objectives and policies.

## **Towards optimal sustainability**

25. This section relates to the whole of PC1 and should be read in conjunction with the previous section. I oppose all provisions of PC1 that were based on achieving Objective 1 without considering and weighing all well-beings of sustainability. Given the scale of the identified economic costs and implied social costs associated with Objective 1, I believe the decision makers need to re-visit the rationale for Objective 1 using the highest standards of regulatory practice.
26. Good regulatory practice requires that regulation of all types must be able to pass a net benefit test<sup>3</sup>.
27. I acknowledge that case law is permissive of decision makers having wide discretion in balancing the various well-beings of sustainability. This is somewhat inevitable given the subjectivity and paucity of information involved, particularly when it involves valuing an environmental enhancement.
28. However, natural resource economics can help frame the trade-offs in an attempt to target optimal sustainability in which societal well-being is maximised. This represents best regulatory practice. That is, not only should a regulation have a net public benefit, but given a choice of regulatory solutions, the chosen option should have the greatest public benefit.
29. Appendix 2 demonstrates the concept. Simply:

**The decision-maker in taking regulatory action to avoid, remedy or mitigate adverse environmental effects should be satisfied that the net benefits are maximised, taking into consideration all of the well-beings of sustainability.**

I will refer to this as the net benefit test.

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<sup>3</sup> New Zealand Treasury (2012), "The best practice regulation model: principles and assessments". Wellington

30. The inclusion of “net” acknowledges that each limb of sustainability is multi-faceted and that the facets may be reinforcing or negating of each other. For example, and with respect to environmental well-being, planting trees alongside riparian margins have benefits to fish life through lowering water temperature, but usually shade-out grasses that filter contaminants from entering streams.
31. The economic cost of mitigation is usually much easier to price than the environmental value of that mitigation. A common approach to optimising the trade-off is to construct a mitigation cost curve by ordering the list of possible mitigations, starting from the mitigation having the best cost effectiveness (lowest cost per unit of abatement). It then is a matter of “harvesting the low hanging fruit” first, and then proceeding through the list until the cost of abatement is judged to exceed the value to the environment in undertaking that mitigation, taking account of all well-beings of sustainability. This is the optimal point, and in some regulatory regimes, is referred to “as low as is reasonably practicable” (ALARP). It is a useful way in which to think of the net benefit test.

**As Low As Reasonably Practicable (ALARP): The level of pollution is tolerable if the cost of any further mitigation exceeds the assessed benefits of that mitigation, taking into consideration of all of the well-beings of sustainability.**

32. The CSG has not made this judgement. Rather, the 80 year attribute levels were based on recommendation of a scientific and cultural expert panel.<sup>4</sup> This panel was tasked with populating attributes to meet the CSG core values of swimmability, mahinga kai and ecosystem health.
33. The panel assumed without providing justification that “*swimmability is a value that applies to all waterways, at all times of the year and under all flow conditions*”. This is an extreme interpretation, as in reality:
- (a) There are time windows: People have no desire to swim in winter and should avoid physically dangerous conditions during floods (when the discharges of contaminants generally peak).
  - (b) There are location limitations: It is unsafe to swim where whirlpools are present, and it is impossible to swim in small streams.

This plan change is dealing with a complex landscape overlaid by a complex array of land uses and community values. It is important for efficiency and effectiveness reasons that the regulatory response properly targets the scope of the pressure. For example, it would be more realistic to measure swimmability attributes only during the swimming season when the river was not in flood. Including the typically higher E. coli and sediment concentrations outside of the swimming season within the measured attribute unrealistically skews the reported results. An alternative approach could be as adopted in the proposed 2017 amendment to the National Policy Statement for Freshwater Management, that is, change the exceedance level from the 95<sup>th</sup> percentile to the 80<sup>th</sup> percentile for the E. coli attribute of 540/100 ml.

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<sup>4</sup> Report to TLG (20 June 2016), “Water quality attributes for Healthy Rivers: Wai Ora Plan Change”.

34. I note that the 80 year Objective 1 attribute levels are most commonly A band and much more stringent than the NPS-FM National Bottom Lines (bottom of the C band). The Objective 1 levels typically allow only 20% of the level permitted by the National Bottom Lines, such that each contaminant has typically “*nil*” or only “*slight impacts*”.
35. The CSG failed to test their core values (swimmability, mahinga kai and ecosystem health), and the resulting attribute levels recommended by the expert panel with reference to weighing the well-beings of sustainability. If they had taken account of economic and social impacts, their recommended attribute levels would most likely have been less extreme. With reference to Appendix 2, the marginal benefits of achieving “*nil*” or “*slight*” environmental impacts are likely to be much less than the known large marginal economic and social costs of mitigations to achieve those states. In other words, Objective 1 goes beyond ALARP.
36. To the extent practicable, the environmental value of mitigations should be priced. The most obvious tool is a public survey of willingness to pay for a particular mitigation. However, this technique suffers the free rider problem in that respondents recognise they will benefit from the environmental improvement but would not have to pay for it, and therefore make demands well in excess of the real value they place on the environment. Better approaches are to examine actual behaviour, such as using the travel cost method. Some possible examples:
- (a) To what extent do people travel to more remote hydro lakes to seek out better water quality?
  - (b) Can public swimming pools be funded on user charges alone, or do they require ratepayer or charitable support?
  - (c) What premium are people prepared to pay for food sourced from environmentally friendly production systems?
- Any quantification of the value of improved water quality that was based on any of these posers would be likely in be in the low millions of dollars and very much less than the cost of the proposed mitigations to achieve Objective 1. I am therefore of the view that Objective 1 is sub-optimal, even if it was feasible.
37. In setting the water quality targets, much emphasis has been placed on public and iwi preferences<sup>5 6</sup>. These apparently were no more than preferences, and while laudable and of some relevance, suffer from the free rider problem. The New Zealand resource management lexicon describes such preferences as “values”, which is somewhat of a misleading term, as a preference doesn’t necessarily imply it is valuable.
38. Several principles, concepts and RMA provisions can support or hinder the achievement of optimal sustainability. Examples:

