BEFORE COMMISSIONERS APPOINTED
BY THE WAIKATO REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the First Schedule to the Act
AND	
IN THE MATTER	of Waikato Regional Plan Change 1- Waikato and Waipā River Catchments and Variation 1 to Plan Change 1
AND	
IN THE MATTER	of submissions under clause 6 First Schedule
BY	**BEEF + LAMB NEW ZEALAND LIMITED** **Submitter**

BRIEF OF EVDIENCE OF DR MERRIN HAZEL WHATLEY
5 JULY 2019

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BACKGROUND

1. My name is Dr Merrin Whatley.

2. I am an independent contracting consultant engaged as a Sub-catchment Coordinator in the Waikato for the Mid Northern North Island Farmer Council (MNNFC) of Beef + Lamb NZ.

3. I have the following qualifications and experience:

   (a) I have a PhD in Aquatic Ecology from the University of Amsterdam, The Netherlands (2014), a Master of Science specialising in Ecology from Vrije University, The Netherlands (2009), and a Bachelor of Science majoring in Resource and Environmental Planning from the University of Waikato (2002).

   (b) I have been a member of the Freshwater Sciences Society of New Zealand since 2017.

   (c) I am a farmer, co-managing a small family owned and operated holding in the Auckland Region with an on-going focus on community involvement, education and development of an integrated farming system, applying ecological concepts to resolve management issues and improve diversity and productivity.

   (d) I have 15 years' experience working in the fields of Ecology and Rural Land Management, including two years with the Department of Conservation (DOC), seven years in academia and education in the Netherlands and three years with Auckland Council initially in the role of a Land Management Advisor and then as a Senior Freshwater Specialist.

   (e) In 2017 I established myself as an independent environmental consultant with a focus on freshwater ecology and sustainable rural land management services.

   (f) Since June 2018 (until present) I have been contracted by Beef + Lamb NZ (B+LNZ) as a sub-catchment coordinator, working predominantly in the Whangape and the Upper Pūniu sub-catchments.

(g) In preparing this evidence I have reviewed relevant reports and earlier expert evidence, including:

(i) Mr Richard Parkes;

(ii) Dr Jane Chrystal;

(iii) Mr Gerardus Kessels;

(iv) Ms Corina Jordan;

(v) Mr Simon Stokes;

(vi) The report prepared by Neels Botha Ltd for WRC (May, 2019);

(vii) The report prepared by Ruth Hungerford for WRC and B+LNZ (April, 2019);

(viii) The section 32A report, and

(ix) Plan Change 1 and Variation 1.

4. I have read the Code of Conduct for Expert Witnesses in the Environment Court's 2014 Practice Note and agree to comply with it. I confirm that the opinions I have expressed represent my true and complete professional opinions. The matters addressed by my evidence are within my field of professional expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

5. I have been asked by B+LNZ to prepare evidence on the sub catchment Approach giving specific regard to the potential of community led catchment groups to develop effective catchment management plans and implement cost effective mitigations. This includes:

(a) An Introduction to the B+LNZ sub catchment approach

(b) Potential benefits of community led sub catchment planning

(c) Challenges associated with sub catchment planning

(d) Sub catchment planning in proposed Plan Change 1 (PC1)

(e) Opportunities for policy to support and enable community led sub catchment restoration outcomes.

(f) Considerations for a sub catchment planning framework.

EXECUTIVE SUMMARY

6. Thirty seven sub catchment initiatives have emerged around New Zealand and the Waikato region and that number is growing. The growth of farmer led catchment initiatives correlates with development and implementation of policy aimed at improving water quality around the country and demonstrates a desire by farmers to share resources, collaborate and identify practical solutions to work towards addressing the complex issues associated with a reported decline in water quality and catchment health.

7. The benefits of sub catchment approaches can be wide ranging and multifaceted. In general, if the approaches are developed to be truly collaborative participants are more likely to have improved access to the four capitals; human, natural, financial/physical and social. Collaborative sub catchment approaches, strengthening social ties and networks, encourage the development and uptake of new technologies, enable both farmers and other stakeholders to reach their goals, and are associated with the emergence of new opportunities, including the opportunity for conflict resolution. Support of farmers involved in sub catchment groups should be enabled through capacity building.

8. By their very nature collaborative sub catchment planning processes are complex. A number of potential challenges have been identified both in literature and by the participants of sub catchment groups. These include demands on time, uncertainty of the rules, overly bureaucratic processes, associated costs of work and time investment, and cultural clashes. Underpinning many of these issues is the trust between different stakeholders participating in sub catchment planning. Designing a process which enables equal contribution, equality of different value

systems, and supports shared knowledge building, therefore helps to resolve trust issues.

9. The policy framework of PC1 encourages adoption and implementation of a tailored, risk-based approach to define mitigation options (Policy 2a); a sub-catchment approach to prioritize and implement mitigation and management measures (Policy 8a, Policy 9a,b, c, and d); and application of best practicable options and mitigation or offsets for point source discharges (Policy 11 and Schedule 1). However, despite the aspirations of this policy, the regulatory framework of PC1 is such that it is unlikely to fully achieve its desired policy direction.

10. I support the inclusion of tailored, integrated sub catchment management within the objectives of PC1. Rigid policy and compliance structures do not provide the necessary mechanisms to enable sustainable and effective management of diverse farming systems and catchments. Policy designed on a basis of 'one size fits all', as currently proposed in PC1, hampers the ability of farmers, iwi and councils to achieve water quality outcomes and wider objectives relating to ecosystem health and social and cultural wellbeing. In my opinion the PC1 rules should seek to facilitate adaptive management principles nested within a sub catchment planning process to facilitate the effective management of complex farm systems and catchments. Tailored sub catchment plans based on and incorporating information and knowledge provided by farmers, iwi, councils, and technical experts are more likely to achieve water quality outcomes and improve the overall resilience and health of communities and ecosystems alike.

11. Researchers and collaborators involved in catchment management groups have sighted a number of factors influential to improving the success of collaborative ventures, including; local engagement, avoiding pressure as far as is reasonably practical, trust and good relationships, respect and recognition, adopting a holistic integrated approach, credible commitment, strong effective leadership, and monitoring.

12. Community leadership and support from an independent co-ordinator has been identified as key to encouraging farmer engagement in sub-catchment planning process in the Waikato River catchment.

