BEFORE COMMISSIONERS APPOINTED
BY THE HAWKE'S BAY 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 Hawke's Bay Regional Council Plan Change 9 - Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments
AND	
IN THE MATTER	of submissions under clause 6 First Schedule
BY	**BEEF+LAMB NEW ZEALAND LIMITED** **Submitter**

SUBMISSIONS OF COUNSE FOR BEEF+LAMB NEW ZEALAND LIMITED
9 June 2021

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MAY IT PLEASE THE COMMISSIONERS:

1. Water quality is the focus of Beef+Lamb New Zealand Limited's (**B+LNZ**) case, particularly diffuse discharges from agricultural activities.

2. B+LNZ is a farmer-owned, industry organisation that represents New Zealand's sheep and beef farmers. B+LNZ is funded through a levy paid by all beef and sheep meat producers under the Commodity Levies Act 1990. B+LNZ develops programmes aimed at expanding the sheep and beef industry and seeks to improve market access, product positioning and farming systems.

3. Sheep and beef cattle numbers have fallen by around 50% and 25% respectively in the last 30 years or so. Nonetheless, there have been significant productivity gains[1]. The sector is strong, resilient, and adaptable.

4. B+LNZ's role in environmental regulation has tended to be one of quiet leadership. It has assisted its levy-payers to adopt leading environmental practices on-farm profitably. The organisation provides significant resource nationwide to facilitate this.

5. Developed through a community based collaborative approach that has been dependant on input by TANK group members, the purpose of PC9 is to provide for integrated management of land and water resources in the TANK catchments. B+LNZ has been very involved with that process and is grateful for the opportunity to work with HBRC. B+LNZ supports the community-based collaborative approach process used by HBRC to develop PC9.

B+LNZ'S CASE ON PC9

6. PC9 is a courageous plan change. It is promoting an approach that is novel in New Zealand's RMA environment. As such, many parties have treated it with suspicion and are uneasy about its ability to achieve the outcomes contemplated by the NPSFM and other instruments. It is

[1] Evidence of Tom Orchiston from paragraph 37.

criticised as non-regulatory and enabling the status quo to continue. That is unjustified criticism.

7. B+LNZ submit the empowerment of communities and land users to make decisions on the management of freshwater resources when undertaking pastoral farming land uses can achieve the maintenance and, where necessary, improvement of the health and well-being of water to provide for the values of the TANK catchments. The key to this approach is enabling flexibility, innovation, and adaptation. B+LNZ seek an outcome that improves certainty and empowers the community at the sub-catchment level to manage and take responsibility for the health and well-being of water. It says any regulatory burden should be commensurate to the relative environmental impact or risk from an activity.

8. What makes PC9 so courageous is that it is a change from the traditional 'command and control' approach that has been the cornerstone of the regulatory environment. It is a step-change that links people to water bodies to improve their understanding of what works and what does not and gives them the power and flexibility to manage freshwater through a permitted activity regime using freshwater farm plans (**FFP**), industry programmes and catchment collectives.

9. B+LNZ say that the permitted activity regime can achieve freshwater outcomes if communities are empowered to make decisions on local and catchment levels because this leads to ownership of the problem and the solutions. The approach must be accompanied by a clear planning framework, so that people can understand what they need to do and, importantly, where they need to get to. This requires clarity in Schedule 30 and precision in Schedule 26.

10. B+LNZ is comfortable with both catchment collectives and FFPs. It does not have an industry programme. I am told that in many cases if a catchment collective is in place farmers will use farm plans as a way to order their thinking and contribute to the agreed outcomes. I am also mindful of the Part 9A farm environment plans that are contemplated by the RMA. Although it is important to note that the requirement for those

plans is subject to the making of regulations and as best I understand it from the s 42A report we do not know what will happen in this region.

11. B+LNZ is also comfortable with the catchment priority approach that is proposed. It agrees sediment is a contaminant of concern for the sheep and beef sector and is content with nitrogen use as a proxy for risk.