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<sup>5</sup> Waikato Regional Council (2015), Document #3166221

<sup>6</sup> River iwi (2015), Document #3843800

- (a) Seeking cost effective mitigations is an important partial fulfilment of optimality. Cost effective solutions are those having the least cost to achieve a given level of environmental protection. Given the scale of economic and social costs indicated in this plan change, identifying and prioritising for action the most cost effective mitigations is a key consideration for decision makers. The mitigation cost curve does just this.
- (b) Seeking “win-win” outcomes whereby there are net benefits both to the environment and the other well-beings of sustainability is an even better outcome, but not always possible. Win-win outcomes may not be optimal, and digging deeper into the toolbox of mitigations may be justified.
- (c) Seeking mitigations that reduce adverse environmental effects to insignificant levels is likely to be sub-optimal.
- (d) RMA s 32 goes some way towards a net benefit test. The above demonstrates that robust s32 analysis is a core element of sustainability, and not just a burdensome legislative requirement.
- (e) RMA s70(2) permits rules for discharges that require the adoption of the best practicable option. Its definition in s2 is consistent with the net benefit test, albeit more discretionary.
- (f) Optimality is enhanced if solutions are targeted to sub-catchments, rather than taking a one size fits all whole of catchment approach. The type and severity of contaminant discharge varies throughout the catchment, as do the cost-effectiveness of mitigations and the values local communities place on water quality. Implementation effectiveness is also enhanced if there is buy-in by local communities that drive farmers to be responsible members of the community.
- (g) Likewise, optimality is enhanced if solutions are targeted to flow regimes. For example, there is little value in trying to attain water quality targets during floods. However, targeting adds to the complexity of regulation, so it should be applied with pragmatism.

**39. Decision sought:** That the Hearings Committee take care to limit regulatory measures to the scope of each environmental pressure and applies the concepts of the net benefit test in all decision-making. These are the omnipresent decision criteria.

### **Best management practice**

40. This section relates to the definition of “best management practice” and its application in Polices 3 and 16, and clauses 3.1.12 and 3.11.4.12. It is defined as:

*“For the purposes of Chapter 3.11, means maximum feasible mitigation to reduce the diffuse discharge of nitrogen, phosphorus, sediment or microbial pathogens from land use activities given current technology.”*



41. Best management practices need to embody the concepts of the net benefit test. Whether the proposed definition of "best management practice" does so depends on whether the interpretation of "feasible" includes consideration of cost effectiveness. There also needs to be alignment between the definitions of "best management practice" and "best practicable option" used for point source contaminants so that the regulation of the two sources are consistent.
42. In order to decide the thresholds of best management practices, reference should be made to a mitigation cost curve and the thresholds should be based on cost effectiveness. Only by taking this approach can there be any assurance that the basket of required mitigations provides the greatest environmental gains for the least cost to the nation; surely an important consideration given the huge estimated costs. Taking this approach also provides a mechanism for treating each land use sector consistently.
43. There are two important caveats in taking this approach.
- (a) The relative profitability of the various sectors means that some are much more able to bear the costs than others. The consequences for those sectors that cannot bear the costs are significant loss of profits for the sector, lower performing enterprises going broke (resulting in big losses in capital value flowing across the sector), change in land use, and significant flow-on economic and social effects, impacting most harshly on rural communities. In sectors having low profitability, the flow-on impacts could be avoided by the subsidization of the mitigation through general rates.
  - (b) The same flow-on impacts will occur when the mitigation involves a loss of production. Subsidies can only partially avoid the flow-on impacts of lost production. These two examples illustrate the care required in assessing regulatory impacts so as to avoid unintended consequences.
44. Each industry sector has an essential role in defining best management practices, as that is where the core of experience, knowledge and skills reside. Council's role is to ensure appropriate and consistent levels are set in order to target attribute levels embodied within Objective 3, to challenge and support industries in the process, and to then approve those practices.
45. **Decisions sought:**
- (a) For the avoidance of doubt, add, "*and taking account of cost effectiveness*", to the end of the definition of "*best management practice*".
  - (b) Change clause 3.11.4.12(a) to, "*Work with industry sectors to develop and disseminate a consistent set of best management guidelines that targets Objective 3 attributes, taking account of the cost effectiveness of each mitigation.*"
  - (c) Acknowledge that the implementation of unaffordable mitigations is contingent upon vulnerable landowners having access to financial support.

## Implementation speed

46. This section relates to Rules 3.11.5.3 to 3.11.5.6, and Schedules C and 1.
47. I seek amendments and inclusions to these provisions so as to improve practicality and effectiveness.
48. The proposed targets of Objective 3 will stretch farmers, WRC and the farm plan service providers. The ability to train and recruit suitable personnel may be impossible, let alone for them to gain sufficient experience to make wise decisions. Of greater concern to me is the potential for a headlong rush into unproven solutions. The history of land management is littered by examples of best intentions but poorly understood consequences. This observation is a reflection of the complexities of the natural environment, and the long lag periods for some consequences to emerge. Experiential learning and formal monitoring of the performance of mitigations are keys to informing better future decisions.

Some examples that contradict conventional wisdom and highlight the need to test good ideas by ground-truthing include:

- (a) The downstream impacts of flood debris arising from streambank planting that erode or die. For example, flax is shallow rooted and is easily undermined. It causes havoc in blocking downstream crossings and wrecking riparian fences.
- (b) Riparian trees exacerbate the runoff of contaminants because:
  - i. They shade out grass and so reduce the filtering capacity of the riparian zone.
  - ii. Livestock excrement is concentrated on stock camps. Stock normally prefer to camp on ridges where runoff has long slopes on which the grass can provide significant filtering services. The shelter provided by trees encourages stock to camp adjacent to the trees, and so, riparian trees can bypass the filtering action of the hill slope.
- (c) Riparian planting may shade-out grass, resulting in accelerated streambank erosion and associated substantial increases in sedimentation and phosphorus contamination until a new equilibrium of streambank form is established, maybe taking decades.
- (d) Riparian fencing in hill country can exacerbate soil erosion by forcing livestock off established cattle tracks running on the contour and onto making new tracks alongside the riparian fence.
- (e) Wetlands in the valleys of rolling and steep land have the potential to turn into mudflows during high intensity rainfall. These create large shear forces on the downstream stream beds, resulting in further extreme erosion of otherwise stable streambeds. The mass movement of sediment, leafy and woody debris causes substantial damage to downstream riparian plantings, crossings, fences and other infrastructure. This mechanism was the prime reason for the \$37,000 of costs that we incurred from the June 2016 flood.