13. The complexity and interconnectedness associated with environmental collaborative frameworks benefits from a process of on going evaluation and adaptive management. The development of integrated sub catchment management plans requires involvement and input from all parties potentially impacted by the implementation of the sub catchment plan. At a minimum this would require representation by farmer groups, iwi and/or local hapū, councils, and the relevant primary sector representatives.

14. I support establishing simple networks of monitoring sites within sub catchments. Information gathered across sub catchments supports a process of continuous learning and provides the opportunity for farmers, schools, iwi, councils, researchers and rural professionals to share knowledge and resources. Enabling the sub catchment community to understand the drivers of health, well being and prosperity in their sub-catchment, promotes the development and uptake of new technologies and increases the chance of achieving goals that go beyond improvements in water quality alone.

INTRODUCING THE BEEF + LAMB NZ SUB CATCHMENT APPROACH

15. A stock take of farmer led catchment and environment leadership initiatives undertaken by Beef + Lamb NZ (Richard Parkes, pers comms., 2018) collates 37 different initiatives currently operating across New Zealand. The initiatives represent groups operating at different scales from smaller groups representing distinct sub catchment hubs (like the Upper Maire Landcare Society Inc.) to larger umbrella organisations with representatives from a number of sub catchments and organisations such as mana whenua, regional and district councils, local marae and hapū, and industry and farming groups, such as the Integrated Kaipara Harbour Management Group.

16. Throughout my evidence use of the term sub catchment is synonymous with the [proposed] revised PC1 definition (see paragraph 46, page 16 of this report). I use the term sub catchment hub to describe the smaller groups or collectives which have shared values which are generally associated with either place (geographical) or interest (sheep and beef farmers).

17. The growth of farmer led catchment initiatives correlates with development and implementation of policy aimed at improving water quality around the country. It demonstrates a desire by farmers to share resources, collaborate and identify practical solutions to addressing the complex issues associated with declines in water quality and catchment health.

King Country River Care

18. King Country River Care (KCRC) was developed by a group of farmers concerned about the potential implications of Plan Change 1 and the potential for similar regulation to be rolled out in their region. KCRC is an umbrella organisation covering a geographical area encompassing seven individual sub catchment groups. The sub catchment groups are based on social connections and to a certain extent geography. The KCRC formed an incorporated society in October 2018 and shortly after employed a sub catchment coordinator. The main goal of the coordinator is to facilitate development of a strategy for the group and set about defining an implementation plan.

19. To date fifty farmers have paid voluntary membership, to seed fund the coordination role and establish the society. *"Early on we created a google form to number farms and to document information about completion of Farm / Land Environment Plans (FEPs), and previous access to funding on farm water reticulation etc"* (Anna Nelson, pers comms. 2019). Work has commenced on a 10 year strategic plan and a two year action plan. Strategic aims for KCRC include: 1) community resilience, 2) on farm excellence, and 3) a collective voice. Completing funding applications to allow the group to implement and extend their initiatives is also identified as important factors for the group. There is significant appetite to build momentum in the group with a focus on building community resilience (Anna Nelson, pers comms. 2019).

Whangape and Upper Pūniu Sub catchment groups

20. **The Whangape sub-catchment**: Situated in the lower Waikato freshwater management unit (FMU) the Whangape sub catchment was classified as a priority 1 catchment under Healthy Rivers Plan Change 1. The following is summarized from Singleton (2016)[1]; "*The prioritisation of the Whangape sub catchment is related to its position in the lowest 10% of all catchments for water clarity and moderately high E. coli concentrations. The catchment is about 35,000 ha and mainly consists of steep hill country in the upper catchment and moderately steep and strongly rolling hills in the middle catchment. Land cover is predominantly pasture managed under sheep and beef with dairy grazing on the rolling land, with small areas of native bush and some forestry. There are 272 properties of which there are about 194 farms"*.

21. Lake Whangape is situated at the bottom of the sub catchment (i.e. is the receiving environment for the catchment) and at ~1,450 ha it is the second largest lake in the lower Waikato FMU. Over the last 30 years the lake has become hypertophic and is impacted by introduced pest fish (koi carp, gambusia, rudd and goldfish), and the highly invasive aquatic plant alligator weed (*Alternanthera philoxeroides*).

22. **The Upper Pūniu:** Situated in the Waipa FMU the Upper Pūniu is classified as a Priority 3 area in Plan Change 1. The Pūniu River is the main tributary of the sub catchment at 57 km long. The headwaters of the River start in the Pureora Forest park and flow north towards Seafund Road, Wharepapa South. The catchment supports a mixture of low to high intensity sheep and beef farming and dairying, and contains significant areas of native bush and some production forestry. The Waikato Regional Council deems the river unswimmable with unsatisfactory concentrations of E. coli and poor water clarity.

23. Pūniu River Care Incorporated are an active river care group based on giving back to the marae within the river's catchment. The group manage a nursery, propagating native plants and planting areas of the catchment to systematically restore it. The decline in the health and water quality of

[1] Singleton, P. (2016). The Whangape Sub Catchment report, prepared for Waikato Regional Council.

the Pūniu River as described by Pūniu River Care Incorporated on their website, *"Pūniu River was once a rich source of freshwater kai and provided many picnic and swimming spots for the local people. Currently the river is not classified as being of a swimmable standard, the tuna stocks have been depleted in some areas, the banks of the rivers are eroding and over 10,000 tonnes of sediment discharges into the Waipā River from the Pūniu River every year."*[2]

24. Development of the sub catchments groups in the Whangape and Upper Pūniu sub catchments has been supported by a pilot extension program developed by Beef + Lamb NZ, Farmers for Positive Change and the Mid Northern North Island Farmers Council (MNNIFC). The Farmer council seed funded contracting an independent coordinater to enable and facilitate formation of sub catchment hubs within the two sub catchments.

25. The B+LNZ sub catchment approach is guided by an eight stage process:

    1. identifying sub catchments and community leaders[3];
    2. setting up freshwater ecological health monitoring[4];
    3. developing a community plan[5];
    4. completing an environmental plan[6];
    5. developing a community sub catchment story[7];

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[2] https://puniuinc.org/whakamarama-about

[3] The first stage of the process is to identify the sub catchment and stakeholders in the catchment that are to implement this approach. This includes every enterprise in the area including all farm types and industrial holdings which are contributing to the area.