LEGAL FRAMEWORK

12. Attached as appendices to these submissions are key, but well-trodden, submissions on Part 2 and the plan-making process as explained by the Court. Other counsel have addressed these and other key legal issues. I do not propose to address these matters orally unless there are particular issues that you wish to discuss.

Land Use Rules v Discharge Rules

13. The particular function of PC9, for the purpose of giving effect to the Act in Hawke's Bay, under s 30(1)(c)(ii) and (iiia) is the maintenance and enhancement of water quality and ecosystems in water bodies. It does this by controlling land uses that lead to the discharge of contaminants. It is submitted s 30 does not prevent the control of the use of land to fulfil its functions[2].

14. It is submitted that where effluent is applied to groundwater it is a discharge under s 15. In *Marlborough DC v Wooley*[3] the Court took judicial notice of the fact that effluent penetrating the ground could reach groundwater. Causation is a question of fact and degree to be resolved in the circumstances of the case[4], but the evidential threshold that a contaminant *"may*" enter water is a low one[5].

15. In *Brook Valley Community Group Inc v Brook Waimarama Sanctuary Trust*[6], albeit in a quite different context[7], the Court of Appeal noted the

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[2] *Federated Farmers of NZ v Manawatu-Wanganui RC* [2011] NZEnvC 403 at [7].
[3] [2015] NZDC 13811.
[4] *Re Contact Energy* [2009] NZRMA 97.
[5] *Manawatu-Wanganui RC v Thurston* DC Palmerston North CRI-2007-054-2550, 20 February 2009.
[6] [2018] NZCA 573.
[7] Declaratory and judicial review proceedings relating to the relationship between ss13 and 15 and regulations under s 360 relating to the discharge and depositing of 1080 aerially.

distinction between district and regional rules, which could be significant when assessing what resource consents are required under Part 3. Part 3 RMA restricts a range of activities by reference to the receiving environment: land (s 9), the coastal marine area (s 12); riverbeds (s 13) and water (s 14). Activities on land are permitted unless otherwise restricted. Other activities, including discharges (ss 15 and 16), are generally more sensitive and require resource consent unless otherwise permitted, irrespective of location.

16. In that case the Court observed that Part 3 had the hallmark of being carefully crafted to cover different subject matters that did not have overlapping application[8]. It concluded there is no logical basis to interpret Part 3 as requiring the same action to be consented to twice if it falls under multiple sections in the context of an aerial drop otherwise exempted from s 15 by regulations made under s 360. As such a consent under s 13 was not required[9].

17. I accept that care needs to be taken with relying on these statements because the case was not concerned with plan making under Part 5. Nonetheless, the Court's second observation may have general application and, in my submission, does.

18. Importantly, s 15(1) does not require that the discharge be *expressly allowed* by a particular type of rule i.e. a discharge rule under s 87(e). It simply requires that the discharge be *expressly allowed* by *a rule* in a regional plan. "*Rule*" is defined by s 43AA as a district or regional rule. The definition of "*regional rule*" is in s 43AAB(3) and provides:

> In this Act, unless the context otherwise requires, regional rule means a rule made as part of a regional plan or proposed regional plan in accordance with section 68.

19. It follows then that the rule can be a land use rule, a discharge rule or both (a hybrid).

20. A number of the TANK rules set out whether the rule is a discharge rule under s 15 or a land use rule under s 9. This is not done for rules TANK

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[8] I have my doubts about this.
[9] At [78] – [79].

1 and 2 but their drafting refers to the land use component of the activity only. However, given the scope of the activity, in my submission, they should be interpreted to include discharges of agricultural contaminants and as such are hybrid rules, albeit without express reference to those discharges. The drafting of the objectives and policies supports this interpretation, particularly the catchment objectives, which refer to the use and development of land, along with discharges of contaminants.

Permitted Activities

21. The key question in determining whether a permitted activity rule is valid is asking whether the rule is sufficiently certain to be understandable and functional[10]. Council must not reserve itself a discretion to approve a permitted activity[11].