49. To facilitate this learning and to minimise resource constraints to constructing riparian fences and other mitigations, landowners need to get on and make some early progress, and not wait until the proposed deadlines loom. Many of the works are obvious, and are not contingent upon having an approved FEP, especially as Council and industry already provide general advice. A target for 30% of riparian fencing completed by 2020 (other than for Priority 1 sub-catchments) may be realistic.
50. Monitoring is a key implementation method. Many of the environmental benefits of riparian fencing should be apparent in the short term, including reductions in pathogens, phosphorus, ammonia and sediment during summer low flow conditions. What better incentive for farmers to continue progress in implementing mitigations than official water quality monitoring showing improving trends?
51. On the other hand, Policy 2(e) requires stock exclusion to be completed within 3 years of the deadlines for submitting FEPs, and no later than 1 July 2026. This is the same date as for submitting FEPs in Priority 3 catchments under Rules 3.11.5.3 and 3.11.5.4. Headroom needs to be created to give reasonable time for approval of the FEP and for undertaking the physical works.
52. **Decisions sought:**
- (a) Recognise the value of experiential learning and adaptive management.
  - (b) Monitoring is a key implementation method, including trend monitoring of E. coli, phosphorus, ammonia and clarity during summer low flow conditions.
  - (c) There could be an obligation for a staged implementation of riparian fencing prior to the deadlines set by the FEPs or by Rules 3.11.5.1 and 3.11.5.2.
  - (d) Reasonable time must be given between the deadline for submitting an FEP and completion of the required stock exclusion works.

### **Assumed costings supporting the Section 32 evaluation**

53. This section relates to the costings assumed in the economic modelling and the impacts they had on the proposed PC1.
54. The various economic reports prepared for PC1 unfortunately take account of only some economic costs and superficially consider social costs. Only capital costs were considered for those mitigations that were in the nature of a capital investment, such as riparian fencing. Balanced decision-making and weighing of the well-beings of sustainability must consider all costs and benefits to all well-beings. An in-depth and quantified social impact assessment is a glaring omission.
55. Some of the costings in the economic modelling are well short of the mark. Examples include:

- (a) No cost for land taken out of production. For example, the first paddock I riparian fenced was 6 ha effective. As the stream is meandering and it is impractical to fence closely to the meanders, about 0.6ha of high value flats were retired along with 0.5ha of stream and steep banks. That is, more than a 10% reduction in effective grazing. The 2016 Government Valuation for Land Value over the whole farm (rolling to steep) is \$17,600/ha, which would make the high quality flats worth at least \$25,000/ha, and the steep banks worth about \$8,000/ha; totalling \$19,000. The construction cost of the riparian fence (900m of stream fenced both sides at \$5.50/m (WRC estimate)) is \$9900. That is, the value of the land forgone is almost twice the construction cost of the riparian fence. Another way of expressing the cost of land forgone is that for every additional metre of setback, the value of land at \$25,000/ha is \$2.50/m of fence.
- (b) The construction costs in rolling and steeper land escalates due to greater stream meandering requiring more expensive corner posts, possibly rocky conditions for driving posts, and the need for earthworks benching to provide a platform for the fence and space for stock to walk, so as to mitigate treading erosion.
- (c) Flood damage repairs can be significant. For example, we lost all of our riparian fencing on the main stream (3.5km) in an extreme flood in June. Posts were either broken off or ripped from the ground, and the fence was variously dragged over paddocks or through the stream, leaving debris firmly entwined. The time and effort required to clean-up the destroyed fencing was significant – about half the time required to replace the fencing. I have had to strip debris from the fence and make minor repairs on two previous occasions over the 20 years since erecting the fence. That is, flood damage costs are a significant part of the total cost, as well as being demoralising and causing significant business interruption and resourcing pressures.
- (d) Repairs, maintenance and replacement costs of other mitigations are also significant if not substantial. For example, recently, I have had 20 year old poplars removed from easy-contoured land at a cost of \$153 per tree (WRC estimate). On steep or inaccessible land, the costs would have been considerably more. This contrasts with a cost of \$15.50 to establish a willow or poplar (WRC estimate).
- (e) Weed control is a necessary on-going activity in riparian zones that previously had been controlled by stock. Long grass and other plants hiding obstacles increase safety risks of slipping while carrying a knapsack.

**56. Decisions sought:**

- (a) Take account of all economic costs when evaluating sustainability trade-offs.
- (b) Commission and consider an in-depth social impact study that quantifies likely impacts.

**Moratorium on land use intensification**

57. This section relates to:

- (a) Policy 6: Restricting land use change
- (b) Policy 16: Flexibility for the development of ancestral lands
- (c) Policy 3 and Rule 3.11.5.5(f) and (g): Capping the area used for commercial vegetable production
- (d) Rule 3.11.5.7: Land use change

58. I oppose these provisions in part.

59. The modelling undertaken<sup>7</sup> for the policy mix of this plan change suggest that the Objective 3 water quality targets will be achieved in most instances.

60. The need to place a moratorium on land use intensification now is therefore as much about achieving further water quality improvement in subsequent plan reviews as it is about preventing slippage in achieving Objective 3. Given my reasons for opposing Objective 1, and the likelihood of achieving Objective 3, I contend that the justification for a moratorium is at best weak.

61. The imposition of a moratorium is somewhat harsh, as it limits option value which can be a valuable property right. For this reason, the duration of the moratorium should be as short as possible. It should be possible to develop alternative policy within a few years, so the sunset clause could be reduced from 10 to 5 years.