[4] Identify key water quality monitoring sites which will show how the catchment is doing compared to their set ecosystem health limits. Also implement any other measures which need to be implemented that have been set by the community values i.e. macroinvertebrate index if required.

[5] The purpose of bringing everyone together is to get engagement in improving water quality in the identified sub-catchment and by doing this it will empower individual landowners through a community approach.

[6] The intention is to take stakeholders through the four contaminants and develop a complete plan for their property at the end of the workshop, with an emphasis on Land Use Capability in the region and the capability of the natural resources are in the catchment.

[7] The meeting will cover the following; history of the region from how the community has been created to the current point in time. Including Māori history, the values and goals the community are engaged with i.e. when the community want to be able to swim in

6. completing Overseer modelling[8],

7. show and tell[9], and

8. reassessing the community plan[10]

26. The B+LNZ sub catchment approach has been designed to support the community to set interim targets, timeframes, and work together to form a workable and practical approach which can be implemented by all stake holders by applying good management practices.

27. In the Whangape catchment, B+LNZ and Waikato Regional Council (WRC) have supported community catchment initiatives since at least 2016, including extension work and have delivered several Farm Environment Planning (FEP) and risk and mitigation workshops around the Whangape sub catchment. Farmer groups had commenced formation to assist one another with writing submissions. This led to farmers becoming more involved, building understanding, and "being empowered to address the issues" (Hungerford, 2019)[11] (supplied as Appendix 1 of this evidence).

28. In the last year since the sub catchment coordinator role was filled, covering the period from June 2018 to June 2019, progressive steps have been made to support emergence of sub catchment hubs in the Upper Pūniu and Whangape. They include:

(a) Contact has been made with 7 farmer groups across the two sub catchments (Stage 1);

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waterways; set eco system health limits based around the values and the four containments; identified mechanisms to extend the story out to the wider community i.e. school newsletter & social media; create a map to identify key areas of significance for community in the catchment i.e. fishing and swimming areas.

[8] This workshop will cover; drivers of Overseer, the completion of individual nutrient budgets, learnings of how to decrease nutrient loss, process of working towards an approved N reference point.

[9] This meeting will cover; progress that has been made towards ecosystem health limits, water quality progress, visual aids of what has been done.

[10] The key objectives are; reassess funding opportunities, re-establish how the community would like to progress, reassess eco system health limits, reassess monitoring of data towards eco health systems limits set.

[11] Hungerford, R. (2019). Evaluation report on sub catchment planning. Report prepared for Waikato Regional Council by momentum research and evaluation ltd.

(b) Key farmer leaders in the sub catchment hubs have been identified or are in the process of being identified (Stage 1);

(c) Contact has been made and continued with a number of other stakeholders include staff and representatives of the Waikato Regional Council, Waikato River Authority, local hapū and/or marae clusters, and the Department of Conservation in each sub-catchment;

(d) A contact database of farmers who are engaging with the sub catchment approach has been developed for both sub catchments and is continuing to be added to (Stage 1);

(e) Waikato Regional Council has agreed to fund water quality and aquatic invertebrate monitoring for four separate sampling events covering 11 sample locations in each of the sub catchments (Stage 2);

(f) The 11 monitoring sites were identified by each sub catchment community and the coordinator and monitoring has commenced in both sub catchments (Stage 2);

(g) At the request of the sub catchment groups the sub catchment coordinator has organised and/or facilitated about 14 different events including six initial sub catchment meetings, two risks and mitigations workshops, two Farm Environment Planning workshops, and four stream health and monitoring workshops (Stage 3);

(h) Smaller group meetings have been held and support has been provided to assist sub catchment hubs and their participants to identify funding opportunities with a successful application to the Waikato River Authority received for one sub catchment hub from the Whangape (Stage 3);

(i) A number of farmers have completed their FEPs or are in the process of completing them (Stage 4);

(j) A survey has been circulated to sub catchment participates to understand community members values, engagement and concern about their waterways and catchment (e.g. erosion, source of kai, recreation potential, swimmability and presence of invasive species)[12].

POTENTIAL BENEFITS OF COMMUNITY LED SUB CATCHMENT PLANNING

29. Sub catchment planning that is led by the community, includes representatives from different parts of that community and is developed in conjunction with iwi groups, regional council staff and researchers, provides the basis for an integrated and collaborative process. The potential benefits of collaborative processes can be wide ranging and have long lasting impacts. The following section summarises a literature review on the key benefits of farmer led collaborative sub catchment policy in the Waikato catchment prepared for the Waikato Regional Council by Botha (2019)[13] (supplied as Appendix 2 of this evidence).

30. In both New Zealand and overseas collaboration has been reported to improve social capital through strengthening social ties and networks and facilitating mutual learning between famers and the wider community.

31. Collaboration also encourages the development and uptake of new technologies (e.g. nutrient budgets, deferred grazing, Land Use Capability, Farm Environment Planning, Farm Ecosystem Processes), which enables both farmers and other stakeholders to reach their goals.

32. New opportunities also emerge and can be taken advantage of (e.g. sharing data, rapid dissemination of information and community engagement events). Collaboration between farmers and councils provides the opportunity for farmers to take the lead and take ownership of protecting the environment to achieve greater outcomes than could

[12] See also, Hungerford, R. (2019). Evaluation report on sub catchment planning. Report prepared for Waikato Regional Council by momentum research and evaluation ltd.
[13] Botha, N. (2019) The benefits and challenges of farmer-led, collaborative, sub-catchment policy methods and plans for consideration in the Waikato Catchment: A literature review. Report prepared for Waikato Regional Council by Botha Ltd.

have otherwise been achieved (e.g. the Waitangi River catchment project and the Aorere Catchment project).

33. Collaboration also provides the opportunity to resolve conflict and achieve constructive outcomes (e.g. legal action was avoided between the mussel industry and farmers in the Aorere Catchment Project). It gives farmers a united voice which can provide greater access to information and knowledge and foster the development of alternative and effective solutions.

34. Similarly, Hungerford (2019)[14] reported the advantages of participating in sub catchment groups to include:

    (a) Having a sense of community;

    (b) Feeling empowered through learning;

    (c) Access to support and information;

    (d) Stories to showcase the good work of farmers;

    (e) Access to funding;

    (f) Learning more about and being prepared for PC1, and;

    (g) Improving farmer input into decisions.