22. In *Ruddlesden v Kapiti Borough Council*[12] the Court held that a condition which permits a Council to refuse approval for a permitted activity on the basis of some value judgement by the Council was ultra vires the relevant sections of the Town and Country Planning Act 1977[13].

23. In A *R & M C McLeod Holdings* the Court made the following statements (references are to "predominant use" as the case was decided under the Town and Country Planning Act)[14]:

> "The authorities cited establish two distinct propositions. The first is that a Council may not reserve by express subjective formulation, the right itself to decide whether or not a use comes within the category of predominant use. Council cannot, for example, put forward an ordinance which says A will be a predominant use "if the Council is satisfied that situation B exists." Predominant uses fall for objective ascertainment. That much certainty is always required. The second is that predominant use rights must not be described, even in an objective fashion, in terms so nebulous that the reader is unable to determine whether or not a use may be carried on in the zone. This second aspect does not involve any

[10] *A R & M C McLeod Holdings Ltd v Countdown Properties Ltd* (1990) 14 NZTPA 362 at page 28.
[11] At page 24.
[12] (1986) 11 NZTPA 301.
[13] *Ruddleston* at p 27.
[14] *McLeod* at page 22.

express subjective formula. It involves, simply, invalidity through inherent vagueness."

24. These cases remain good law under the RMA[15]. The key is that the permitted activity must be capable of objective assessment and application. In *Friends of Pelorus Estuary Inc*[16] whilst the Court stated its agreement that conditions requiring a subjective assessment are unlawful, it held that a condition requiring some degree of evaluation is not automatically so. In that instance the conditions attached to the permitted activity used the terms "significant" and "best practicable option"[17]. Whilst the Court held that there were practical disadvantages in adopting conditions that require evaluation, there the terms used had sufficient meaning under the RMA to be capable of being applied in practice[18].

25. In PC9 it is submitted that the rule is clear, the farmer must be a member of either an industry programme or catchment collective or prepare an FFP. The requirements for either of the two groups or a FFP are set out in Schedule 30, which, in turn, makes the rule clear as to what a farmer needs to do in order to farm as a permitted activity.

26. The permitted activity rule does not require any form of subjective judgment to be exercised by the Council, rather the Council is to be provided with the FFP and information about the implementation of the mitigation measures identified for the property. If these conditions are met the plan can be approved based on the factors in the schedule[19].

27. Schedule 30 is comprehensive and expressed with sufficient detail to remove any chance of there being a subjective discretion in the approval by Council. The Schedule is not prescriptive per se, but it clearly identifies the matters the FFP or the catchment collective must address. This is the best way to approach it because it empowers farmers to assess risk and think about what the plans should contain in order to

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[15] See, for example, *Friends of Pelorus Estuary Incorporated v Marlborough District Council* Environment Court Blenheim, 24 January 2008, C004/08.
[16] Ibid.
[17] A condition attached to a permitted activity rule for discharge of storm water stated: "The discharge shall not have any significant adverse effect on water quality."
[18] At [100]-[102].
[19] See Schedule 30.A.3.1.

achieve the outcomes that are pursued either at a property, catchment, or sub-catchment scale[20]. Council is not being asked to judge if the Schedule 26 objectives can be met, if it were the rule would be unlawful. It will be for the catchment collective or farmer to show that the plan *addresses* the matters Schedule 30 identifies as requiring management responses to maintaining or improving the outcomes in Schedule 26, so as to achieve the values in the catchment objectives and other places. If the *plan* cannot demonstrate that then the agricultural activity will not be permitted. This is on the basis that the plans will provide for property-scale management in accordance with good management practice in the context of the actions and mitigations described.

28. B+LNZ agrees with the s 42A report's comments that the permitted activity regime is not a low cost or no obligation management regime[21]. The rigour required by Schedule 30 takes care of that and elevates PC9 from a 'trust us' regime. Mr Kessels in his evidence has helpfully set out what is required for catchment collectives to work[22].