62. A restrictive moratorium can adversely affect dynamic efficiency by stifling innovative changes to more efficient land use. One simple means of providing some flexibility is to allow off-site mitigation to offset the assessed increase in discharges from land use intensification. For example, a person converting a drystock farm to dairy may be able to offset discharges by converting other drystock farming land to forestry. Off-site mitigation enhances efficiency by allowing the most cost-effective mitigation to be used.

63. On the other hand, if a moratorium on land intensification is not adopted, then greater improvements *may* need to come from existing uses to compensate for any land intensification while targeting the limits of Objective 3. To require discharge constraints for existing use in excess of those in PC1 could impose further costs and constraints on production, could strand assets used for production, processing and rural infrastructure; and could have very significant flow-on economic and social effects. For these reasons, I support a short term moratorium in preference to more onerous impositions on existing use.

64. Policy 16 providing for the development of ancestral lands for commercial use is unfair when other landowners are denied that economic right by Policy 6. Also, in the exercise of Policy 16, other existing users will have to compensate by digging deeper into the mitigation toolbox in order to achieve water quality targets in the future. The Section 32 report failed to demonstrate any genuine grievances that should appropriately be addressed by WRC in a regional plan. If any grievances can be demonstrated, they should not be settled through

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<sup>7</sup> Doole, etal (2016), "Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process"

privileged environmental regulation. A more appropriate mechanism would be monetary compensation.

65. Commercial vegetable production for the local market presents a unique case. In the face of an increasing Auckland and Waikato population, if the caps on land area and nitrogen are applied, from where will we be able to source our produce? Given the perishable nature of most fresh vegetables necessitating local production, the likelihood of similar environmental regulation being imposed in neighbouring catchments, and the constraints of suitable soils, it is inevitable that supply shortfalls and price increases would result. We experience pricing spikes in fresh vegetables today when adverse weather causes shortages. Capping the land area would benefit existing growers both through increases in product prices (albeit under constrained production) and in the value of their land holdings. Consumers would bear the costs in terms of prices and reduced availability of fresh vegetables. There is little need to cap the area of local trade vegetable production, as it will increase only to the extent of increases in local population. It must be allowed to do so in order to avoid the impacts described.

**66. Decisions sought:**

- (a) Rule 3.11.5.7 Land use change:
  - (i) Shorten the sunset date of this rule to 1 July 2021.
  - (ii) Clarify that, “subject to the Council being satisfied that the loss of contaminants from the proposed land use will be lower than from the existing land use” is a condition of consent. Currently, it sits under the “notification” heading and so appears to be part of the notification requirements.
  - (iii) Clarify that off-site mitigation in the same sub-catchment is permissible to offset the assessed increase in contaminant discharge from land use intensification.
- (b) Delete Policy 16 and Objective 5(b).
- (c) Policy 3 and Rule 3.11.5.5(f) and (g): Do not cap the area of commercial vegetable production for those species that are grown only for the domestic market.

## **Nitrogen Reference Point**

67. This section relates to:

- (a) Rules 3.11.5.2 to 3.11.5.4
- (b) Schedule B: Nitrogen Reference Point
- (c) Schedule 1: Farm Environment Plans

68. I oppose these provisions in part.

69. My main concern is that the proposal grandparents existing nitrogen discharges for all but for the highest 25% of dairy farms. That is unfair on those who have responded to

environmental concerns and have deliberately adopted low discharge practices, and rewards high leaching properties.

70. Previously, we applied nitrogen to boost grass growth for lambing and for silage, but stopped the practice when nitrogen leaching issues were raised. Our farm has a Nitrogen Reference Point (NRP) less than 15kg/ha/year, which is a result of a high ratio of sheep to cattle and nil nitrogen application in the reference years. Applying significant amounts of nitrogen would have been a very good investment for us in that it would have secured future flexibility to adjust stock species, stock ratios, stock numbers and cash cropping in response to market and climatic conditions. This flexibility is crucial in being able to operate a successful drystock farming enterprise. The scope of stock classes farmed in the Waikato is large, ranging over a number of species, age classes and sexes. Many drystock farmers grow cash crops such as silage and maize. The nitrogen discharge simulated by Overseer is dependent on stock class, animal growth rates, and crop types, so the need to retain the flexibility inherent in successful drystock farm management implies the need to retain some flexibility in nitrogen leaching.
71. It is somewhat sobering to observe the number of past Farm Environment Award farmers who are up in arms with PC1. It is these same farm leaders that WRC need onside to champion PC1 if it is to be successfully implemented.
72. Farmers outside of the catchment but within the Waikato Region are taking a keen interest in PC1, as they anticipate they will face the same regulation when plan changes are proposed for their catchments. Grand parenting sends a strong perverse signal to those farmers to increase their nitrogen discharges so that they can benefit from a high NRP.
73. Grand parenting nitrogen is designed to address some of the same issues as the moratorium on land use intensification, and is intended by Policy 7 to be an interim measure while an allocation scheme is devised. An allocation system that enables trading would also provide the solution to land use intensification. Therefore, grand parenting should be subject to the same sunset clause as the moratorium on land use intensification. That sunset, in my view, should be 5 years to correspond with that for the moratorium on land intensification.
74. Table 11-1 of PC1 demonstrates that the short term targets for nitrate are very close to the 80 year target, implying that current levels are also very close to the 80 year target. The only doubt is the amount of N to come. This table also demonstrates the main challenge for farmers is to reduce pathogen discharge to typically one tenth of existing concentrations.
75. The present structure of controls that are based on FEPs and the NRP implies that nitrogen is the priority contaminant, whereas E. coli concentrations followed by clarity require the greatest improvements in order to achieve Objective 1 targets.
76. I acknowledge that Table 11-1 does not tell the whole nitrogen story. There are farmers in the drystock sector who are pushing nitrogen discharge limits. It is fair and reasonable that they should be obliged to reduce discharges to align with best management practice (BMP)

for drystock farming. The 75 percentile rule is unlikely to be effective in this regard, as discharges from drystock properties operating at BMP are probably much less than the 75 percentile value established from dairy NRP's.