35. The Whatawhata Integrated Catchment Management Project (ICM) demonstrates the potential co benefits (in this case environmental and economic) which can arise from collaborative models. Commencing in 1996, the Whatawhata ICM project involved multiple stakeholders, include Māori, landowners, farm staff, local government, a group representing farmers and researchers from different disciplines. The group set the vision of a "well managed rural hill country catchment" (Quinn et al., 2007[15]).

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[14] Hungerford, R. (2019). Evaluation report on sub catchment planning. Report prepared for Waikato Regional Council by momentum research and evaluation ltd.

[15] Quinn, J.M., Dodd, M.B., Thorrold, B.S. (2007). Whatawhata catchment management project: the story so far. Proceedings of the New Zealand Grassland Association 69: 229-233.

36. The ICM plan developed by this diverse collaborative group involved identifying the main issues in the catchment (i.e. erosion, stream degradation and a poorly performing beef and sheep breeding enterprise), the catchment was Land Use Capability (LUC) mapped, and potential and practical mitigations to address the issues were identified (i.e. indigenous forest restoration, strategically located plantation pine forest, intensification of the farming enterprises on the more versatile LUC classes, changes in stock type, poplar planting for soil stabilisation and excluding livestock from streams), prioritised and implemented.

37. Significant improvements where reported for the Whatawhata project between 1995 to 2003, including the economic surplus of the pastoral enterprise, in relation to industry average, improving by 43%, decreases in the export of suspended sediment (- 76%), total phosphorus (- 62%), and total nitrogen (- 33%). In streams water clarity was improved, aquatic invertebrate community indices improved and stream temperatures declined (Quinn et al., 2007).

38. In general, participants of collaborative processes are more likely to have improved access to the four capitals; human, natural, financial/physical and social[16].

39. Capacity building is important as it allows farmers to fulfil their own goals, increases the likelihood of success of the collaborative venture and increases the likelihood of achieving wider regional goals.

CHALLENGES & CONSIDERATIONS FOR SUB CATCHMENT PLANNING

40. Naturally there are challenges associated with collaborative sub catchment approaches. These must be acknowledged in order to address each issue appropriately.

41. By their very nature collaborative sub catchment planning processes can be complex as they bring together people from different backgrounds, cultures and with different value systems. This is both a key strength and potential challenge associated with collaborative sub catchment planning.

[16] Botha, N. (2019) The benefits and challenges of farmer-led, collaborative, sub-catchment policy methods and plans for consideration in the Waikato Catchment: A literature review. Report prepared for Waikato Regional Council by Botha Ltd.

With respect to farmers, some of the recognised potential barriers to participation include:

(a) Multiple demands on time;

(b) Uncertainty about rules;

(c) Maintaining motivation;

(d) Overly bureaucratic processes (too much red tape);

(e) Costs and access to funding;

(f) Drawn out timeframes;

(g) Cultural clashes;

(h) Role confusion;

(i) Agenda setting and decision making;

42. Underpinning many of these issues is the level of trust each hub (nested within a larger sub-catchment group) has in both their own representation and the other representatives of different hubs or sub-groups within a given sub catchment. Designing a process which enables equal contribution, equality of different value systems, and supports shared knowledge building, therefore helps to resolve trust issues.

SUB CATCHMENT PLANNING IN THE PROPOSED PC1

43. The Vision and Strategy for the Waikato River recognises all elements of the health and wellbeing of the River and its communities and the relationships people have with water, including their social and economic wellbeing[17].

44. In line with evidence presented by Ms Jordan[18]; "*it is my understanding that B+LNZ is in support of giving effect to the Vision and Strategy through PC1, by establishing actions to manage water quality, and identification*

[17] Waikato River Authority (2011). Vision and strategy for the Waikato River. Restoring and protecting the health and wellbeing of the Waikato River.
[18] Brief of Evidence of Ms Jordan (February 2019), paragraphs 34 and 35, page 12.

of environmental risk linked to appropriate actions to avoid, remedy, or mitigate this risk. B+LNZ, however, is concerned with the lack of linkages, between the values, freshwater objectives, and the numerical reflection of these through Table 3-11.1". I share these concerns.

45. As highlighted in the evidence of Mr Kessels[19]; *"The policy framework of PC1 encourages adoption and implementation of a tailored, risk-based approach to define mitigation options (Policy 2a); a sub-catchment approach to prioritise and implement mitigation and management measures (Policy 8a, Policy 9a,b, c, and d); and application of best practicable options and mitigation or offsets for point source discharges (Policy 11 and Schedule 1). However, despite the aspirations of this policy, the regulatory framework of PC1 is such that it is unlikely to fully achieve its desired policy direction in this regard".* I share these concerns, and support the position articulated by Dr Kessels.

46. I agree with the revised definition of a sub catchment for the purpose of Chapter 3.11 detailed in the Section 42A report[20], however, in its proposed form PC1 adopts a 'command and control' approach which does not incentivise best practice in relation to enabling widespread collaborative management at the sub catchment level. In his evidence Mr Kessels[21] reasoned that sub catchment scale, community based approaches to restoration, mitigation and monitoring lends itself to more effective, collaborative solutions, than top down, 'command and control' approaches. A position which, as set out in my evidence, I also share. Moreover, the WRC has not undertaken sufficient analysis to account for the full range of mitigations and benefits that could be achieved through a sub catchment planning approach.

OPPORTUNITIES FOR THE POLICY TO SUPPORT AND ENABLE COMMUNITY LED SUB CATCHMENT RESTORATION OUTCOMES.

47. I support the recommendation that tailored, integrated sub catchment management be included within the objectives of PC1, as proposed in the evidence of Ms Jordan[22], and as presented in her HS3 evidence. Tailored

[19] Evidence in Chief of Mr Kessels (February 2019), paragraph 18, page 6.
[20] Section 42A Report (Block 3, 2019), paragraph 177, page 32.
[21] Evidence in Chief of Mr Kessels (February 2019), paragraphs 19 and 20, page 6.
[22] Brief of Evidence of Ms Jordan (February 2019), paragraph 126, page 39.

integrated sub catchment management provides an efficient and effective method to sustainably manage land and water resources in a way which provides for the economic, social, and cultural wellbeing of communities, and as such should be enabled and empowered through PC1[23].