29. Mr Kessels also makes the point, which B+LNZ support, that there is a need for demonstrable and measurable improvements to ecosystem health and biodiversity outcomes at the catchment or sub-catchment level. Dr Greer says that the Council's existing monitoring network is sufficiently robust so that changes in water quality and ecology associated with management changes are detectable. This cannot sustain a criticism that the approach is a "business as usual" model. There are measurable outcomes to assess the activity against as set out in Schedule 26.

30. Council must also be satisfied before it includes a permitted activity rule that it does not lead to any of the effects, after reasonable mixing, described in s 70. Those effects include as a result of cumulative effects. In my submission the application of s 70 is a material matter given my earlier submission about the status of rules TANK 1 and 2.

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[20] See evidence of Mr Orchiston and Mr Kessels.
[21] See paragraph 904.
[22] See paragraph 39.

31. Importantly the issue of *receiving waters* needs to be considered, given the discharges the rules are regulating are diffuse. In the decision of the Commissioners appointed to hear Plan Change 1 to the Waikato Regional Plan there is a useful discussion of the application of that term to diffuse discharges. From paragraph 451 the Commissioners analyse the scant authority on the issue and ultimately conclude on the basis of the decision of a Board of Inquiry decision[23] that the receiving waters are the waters at the point of discharge. What this means is that for some contaminants, notably soluble contaminants such as nitrogen, s 70 is unlikely to be an issue for the permitted activity considerations. On the other hand, for contaminants such as E.coli or sediment, that are transported above the surface and can discharge into waterways, this is a consideration that you must turn your mind to.

National Policy Statement for Freshwater Management 2020

32. This plan change process was commenced in 2012, prior to the NPSFM 2014, and notified when the NPSFM 2014 as amended in 2017 was in force. The current NPSFM (2020) came into force on 3 September 2020 after PC9 was notified. HBRC has recommend changes to PC9 if there is scope to make the changes through submissions, if there is enough information, and if it is possible to make changes based on the work HBRC has done.

33. I agree with submissions of counsel for the Environmental Defence Society that *Hawkes Bay and Eastern Fish and Game Council v Hawkes Bay Regional Council*[24] is the preferred approach to giving effect to replacement national policy statements. You should, as far as is possible, give effect to the current national direction as reflecting the direction set by the Minister under the process provided for in the Act. At a first instance hearing this better reflects the intent of the Act as directed by s 67(3)(a).

[23] Board of Inquiry Final Report and Decision on NZ King Salmon Request for Plan Changes and Applications for Resource Consents, 22 February 2013.
[24] [2014] NZHC 3191 from [178].

34. Notwithstanding that, *Minister of Conservation v Northland Regional Council*[25] tentatively expressed views on the relationship between the NPSFM 2020 and the NPSFM 2014, saying that there is no change of focus or desired outcomes and that the primacy given to ecological values remains[26]. However, it does need to be noted that this case had a limited focus and extensive evidence on the issue was not heard.

35. What you can take from that case is comfort that in your analysis of PC9 you should not be concerned that work under the previous NPSFM regime is wasted or unhelpful. There remains a focus on the health and well-being of freshwater, determined and protected through the discipline imposed on councils to follow when setting freshwater objectives to maintain or improve water bodies.

36. As you are aware, the fundamental concept underpinning the NPSFM is *Te Mana o te Wai*. The Environment Court in *Aratiatia Livestock Limited v Southland Regional Council*[27] identified Te Mana o te Wai as referring to the integrated and holistic wellbeing of a freshwater body. It is a matter of national significance that freshwater is managed through a framework that gives effect to the fundamental concept of Te Mana o te Wai, which has been likened to a korowai or cloak that frames and informs freshwater planning. It is a concept that:

> … refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. It protects the mauri of the wai. Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community.[28]

37. Te Mana o te Wai is further elaborated in the hierarchy of obligations at objective 2.1[29]. The first management outcome is the health and wellbeing of water bodies and freshwater ecosystems, followed by the health needs of people and then the ability for people and communities to provide for their social, economic and cultural wellbeing.