77. The establishment of the NRP comes at a significant compliance cost in consultancy fees, farmers' own cost and Council administration and audit. This cost could be better spent on undertaking mitigations that will make tangible improvements to water quality.
78. Council's science and strategy director claims that the NRP *"is more like data gathering (than) grand parenting... Then we can use that information to decide on future plan changes"*.<sup>8</sup> That being the case, there are far simpler and cheaper means of data gathering than requiring NRPs for each property. For example, an annual return for each property of stock numbers, fertiliser applied and feed imported/exported would enable Council to amalgamate information from similar farm enterprises and run Overseer on the amalgamated data. This would provide the basis for sound trend monitoring as desired by Council.
79. **Decisions sought:**
- (a) Replace the requirements to establish NRPs and cap N discharges with the requirement to adopt BMPs to control nitrogen leaching.
  - (b) Require farmers to submit an annual return to Council similar to that required under rule 3.11.5.2(5), so as to enable Council to monitor trends in land use intensity.

## Preparing for allocation in the future

80. This section relates to Policy 7.

I support this policy except:

- (a) Policy (b) "Allowance for flexibility of development of tangata whenua ancestral land" for the reasons stated in Paragraph 64.
- (b) The last paragraph of Footnote 5(e).

81. With respect to the latter:

- (a) *"...land suitability criteria exclude current land use..."* There is no way of determining the suitability of land for productive purposes in the absence of production and economic considerations.
- (b) *"...land suitability criteria exclude... the moderating effects of potential mitigations..."* Potential mitigations are relevant considerations for an allocation system.
- (c) It seems that land suitability criteria that do not include existing use are unworkable or sub-optimal. An allocation system that does not take into consideration existing use will end in a train wreck of frustrated land users who will either be forced to

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<sup>8</sup> Coast and Country News (December 2016)



change land use or to trade discharge permits creating windfall wealth transfers. Trading will be frustrated by illiquid markets, such as has been experienced in water trading regimes, as landowners are reluctant to sell valuable property rights, even when excess to their own immediate requirements. Trading will also be frustrated by small markets and few opportunities for trade, as trading will likely be limited to trades within the same sub-catchment.

- (d) On elite soils having several land use opportunities, an allocation system that ignores existing use cannot simultaneously meet the needs of, for example, vegetable production, dairying, equine and fruit production.
- (e) Existing use should however not be an unfettered right, nor the dominant factor determining allocation because it unfairly rewards those who have been pushing the limits and penalises those who have a low environmental footprint.
- (f) Allocation based on good management practice is a feasible option, and should not be ruled out by (a) and (b) above. A GMP allocation would allocate discharge rights on the basis of existing land use employing the set of mitigations required by the FEP for that property. Such a system would therefore provide a seamless transition from PC1 requirements into a system that facilitates innovation through the opportunity to trade.

**82. Decisions sought:**

- (a) Delete Policy 7(b)
- (b) Delete the last paragraph of Footnote 5.
- (c) Modify the text to clarify that an allocation system will consider biophysical, production, economic, good management practices and other relevant matters, but will exclude grand parenting of existing use.

## **Stock exclusion**

83. This section relates to Schedules C and 1, which I oppose in part. However, I support the proposal to exclude cattle but not sheep from riparian margins to the extent it is practicable to do so.

84. We made a start on our own property 20 years ago, and have made significant progress in the interim, only to have 3.5km of it destroyed in an extreme flood last June. We have spent considerable time and money in cleaning-up the damage and replacing the fences.

85. Riparian fencing progressively becomes more difficult as the contour steepens.

- (a) Fencing of drains on flats is cheap and simple.
- (b) Meandering streams on flats become a little more challenging and expensive because of the additional costs of larger corner posts and additional high quality land taken out as a result of the meanders. As the bed slope of the stream increases, so does the velocity of flood flows. If the fence posts and wires become inundated,

they will catch debris and succumb to high flood velocities. That was the case in June for us.

- (c) In rolling country it is often possible to find a route for a riparian fence that is a safe height above any potential flood. Benching of the fence line is commonly desirable to make construction of the fence easier, to improve the effectiveness of the fence in excluding stock from the riparian margin, and to minimise erosion from treading damage.
- (d) On steep country, it is often impossible to route a riparian fence without causing erosion from treading damage caused by the fence re-directing livestock away from established stock tracks. Even where the fence line is benched, stock can cause erosion on the cut batters. Also, construction costs escalate in steep country, and more so if rock is encountered.

86. The requirements for minimum grazing setbacks in Schedules C and 1 are inconsistent. In Schedule C, it is a mandatory 1m minimum from the bed of the water body, which the RMA defines as the highest flood level without overtopping the bank. In Schedule 1, the setback is from the water body, which the RMA defines as the water itself, presumably under normal flow. This schedule requires, where practicable, minimum setbacks of 1m on land slopes less than 15° and 3m on land slopes of 15 to 25°.
87. As a matter of practicality, fences are placed on average several metres from the water body and more than a metre from the top of the bank. However, there are several instances in the riparian fencing that I have completed where a mandatory 1m minimum setback from the bed of the stream is not possible. Examples include where access lanes are constrained by topography to be adjacent to the stream, or where spurs run down to the stream leaving a narrow flat between the spur and the stream bank on which to site the fence.
88. The cost of riparian fencing in terms of loss of grazing land is significant. In Paragraph 55(a), I cite a personal example where the value of the land forgone was almost twice the construction cost of the riparian fence.
89. Furthermore, the chief environmental benefit of fencing is to exclude stock; the other main benefit being grass buffers within the fenced margin filtering contaminants. The science points to low and variable effectiveness of filter strips.<sup>9</sup> Any filtering depends on the presence of grass (not shrubs or trees), sheet flow of runoff into the stream, rather than the typical channelised flow; and in the case of nutrients, the ability to graze and export the nutrients periodically to prevent nutrient saturation within the riparian zone.
90. Controls on setback distances therefore would have little impact on the environmental effectiveness of the riparian zone and workable controls are difficult to draft. The Schedule C mandatory control of 1m would enable enforcement of trivial detail at the expense of tarnishing Council-land owner relationships.