48. As presented in the earlier evidence of Ms Jordan[24] and Dr Muller[25] the concept of waterway health is not synonymous with the limited suite of water quality parameters encompassed in PC1. The principal drivers recognised as having adverse effects on water quality and waterway health are wide ranging and include elevated nutrient levels, habitat degradation from loss of riparian habitats, altered and reduced flows, suspended and deposited sediment, pest species and changes to the hydrological nature of the river systems resulting from dams and wetland drainage. All the above drivers will need to be suitably address at the appropriate scale to achieve the objectives set out in the Vision and Strategy for the Waikato River and PC1.

49. Recognition that provision for the restoration and protection of the Waikato River is broader than just water quality, and encompasses ecosystem processes and the health and wellbeing of communities, is reflected within the strategies of the Vision and Strategy, in particular those that recognise and provide for integrated and holistic management of the health of the Waikato river. These strategies include strategies 9 which encourages a "*whole of river' approach to the restoration and protection of the Waikato River*", and 8 and 10 which recognise the importance of community understanding, ownership, and participation in working together to restore and protect the health of the Waikato River.

50. I agree with the expert evidence presented by Dr Mueller[26] where she highlights other indices of importance to waterway health, which may include:

[23] Brief of Evidence of Mr Parkes (February 2019), paragraphs 103 – 105, page 26.
[24] Brief of Evidence Ms Jordan (February 2019), paragraphs 23 and 89, pages 9 and 27, respectively.
[25] Evidence in Chief Dr Mueller (February 2019), paragraphs 18, 37 – 39, pages 6 and 19.
[26] Evidence in Chief Dr Mueller (February 2019), paragraph 35 - 48, Table 1, pages 18 – 22.

(a) River geomorphology and processes;

(b) Connectedness;

(c) Ecological corridors, and riparian margins;

(d) Additional water quality parameters (DO, temperature, conductivity, deposited sediment);

(e) Instream nitrogen concentrations ranging from <0.11 mg/L (A band<), >0.58 mg/L (B band) and <1.66 mg/l (C band) for nitrate;

(f) Biodiversity indicators such as the Macroinvertebrate Community Index (MCI) and measurements of biota (e.g. fish, birds); and

(g) Mātauranga Māori indicators such as the cultural health index (CHI).

51. I agree in principle with the statement in the Section 42A[27] report that many PC1 mitigations are best applied on individual properties and other mitigations (e.g. sediment traps, created wetlands and stream naturalisation) may be more effective if applied to a larger scale within a specific sub catchment. Further to this statement, I reason that achieving the Vision of Strategy for the Waikato River *"A future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and wellbeing of the Waikato River, and all it embraces, for generations to come"*[28] necessitates a coordinated and integrated approach, which looks beyond the impacts and mitigations related to individual contaminates allocated at the scale of individual properties.

52. Ecosystems experience temporal variations and farming is inextricably influenced by the same variations, relating to season, rainfall patterns and climate change. Flexibility is required to allow for adaptation of management systems and achieve water quality and environmental outcomes. Mr Parkes highlighted the importance of diversity and

[27] Section 42A report (Block 3, 2019), paragraph 162, page 30.
[28] Waikato River Authority (2011). Vision and strategy for the Waikato River. Page 4.

adaptability to promote productivity and resilience of the sheep and beef industry[29].

53. Based on the body of evidence summarised here, restrictive policies based on a concept of 'one size fits all', as proposed in PC1 are unlikely to achieve improvements in water quality or the health and wellbeing of the Waikato River and its tributaries. In particular, policy seeking to support environmental, cultural and social outcomes should look to complement the inherent temporal and spatial diversity of rural communities and farming enterprises. Such measures will naturally facilitate expansion of ideas and technologies across sub catchment landscapes and hubs which encompass a diversity of geology, soil types, rainfall patterns, vegetation, stocking density and farm business structures.

54. I agree with the evidence of Mr Beetham[30] where he states, "*Sheep and beef farm systems are complex and diverse. There is huge variation in topography, soil type, climate, stocking rates and livestock policies. No two sub catchments are the same and often no two farms are the same.*" The diversity of sheep and beef operations reflect the ecological diversity of the wider landscapes they are a part of.

55. I agree with the evidence presented by Mr Parkes that effective reduction of contaminant losses from sheep and beef farms is best achieved by identifying key contaminate pathways (Critical Source Areas (CSA)) and appropriate mitigations which are implemented through Farm Environment Plans focusing on maximum efficiencies[31,32]. Applying technologies, including Land Use Capability, decision support tools like MitAgator® and LUCIAg® can help ensure on-going provision of ecosystem services.

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[29] Brief of Evidence of Mr Parkes (May 2019), paragraphs 9 and 12, pages 2 – 3.
[30] Brief of Evidence of Mr Beetham (February 2019), paragraph 14, page 6.
[31] Maximum efficiency from mitigations in the long-term are supported when they are; a) chosen on the basis of suitability to the farm; b) implemented on the basis of cost-effectiveness; and c) implemented in critical source areas, as reported by Dodd et al., (2016).
[32] Dodd, M.B., McDowell, R.W., Quinn, J.M. 2016. A review of contaminant losses to water from pastoral hill lands and mitigation options. *Hill Country – Grassland Research and Practice Series* 16, 137-148.

56. Ecosystem services[33] are termed as such because they provide services which benefit human society. As described by Mr Parkes[34] in his evidence; *"this includes both non-market and market services associated with the natural environment"* (Dominati et al., 2010[35]). The variable and universal nature of ecosystem services implies that (in theory) all industries, business, communities and individuals have equal access and benefit from these services. Moreover, these different fractions of society require certain ecosystem services and if these are no longer supported by natural systems this may necessitate establishment of costly infrastructure and processes to fulfil the need (i.e. access to clean water, flood mitigation, drought tolerance, plant and animal productivity).

57. Blanket rules and rigid policy and compliance structures do not provide the mechanisms to enable the sustainable and effective management of diverse farming systems and landscapes to achieve either water quality outcomes or wider objectives of ecosystem health, and social and cultural wellbeing. If the PC1 rules do not facilitate adaptive management principles it creates potential for decline in the health of our more diverse farming ecosystems and the wider services they provide (e.g. biodiversity, productivity, flood mitigation, surface water filtration and carbon sequestration and climate resilience).