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[25] [2021] NZEnvC 1.
[26] At [33] – [36].
[27] [2019] NZEnvC 208.
[28] At [5].
[29] And 1.3(5).

38. Regional councils must give effect to Te Mana o te Wai as articulated by the hierarchy and the principles by actioning five key requirements set out in clause 3.2 NPSFM. It requires regional councils to actively involve tangata whenua when identifying local approaches to give effect to Te Mana o te Wai, when making or changing regional plans, implementing the national objectives framework and developing and implementing monitoring.

39. The Court has observed that under NPSFM 2014 all provisions of a plan are to be interpreted and applied in a manner that considers and recognises Te Mana o te Wai[30]. The language in the NPSFM 2020 has changed to *give effect to*, but it is submitted that this principle remains the same.

40. I agree that PC9, realistically, can only partly give effect to the NPSFM. I agree that this approach is lawful and that the NPSFM provides for staged implementation. In my submission the focus should be on the integrated management of freshwater and wherever possible using approaches and language that is consistent with the NPSFM.

41. B+LNZ's submission sought relief to amend several TANK objectives and policies to ensure the provisions provide for freshwater values in a manner consistent with the direction in the NPSFM. B+LNZ's view, as expressed in submissions, is that the TANK objectives should provide for integrated management of freshwater and land use, not to improve the attributes of freshwater (those measurable characteristics that enable an assessment of the extent to which a particular value is provided for), but instead ensuring that the values of freshwater are provided for. Target attribute states should be set to provide for the values, including allowing for changes in current water quality where this will not impact on the values. Dr Greer's evidence discusses how the references to seeking a healthy ecosystem can be understood objectively, and more about that shortly

[30] *Aratiatia* at [7].

THE PLAN

Are the TANK areas FMU's under the NPSFM?

42. The NPSFM 2020 requires Freshwater Management Units (**FMU**) to be identified in the region as part of the National Objectives Framework (**NOF**)[31]. An FMU is defined as:

> All or any part of a water body or water bodies, and their related catchments, that a regional council determines under clause 3.8 is an appropriate unit for freshwater management and accounting purposes; and **part of an FMU** means any part of an FMU including, but not limited to, a specific site, river reach, water body, or part of a water body.

43. The terms that are used in PC9 to define spatial units for the management of freshwater are Freshwater Quality Management Unit and TANK areas. In my submission this is unnecessary and confusing and PC9 should try where possible to adopt the approach and language in the NPSFM. There is no time like the present and, in my submission, notwithstanding Council may not have settled on the approach to FMUs across the region, reclassifying the Freshwater Quality Management Units or TANK Areas as FMUs in PC9 has merit. If the Council ultimately wishes to take a different approach,[32] then that approach can be tested as part of the Kotahi Review.

The articulation of values in PC9

44. The identification of the values at cl 3.9 NPSFM is a foundational action when preparing a robust plan framework to manage freshwater in a manner that gives effect to Te Mana o te Wai[33].

45. Values in PC9 are articulated in several narrative provisions and in Schedule 26. As explained by the s 42A report, Schedule 26 includes target water quality attribute states and environmental outcomes, which will provide for the values identified for the different waterbodies in the

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[31] Clause 3.7(2)(a) NPSFM.
[32] See s 42A report at [124] and NPS Freshwater Management 2020 (NPSFM) Comparison With TANK Plan Change 9 (PC9), Mitchell Daysh at p2.
[33] Policy 1.

TANK catchments[34]. As such, Schedule 26 is a critical component of PC9's architecture.

46. 'Critical values' in Schedule 26 include values that are similar to but not an 'exact match'[35] to NPSFM values, such as mahinga kai, recreation and natural character. However, Schedule 26 also identifies critical values such as 'algal growth' and 'toxicity'. These critical values would appear to more closely resemble NPSFM attributes. Not being toxic is not a value. It is an outcome that contributes to identifying whether a value is or can be achieved – for instance ecosystem health.