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91. The need to exclude cattle from small headwater streams is apparently less. My observations lead me to believe that cattle are not attracted to linger in small streams like they do in larger ones.
92. Also in my experience, trough water is a very good mitigation, as cattle have a preference to drink clean water from a trough, rather than water they have stirred-up and dirtied in a stream. The strategic location of troughs so that they are readily accessible further improves their effectiveness.
93. Having a condition that permits alternative mitigations to fencing when the slope is greater than 25° is unworkable. Over what scale should slope be measured? Along a riparian margin within a paddock, slopes often oscillate above and below this threshold, yet the fence needs to span from one side of the paddock to the other in order to exclude stock. I also have paddocks where the slope is less than 25° on one side of the stream and greater than 25° on the other. It would be easy to fence one side, but I have not done so because it would trap cattle and cause treading damage on the opposite stream bank and base of the steep slope. In my experience, what is possible to fence depends on the considerations that I have outlined above. In other words, fence what is practicable, and use other mitigations elsewhere.
94. The current rules in the regional plan often require resource consents to undertake earthworks to form benches for riparian fencing, for stock crossings and for vegetation clearance in riparian zones. While I appreciate that these rules are not currently under review, they are relevant to PC1 as they impact on the cost and practicalities of implementing the stock exclusion rules in PC1.
95. The extent of stock exclusion that includes all rivers and drains that continually contain surface water seem unnecessarily restrictive. Stock exclusion is about restricting contaminants entering surface water. Without flow in the surface water, the contaminants cannot be transported downstream. The RMA definition of “river” is a continually or intermittently flowing body of fresh water. The Land and Water Forum’s fourth report recommends stock exclusion only for permanently flowing waterways, natural wetlands and adjacent to intensive grazing practices. Only waterways greater than 1m wide and 30cm deep on rolling and steeper country are recommended for stock exclusion.
96. **Decisions sought:**
- (a) Delete the minimum setback requirements in Schedule C clause 2 and Schedule 1 clause 2(b)(ii).
  - (b) Delete the 25° slope criterion in Schedule 1 clause 2(a)(ii) so that fencing is required where practicable and elsewhere require the adoption of the “*best practicable option*” (RMA s2 definition) to mitigate the diffuse discharge of contaminants.
  - (c) Amend the types of rivers and drains that require stock exclusion to those having continually flowing water.

## Farm Environment Plans

97. This section relates to Schedule 1: Farm Environment Plans, which I support in part and oppose in part.
98. I support in principle the regulatory use of Farm Environment Plans that allows mitigations to be targeted to the specific farm management and biophysical issues of each property. I also support using the expertise and independence of Certified Farm Environment Planners in conjunction with the knowledge and experience of the farmer in managing their land. I believe this bilateral approach should both foster buy-in by the farmer and give public confidence in the integrity of the regulation. The planner is incentivised to meet regulatory standards through registration requirements and independent audit; and enforcement provides the backstop.
99. I am concerned with the high transaction costs to prepare, audit and enforce FEPs, and the costs of annual reporting. These duties will take up significant time for farmers, Certified Farm Environment Planners, independent auditors and Council staff, and in total will impose significant if not substantial compliance costs.
100. I am concerned about the affordability of PC1 for hill country farmers, who will face the perfect storm of high compliance costs per hectare (as demonstrated by the Federated Farmers FEP pilot study) and inherently suffer low profits per hectare. The Beef and Lamb NZ economic survey of hard hill country in the Northland Waikato Bay of Plenty region<sup>10</sup> shows an average economic farm surplus over the past 10 years of only \$82/ha (ranging from \$71/ha loss to 159/ha profit between years) and an average 1.18% return on total farm capital. The average effective farm area is 561ha. The quintile analysis for the same farms in 2014-15<sup>11</sup> (a very profitable year) shows an economic farm surplus as follows:

Quintile	Economic farm surplus (\$/ha)
1	-53
2	52
3	118
4	231
5	331
Average	146

101. I oppose the broad discretions given to Council in Implementation Method 3.11.4; in particular:

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<sup>10</sup> <http://beeflambnz.com/information/on-farm-data-and-industry-production/sheep-beef-farm-survey/nni/>

<sup>11</sup> <http://beeflambnz.com/Documents/Information/Sheep%20and%20beef%20farm%20survey%20Northern%20North%20Island.pdf>

3.11.4.3 *“Waikato Regional Council will prepare parameters and minimum requirements... for Farm Environment Plans”.*

102. Schedule 2 states that the approval of an industry scheme will be at the discretion of Council’s CEO subject to the CEO being satisfied that the scheme meets with the listed assessment criteria, including:
- a. *Achieving the water quality targets of Objective 3.*
  - b. *The purpose of Policy 2 or 3 to manage and require reductions in sub-catchment-wide discharges from farming and commercial vegetable production.*
103. What is missing from Schedule 1 is a menu of best management practices (BMPs) and minimum standards that farm FEPs will be measured against. These will be central to the *“minimum requirements”* in Section 3.11.4.3, in achieving the water quality targets of Objective 3, and in achieving the purposes of Policies 2 and 3. The science linking mitigations (best management practices, minimum standards) to sub-catchment impacts on water quality is, at best, vague; thereby giving the CEO wide discretion as to how high the mitigation hurdles will be set. In the absence of such information, farmers cannot make a reasonable impact assessment of PC1.
104. Farmers and rural professionals have a vital role in developing menus of BMPs and minimum standards to ensure that they are practicable and the least cost ways of meeting the water quality targets. Industry schemes will have such input, but those farm types for which there is no industry scheme, will not. It would appear that while Beef and Lamb may be willing to play a central role in developing menus of BMPs and minimum standards, they do not have the capacity or the mandate to fulfil all of the requirements of a certified industry scheme.
105. The position in Policy 2(b) and Schedule 1 apparently call for consistency between FEPs, whether established through resource consent or Certified Industry Scheme.
106. Under controlled activity Rule 3.11.5.4; Council has reserved discretion under (v) as to the term of the consent; under (vii) as to the timeframe and circumstances in which consent conditions may be reviewed or the FEP amended; and under (viii), the procedures for such amendment.
107. However, under the permitted activity Rule 3.11.5.3, sub-section (7) enables a farmer to amend an FEP but doesn’t give Council an ability to shorten the term of an FEP to less than the life of PC1, or the ability to amend an FEP.
108. As investment certainty for the significant capital sums required to implement an FEP is a key consideration, farmers need assurance that Council will not shift the goal posts during the life of PC1.
109. **Decisions sought:**