58. I agree with the evidence presented by Mr Parkes[36] and Mr Kessels[37] that sub catchment approaches can enable communities to find practical and effective solutions to achieve freshwater and wider environmental objectives. Among other benefits community led sub catchment initiatives have been reported to improve community connection and provide a platform for communication and engagement between farmers, iwi and hapū and councils[38]. Greater interaction by different groups contributes towards sharing of ideas, technologies and understanding, innovation,

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[33] Ecosystem services are defined as *"the benefits people obtain from ecosystems"*.
[34] Brief of Evidence of Mr Parks (February 2019), paragraph 66, page 18.
[35] Dominati E., Patterson M., Mackay A. (2010) A framework for classifying and quantifying the natural capital and ecosystem services of soils. Ecological Economics 69:1858-1868.
[36] Brief of Evidence of Mr Parkes (February 2019), paragraph 87, page 23.
[37] Evidence in Chief of Mr Kessels (February 2019), paragraph 50, page 17.
[38] Botha, N. (2019) The benefits and challenges of farmer-led, collaborative, sub-catchment policy methods and plans for consideration in the Waikato Catchment: A literature review. Report prepared for Waikato Regional Council by Botha Ltd.

knocking-down social barriers and trust building. If they are well structured and supported, sub catchment groups (aka community catchment groups) can increase social diversity and networks, enabling innovation and achievement of the goals of multiple stakeholders.

A POTENTIAL SUB CATCHMENT PLANNING FRAMEWORK

59. Researchers and collaborators involved in catchment management groups have sighted a number of factors influential to improving the success of collaborative ventures. In the context of the Waikato Catchment Botha (2019) summarised the key factors as:

- Local engagement,
- Avoiding pressure as far as is reasonably practical,
- Trust and good relationships,
- Respect and recognition,
- Adopting a holistic, integrated approach,
- Credible commitment,
- Strong, effective leadership, and
- Monitoring

60. Further, the author makes comparison between the findings of their review and Ostrom's rules for governing common pool resources (1990)[39].

61. Equally, Hungerford (2019)[40] reported that participants from three different sub catchment initiatives in the Waikato River catchment highlighted the importance of community leadership and support from an independent co-ordinator as key to their engagement and continued involvement in the process.

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[39] Botha, N. (2019) The benefits and challenges of farmer-led, collaborative, sub-catchment policy methods and plans for consideration in the Waikato Catchment: A literature review. Report prepared for Waikato Regional Council by Botha Ltd. Pages 58 – 61.

[40] Hungerford, R. (2019). Evaluation report on sub catchment planning. Report prepared for Waikato Regional Council by momentum research and evaluation ltd.

62. Based on the principles and factors identified and compiled by Botha and Hungerford (provided as Appendix 1 and 2 of this evidence) key aspects pertaining to the success of a sub catchment framework are summarised in paragraphs 63 – 74, below.

63. **Build on existing community networks and social bonds:** The sub catchment approach should maintain local ownership and build on and support existing community networks whilst looking to broaden these networks to foster a supporting and inclusive culture.

64. **Equality of roles:** While there will be differing structural aspects of the various agencies involved the value and importance of the representatives from each group tasked with developing a sub catchment plan should hold equal weighting. This is necessary to ensure all parties can contribute equally to development of technologies to address issues and enable continued by in from all members.

65. **Axillary support for groups:** Each sub catchment group will be different, as an example some of the support required by groups may include independent coordination, help with accessing funding for projects, facilitation, specialist expert advice and admin and accounting advice and support.

66. **Conflict resolution:** A clear process for conflict resolution should be identified from the outset.

67. **Defining the vision and goals for the sub catchment group:** These must be set by the sub catchment group members and encapsulate the goals of the different groups representative of the sub catchment community.

68. **Project planning and time bound actions:** Engagement processes can be lengthy and momentum can take time to build. It is important to set some timeframes and goals to work towards, so that progress can be made and ensure engagement does not wane. Concomitantly, it is necessary to engineer a degree of flexibility in the process to allow for adaptive management as new information and technologies come to light.

69. **Develop plans on a knowledge and information basis:** This should support a holistic approach which recognises social, practical and traditional sources of knowledge and matauranga Māori alongside scientific and research driven information.

70. **Importance of quick wins:** Quick wins help to maintain enthusiasm and can provide a platform to test new technologies. Achieving quick wins helps demonstrate progress and fosters confidence and motivation in what can be a long process.

71. **Monitoring of progress and outcomes:** Identifying relevant and practical methods for tracking the performance and progress of a sub catchment plan in relation to the identified goals set by the wider sub catchment group is necessary to maintain motivation and enable a process of continuous learning.

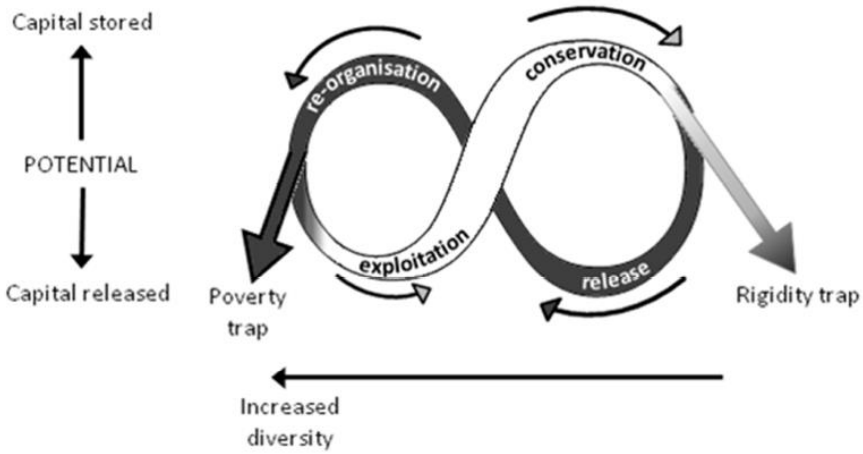
72. **Graduated sanctions:** To deter participants from repeated or excessive violations an appropriate process for recording violations and escalating the response must be defined. An example of this may be a process whereby the first response is farmer to farmer correspondence which if it does not yield the desired outcome can then be gradually escalated. This process needs to be developed with input from all group representatives and agreed to by all, and established from the outset.

73. **Nested enterprises:** Many scholars, particularly those focusing on pastoral and irrigation systems, have stressed the importance of nesting smaller common property systems within larger ones.

74. **Mandating participation in the process:** The involvement of all impacted stakeholders needs to be mandated, however, the involvement of farmer, community and iwi representatives need to be well supported in consideration of the time commitment, travel and other trade offs these representatives must make to be involved in the process. To ensure equal representation is maintained across all groups involved in a sub catchment approach that involvement must not put any one individual at a disadvantage, nor should it result in an disproportionate advantage, and any potential conflicts of interest should be identified from the outset.

75. The complexity and interconnectedness associated with environmental collaborative frameworks benefits from a process of on going evaluation and adaptive management as proposed by Murray and Hasselman (2013)[41] and summarised in Figure 1 below.

Figure 1. Illustrates the adaptive cycle and *"the phases that make up the recurring resilience adaptive cycle; release, reorganisation, exploitation, and conservation. The cycle represents a heuristic model where the system response and learns from the responses, leading to learning and improvement."*



76. Certainty applied within an adaptive management framework will be crucial to encouraging involvement and improving the wider by in of a sub catchment approach. Equally, defined and agreed roles and responsibilities for representatives of different groups, involved in the sub-catchment planning processes, will improve certainty and consistency in the process. Moreover, equal spheres of influence shared by all sub catchment representatives facilitates open communication and encourage goal setting and commitment.

77. In practice the development of integrated sub catchment management plans requires involvement and input from all parties potentially impacted by the implementation of the sub catchment plan. At a minimum this

[41] Murray, A. and Hasselman, L. (2013). A solution to rigid government NRM planning requirements through adaptive management. Extension Farming Systems Journal. 9 (1), 290 – 296.

would require representation by farmer groups, iwi and/or local hapū, councils and the relevant primary sector representatives.

78. An excellent example of a successful collaborative sub catchment planning approach is the Parore Project in the Te mania catchment, western BOP, as detained in the submission of Mr Burke[42]. The Parore Project involved farmer leaders, iwi, industry groups and councils early in the process and laid out a clear framework for engagement and knowledge sharing. The success of Parore Project is supported by the BOPRC looking to replicate the approach through the Tauranga Moana sub catchments.

Sub catchment planning allows for environmental complexity

79. Sub catchment planning allows for adaptive management tailored to local environmental conditions and farming enterprises. Environmental processes are inherently complex, as outlined in earlier paragraphs water quality issues can arise from many different pressures and processes. In the Waikato River catchment increases in nitrogen concentrations are correlated with land use intensification, and the increase of dairy farming in a catchment[43]. When mitigation approaches are applied via a top down approach, however, the key drivers of the issues can be overlooked and the symptoms of the issues become the focus of attention.

80. In respect to the nutrient enrichment of waterways and nitrogen application it is not only the timing and quantity of fertiliser applications and the stocking density that contribute to eutrophication. Importantly soil structure, microbial diversity, soil organic matter and the type of fertiliser applied also play a role. Measures taken to manage soils to reducing pugging and erosion and reduce inputs of synthetic, quick release, fertilisers can reduce nitrogen leaching process and have beneficial

[42] Hearing Statement of Mr Burke (March 2019), paragraph 65, pages 12 – 13.
[43] Brief of Evidence of Mr Cox (May 2019), paragraph 18 – 19, page 10.

impacts on soil health, as well as crop health and resilience against pests[44,45].

81. A second example of complexity in environmental systems is dynamic peak flow, for example flooding on in stream erosion processes. The rate of in stream erosion is essentially governed by the capacity of channel material to resist hydraulic and gravitational forces. Traditional mitigation techniques aimed at targeting in stream erosion have therefore, focused on methods to increase the structural stability of eroding stream banks[46]. Once stream banks are actively eroding, however, stock exclusion and riparian planting may not suffice to curb further erosion as depicted in Figure 2 below.

Figure 2. Example of an actively eroding stream bank in the Whangape sub catchment with exposed roots of established native plants, 2019.

82. I am in support of the identification and adoption of mitigations at the farm scale applied through a robust and adaptive Farm Environmental Planning process. This approach should be integrated across a sub catchment and applied to develop sub catchment management plans which are developed from a bottom up approach.

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[44] Altieri, M.A., Nicholls, C.I. (2003), Soil fertility management and insect pests: harmonizing soil and plant health in agroecosystems. Soil and Tillage Research. 72(2), 203-2011.

[45] Liu B, Gumpertz, M.L., Hu, S., Ristaino, J.B. (2007). Long-term effects of organic and synthetic soil fertility amendments on soil microbial communities and the development of southern blight. Soil Biology and Biochemistry. 39(9), 2302-2316.

[46] Daigneault, A., Dymond, J., Basher, L. (2017). Kaipara Harbour sediment mitigation study: Catchment economic modelling. Landcare Research Contract Report: LC2905. 107 pp.

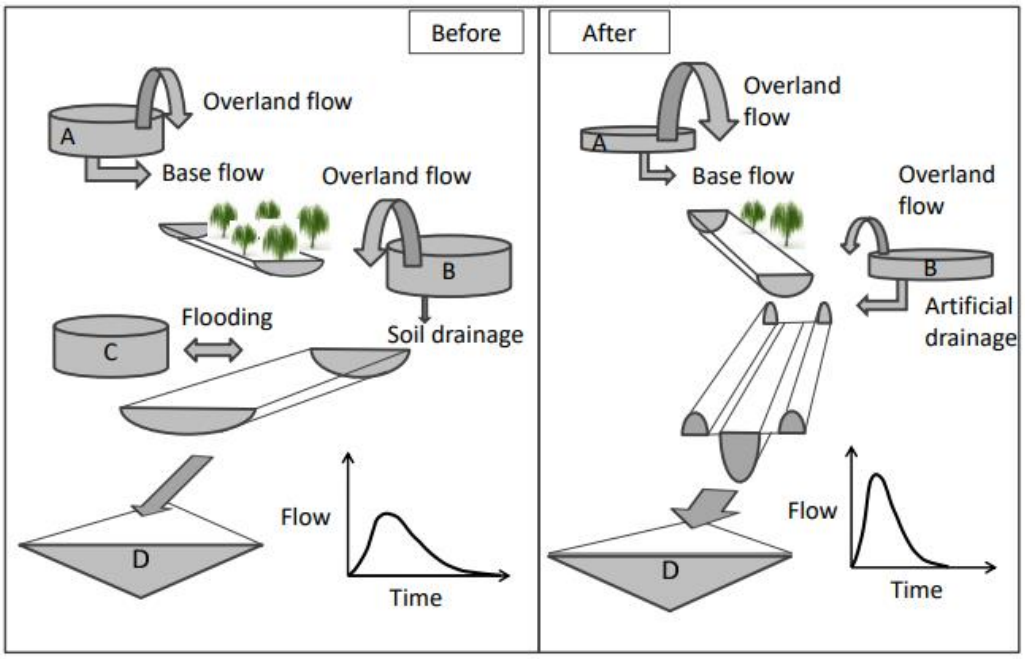
83. Ellis et al. (2018)[47] propose a holistic approach to help identify and understand the underlying drivers of in stream erosion processes by considering socio economic factors and catchment history in conjunction with traditional environmental variables. The traditional Māori interpretation of ecosystems to include humans was considered in the context that healthy, functional catchments may provide for social, cultural and economic wellbeing.