- (a) Consider the transaction costs of FEPs and seek through regulatory design to minimize time inputs required by farmers, Certified Farm Environment Planners, independent auditors and Council staff.
- (b) Acknowledge the unaffordability of the proposals for hard hill country farmers and seek solutions that are affordable for all land users. These may include:
  - i. A more targeted approach to water quality standards that recognises both the farm class-specific cost of mitigation and the site-specific value to society of those mitigations.
  - ii. Where such net benefits can be demonstrated, identify where subsidy is required to avoid substantial financial dislocation of individuals, with consequent economic, social and property value impacts.
- (c) Add commentary to 3.11.4.3 regarding Council consulting with farmers and rural professionals in developing menus of BMPs and minimum standards regarding their practicability and cost effectiveness in achieving Objective 3.
- (d) In Rule 3.11.5.4, delete the provisions that give Council discretion to review and amend the term of consent, the consent conditions and the FEP.

## Appendix 1: Healthy Rivers decision making framework

My understanding of the decision-making framework as required by the law regarding Attribute States (levels) for water quality is as follows:

### **Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 (WRSA) and the other river settlement acts**

Section 11: The Vision and Strategy for the Waikato River (V&S) contained in Schedule 2 is deemed part of the Waikato RPS.

Section 12: The V&S prevails over any inconsistent provision in an NPS, an NES, the NZ Coastal Policy Statement, and the regional and district plans in the Waikato. Note that WRSA is silent in regard to the relationship between the V&S and the RMA.

Clause 1(3) in Schedule 2: The V&S lists 13 objectives. The recommendations of the CSG were based on the achievement of a single objective, being (k) *“the restoration of water quality within the Waikato River so that it is safe for people to swim in and take food from over its entire length”*. This objective cannot be read alone and be interpreted as a must-do without considering the other V&S objectives, all of which rank equally. Importantly, the CSG omitted the procedural step of considering all objectives and providing justification for placing prime focus, if not sole focus, on just one objective.

Some objectives compete with objective (k), such as objective (d), *“the restoration and protection of the relationship of the Waikato Region’s communities with the Waikato River, including their economic, social, cultural, and spiritual relationships.”* The economic report demonstrates the large economic cost in meeting objective (k), as well as the implied large social cost of accelerated rural depopulation through the required change in land use.

So how should competing objectives be weighed? It is insufficient to simply select one objective without first carefully considering all other objectives and weighing those considerations in accordance with any legal requirements.

In the first instance, reference must be made to the purpose and guiding principles of the river settlement legislation.

Section 3: The overarching purpose of settlement is *“to restore and protect the health and wellbeing of the Waikato River for future generations”*.

*“restore and protect”* is not defined in WRSA. Nor is it defined in the RMA or Waikato Raupatu Claims Settlement Act 1995. However, the Conservation Act 1987 provides some guidance in that it defines *“protection in relation to a resource”* as meaning *“its maintenance, so far as practicable, in its current state; but includes-*

- (a) its restoration to some former state; and*
- (b) its augmentation, enhancement, or expansion.”*

Clearly, “restore” cannot mandate an impossibility, such as its pristine state. The dictionary meaning of “restore” is to return to some former state.

It may therefore be inferred that “restore and protect” means, so far as practicable, its restoration to some former state or its maintenance in its current state.

The CSG erred by taking a narrow and extreme view of “restore and protect” to mandate Scenario 1 without further consideration.

“practicable” means feasible, capable of being successfully put in practice. It includes the considerations of costs and cost effectiveness (refer for examples to the RMA definition of “best practicable option” and the definition in the Accident Compensation Act 2001 of “practicable”).

The overarching purpose can therefore be interpreted as requiring improvements in water quality to the extent practicable.

#### Section 5: Guiding principles of interpretation

*(1) The vision and strategy is intended by Parliament to be the primary direction-setting document for the Waikato River and activities within its catchment affecting the Waikato River.*

The over-arching purpose of settlement sets a direction that is consistent with the NPS-FM 2014.

Section 12 describes how the V&S trumps inconsistencies with other RMA policy statements and plans, making it the preeminent regulation sitting under the RMA. Section 17 requires Council to have particular regard to the V&S in decision-making that includes decisions on PC1.

Schedule 4 allows for the Waikato River Authority to review and propose amendments to the V&S. In making decisions, clause 7(3) requires that the Authority:

- (a) must seek to identify all reasonably practicable options for the achievement of the overarching purpose of the settlement; and*
- (b) must assess the options by considering –*
  - (i) the benefits and costs of each option in terms of the present and future social, economic, environmental, and cultural wellbeing of the communities associated with the Waikato River, including if practicable a quantification of the benefits and costs of each option; and*
  - (ii) the extent to which the vision and strategy would be promoted or achieved in an integrated and efficient manner by each option; and*
- (c) may recommend that the vision and strategy be amended only if the amendment would be consistent with the overarching purpose of settlement.*

While the river settlement legislation gives little direct guidance as to how the V&S objectives should be weighed, it gives strong guidance that any amendment to the V&S must consider optimal sustainability outcomes in restoring and protecting the River. Clause 7(3), in effect, informs the overarching purpose of the river settlement legislation.



The overarching purpose can therefore be interpreted as requiring improvements in water quality to the extent practicable, taking account of the benefits and costs of all the well-beings of sustainability. The weighing of the 13 V&S objectives should therefore be seen in this light.

This is consistent with the purpose of the RMA.

### **Resource Management Act**

Key sections:

Section 59: The purpose of a regional policy statement is *“to achieve the purpose of the Act ...”*

Section 63 purpose of a regional plan *“... is to assist a regional council to carry out any of its functions in order to achieve the purpose of this Act”*.