84. The visible signs of widescale hydrological alteration are evident around the Waikato and Waipa river catchments, in particularly wetland drainage. Efforts to drain and reclaim wetlands have been guided by the values society places on different ecosystem services (e.g. high value on productive output and lower value on biodiversity and carbon sequestration). Societal desires and needs have encouraged farmers to undertake measures to drain wetlands, hasten the flow of water from the land, extract groundwater for irrigation, clear forests and increase the economic value of farmland.

85. Ultimately, catchments have been transformed and now lack many of the functions they once had, to absorb, slow and filter water as it flows overland into waterways. Such alterations to catchment function and the resulting increases in peak flows and hydraulic forces in streams and rivers were conceptualized by Ellies, et al. (2018) as illustrated in Figure 3 below.

[47] Ellis, T., Hodgetts, J., & McMecking J. (2018). Stream bank erosion in Murihiku/Southland and why we should think differently about sediment. Environment Southland Regional Council.

Figure 3. Schematic diagram of conceptual alterations to the hydrology of altered catchments. A and B represent catchment water storage capacity in hill country; C represents flood plain storage and D represents estuary or harbour. This figure was developed by Ellis et al. (2018) to represent hydraulic changes in Murihiku/Southland catchments.



86. I support the identification and adoption of mitigations at the farm scale applied through a robust and adaptive Farm Environmental Planning process. This should be integrated across a sub catchment and applied to develop sub catchment management plans which are developed from a bottom up approach. FEPs should be underpinned by a robust stock take of the biophysical characteristics of the farm in the broader catchment context, and inform farm systems and environmental action which builds environmental (natural capital across all natural resources) and business resilience.

Monitoring the ecological performance of sub-catchments

87. Monitoring over sub catchment areas is expected to be more cost effective and provide a greater depth of understanding compared to monitoring at the farm level. Combinations of indicators representing soil (e.g. % soil organic matter), vegetation and waterway health (nutrients, E. coli, water clarity, SQMCI, and physical habitat assessment) could

provide a snapshot of sub catchment health, while measuring temporal changes in these indicators can provide insight into ecological function and potential provision of ecosystem services of a given sub catchment.

88. Assessment of ecological functions (i.e. soil and site stability, hydrologic function and biotic integrity) can be simplified by selecting a set of discrete but complimentary indicators tailed for productive grassland ecosystems. For example, Xu et al. (2019)[48] developed an Ecological Health Index based on a mixture of quantitative and qualitative measures of vegetation diversity and biomass, leaf litter accumulation, soil capping (reflective of compromised soil permeability) and erosion for grasslands in Argentina. The authors reported that species richness of plants and percentage vegetation cover and bare ground were significantly correlated to other quantifiable measures recognised as ecological indicators (i.e. such as plant species richness, percentage are of bare ground, standing dead material and total live vegetation abundance. Carrying capacity (equivalent to number of sheep per day per hectare) was positively correlated to percentage of total live vegetation and negatively correlated to percentage bare ground. Significantly in this study carrying capacity was positively correlated to species richness in one of the two regions studies (Xu et al., 2019) [49].

89. Evidence on the relationship between plant biodiversity and above ground productivity of grasslands has been contentious (i.e. Hector et al., 1999[50] and Huston et al., 2000[51]). Recently the body of evidence has been mounting to not only report the positive relationships between biodiversity and productivity but also ecosystem stability and the provision

[48] Xu, S., Rowntree, J., Borrelli, P., Hodbod, J., Raven, M. (2019). Ecological health index: a short term monitoring method for land managers to assess grazing lands ecological health. Environments (6) 67.
[49] Xu, S., Rowntree, J., Borrelli, P., Hodbod, J., Raven, M. (2019). Ecological health index: a short term monitoring method for land managers to assess grazing lands ecological health. Environments (6) 67.
[50] Hector, A., Schmid, B., Beierkuhnlein, C., Caldeira, M.C., Diemer, M., Dimitrakopoulos, P.G., Finn, J.A., Freitas, H., Giller, P.S., Good., J., Harris, R., Högberg, P., Huss-Danell, K., Joshi, J., Jumpponen, A., Körner, C., Leadley, P.W., Loreau, M., Minns, A., Mulder, C.P.H., O'Donovan, G., Otway, S.J., Pereira, J.S., Prinz, A., Read, D.J., Scherer-Lorenzen, M., Schulze, E.D., Siamantziouras, A.S.D., Spehn, E.M, Terry, A.C., Troumbis, A.Y., Woodward, F.I., Yachi, S., Lawton, J.H. (1999). Plant diversity and productivity experiments in European grasslands. Scince Vol 286 (5) pages 1123 – 1127.
[51] Huston, M.A., Aarssen, L.W., Austin, M.P., Cade, B.S. (2000). No consistent effect of plant diversity on productivity. Science 289 (548) 1255.

of ecosystem services[52]. Moreover, ecosystems containing more functional groups and trophic levels have been linked to greater productivity and provision of a wider range of ecosystem services.

90. I support establishing simple networks of monitoring sites within sub-catchments. The location and parameters of which should be selected to provide information on the performance of measures taken to improve water quality, ecosystem health and farm profitability. Information gathered across sub catchments supports a process of continuous learning and provides the opportunity for farmers, schools, iwi, councils, researchers and rural professionals to share knowledge, information and resources. Enabling the sub catchment community to understand the drivers of health, well being and prosperity in their sub catchment, promotes the development and uptake of new technologies and increases the chance of achieve goals that go beyond improvements in water quality alone.

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5 July 2019

[52] Stevens, C.J. (2018). Recent advances in understanding grasslands [version 1; referees: 2 approved] F1000Research, 7 (F1000 Faculty Rev): 1363.