Section 67(3)(c) requires a regional plan to *“give effect”* to any regional policy statement. In giving effect to the provisions of a regional policy statement, the decision-maker needs to interpret those provisions in light of the purpose of the Act (RMA ss 59 and 63 as above, Interpretations Act 1999 s5(1)).

Section 5 purpose of the RMA is *“to promote sustainable management of natural and physical resources”*. This section is enabling of social, economic, cultural, health and safety well-beings while controlling the environmental limb by requiring natural and physical resources to be managed for the long term.

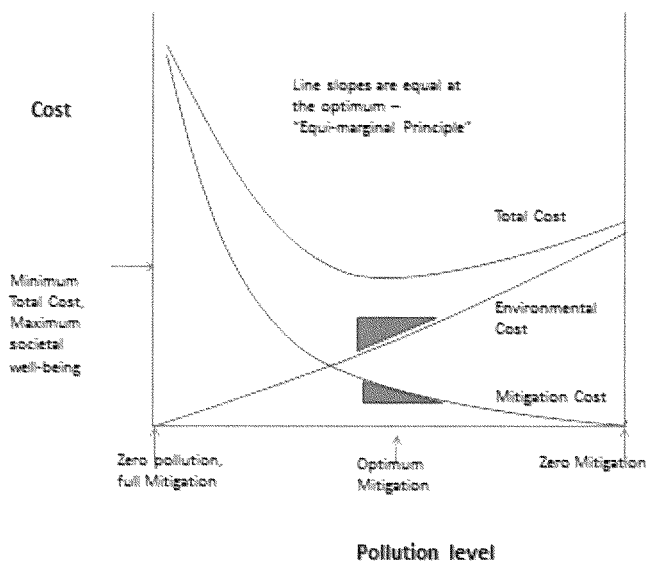
Therefore, the V&S objectives are subject to the weighing of these 5 well-beings of sustainability. In contrast, the CSG apparently focussed only on objective (k) of the V&S, and did not take account of and appreciate the primacy of s5 of the RMA.

## Appendix 2: Weighing RMA section 5 environmental, social, economic, cultural, health and safety well-beings

The RMA does not prescribe how the weighing of the various elements of sustainability in section 5 should be done. In particular, when should adverse effects be avoided, and to what extent should mitigation and remediation be prescribed?

The Environment Court has granted wide discretion to decision-makers. Clearly, the goal of optimising sustainability in order to maximise the well-being of society is worthy of being recognised as the preeminent goal. Natural resource economic theory allows us to ask the right questions in quest of this goal. The answers may be less definitive, because there is seldom sufficient information. However, asking the right questions provides a powerful frame for decision making.

In fixing attribute states, we need to decide the optimal level of contaminants in water. Natural resource economics tell us that is when the marginal costs of pollution control equals the marginal benefits, taking account of all of the well-beings of sustainability. This is another example of the equi-marginal principle that has widespread application in microeconomics. It derives from simple calculus, as shown in the diagram. The point at which the opposing slopes are equal is the point at which the combined relationship has zero slope (horizontal), representing a minimum cost for the combined relationship.



Another way of expressing the equi-marginal principle is ALARP – As Low As is Reasonably Practicable. That is, the level of pollution is tolerable if the cost of any further mitigation exceeds the assessed benefits of that mitigation, taking account of all of the sustainability well-beings. This principle is used in a number of regulatory jurisdictions. Perhaps of most relevance is the Australian National Offshore Petroleum Safety and Environmental Management Authority.

ALARP is a concise expression of how sustainability is optimised. In one sense it is a blindly obvious statement requiring cost-benefit appraisal. However, importantly, it reminds us that marginal costs and benefits (the slopes of the environmental cost and mitigation cost curves) must be considered, rather than total costs (the height of the curves). That also conveniently reduces the information requirements to the slopes of the curves around the optimal point; the whole diagram does not have to be constructed.

The above derivation of ALARP demonstrates that it is a central tenet of sustainability, and as such, has a noble pedigree.

To put the ALARP principle into practice, the key ingredients and process are:

- Use quality information and science.
- Cost-effectiveness. Cost-effectiveness is about finding the least cost way of achieving a chosen level of pollution and says nothing about the optimal level. Importantly, however, cost-effectiveness does remind us to harvest the low hanging fruit first. Appraising cost-effectiveness requires ordering all feasible pollution mitigations starting from the mitigation that achieves the largest pollution abatement per unit of cost. This then gives assurance that for any chosen level of abatement, the least cost methods are adopted. In the diagram, this is shown as the Mitigation Cost curve, starting from the right hand side and proceeding to the left. In reality, the mitigation curve is a number of points joined by straight lines of increasing slope, reflecting the number of available mitigations.
- Apply ALARP by stepping along the mitigation curve from left to right, and for each mitigation ask the key question, that is, whether the cost to further reduce pollution would exceed the value gained until the answer is “yes”, which defines the point of optimal sustainability.
- What matters is that all costs and benefits are considered; both direct and indirect, tangible and intangible. For example, a polluter may receive a co-benefit from reducing pollution (e.g., easier mustering with riparian fencing). On the other hand, reducing pollution may result in reducing other societal well-beings, such as farming to forestry conversions that have negative social impacts. Costs and benefits to the nation should be considered, including flow-on effects beyond the farm gate and transaction costs in implementing policy. Transfer costs and benefits, such as subsidies and taxation are netted-out and therefore must be ignored.
- Intangible costs are inherently difficult to value. Beware of public opinion surveys that seek wishes on the basis that the respondents know they will not bear the costs.
- A better way to measure willingness to pay for reduced contamination is to offer members of the public and corporations seeking environmental credentials the ability to purchase discharge rights through a market. Those rights could then be cancelled, thereby reducing the contaminant load.

- Water quality in and downstream of the hydro lakes is affected by the presence of the lakes. Mighty River Power contributes to some of the water quality issues, but probably has no reasonably practicable options for mitigating its effects. However, that does not absolve them of responsibilities to co-fund offset mitigations, such as wetland and riparian enhancement. Alternatively, MRP's contribution could be used to purchase discharge rights for cancellation, thereby providing a mechanism for reducing discharge loads.