47. This misnomer also contributes to a disconnect between the schedule and other provisions of PC9, and raises questions about how Schedule 26 is meant to function within the wider PC9 architecture. What is the environmental outcome expected in relation to providing for the value of 'algal growth'? How does this relate to the more legitimate value (in an NPSFM sense) of ecosystem health?

48. Clarity is important and the conflation of terms in Schedule 26 that have a specific function and purposes within the NPSFM2020 is more than just an issue of semantics. If Schedule 26 does not have a clear link to the key values provided for in TANK OBJ 11 – 13 there is a risk to the effective and efficient implementation of PC9. This is critically important given the overall approach in PC9 providing for community leadership in the management of freshwater. The grass-roots approach in PC9 means it must be a practical document, able to be picked up and used readily. Lay people need to be able to easily identify the values that management approaches will need to provide for through on-farm actions and mitigations.

49. Of particular concern for B+LNZ is what is meant by *healthy* in the key value-setting objectives at TANK OBJ 10-14. Its ecologist, Dr Greer, tells us that defining what a healthy ecosystem means is better understood by the use of objective and well understood phrasing. He points to Stark and Maxted's poor-fair-good-excellent grading that is

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[34] Paragraph 656.

[35] See NPS Freshwater Management 2020 (NPSFM) Comparison With TANK Plan Change 9 (PC9), Mitchell Daysh at p31.

found in the NPSFM appendices and says the target attribute states reflect these outcomes[36]. The limits in Schedule 26 generally reflect water quality that is excellent in the upper catchments, good in the mid catchments and fair closer to the coast.

50. This can be addressed through the recommended changes proposed by B+LNZ. The intent of these amendments is to clarify what is meant by maintenance and improvement in the Plan. They seek to provide a plan that is easy to understand and use, with a clear line of sight between the values and Schedule 26.

51. The amendments proposed to OBJ TANK 4 provide a link to the catchment objectives, which establish in broad terms the values the management approach in PC9 provides for. It is submitted OBJ TANK 4 – 13 should, as a whole, provide the basis for a values-based management framework as contemplated by the NPSFM.

52. The focus should be on the values (not the attribute states) in Schedule 26 because this is more consistent with the NOF cascade of identifying values, followed by outcomes included as objectives, then attributes and then limits as rules. The NPSFM deliberately requires the process to be done in the right order. The latter tools, target attribute states and limits, are expressly linked to the environmental outcomes. This makes reference to those outcomes in the catchment objectives desirable.

53. Therefore, changes to the catchment objectives linking them back to the maintenance and improvement mandates in OBJ TANK 4 are also proposed:

    (a) A specific amendment, in reliance on the evidence on Dr Greer, has been made to each of the catchment objectives to refer to the 2040 target on the Stark and Maxted scale. The use of the word *healthy* has been limited in favour of a specific reference to the scale e.g. OBJ TANK 11(a).

    (b) This has, in turn, allowed an amendment to (b) to remove the duplication of references to health and instead focus the value on diversity. I am mindful that diversity is an element of ecosystem

[36] See paragraph 34.

health in many systems, but I do not have the evidence either way to determine if that part of the objective can be removed.

(c) Bird habitat is given its own paragraph to improve readability.

(d) Likewise, trout habitat is separately identified for the same, plus an additional reason. Noting the WCO over the Upper Ngaruroro[37], it is proposed to separate the recognition of a healthy trout fishery into a new subparagraph because that recognises the approach provided for in the NPSFM at policies 9 and 10.

54. The balance of the changes are to improve syntax and readability, given the substantive amendments discussed above.

55. There are two important final points to note:

(a) B+LNZ's case does not consider how the objectives address cultural health. We have not called evidence on those matters. It is raised as something to be aware of if you wish to consider B+LNZ's approach further.

(b) Dr Greer has not attempted to provide recommendations as to the appropriate Schedule 26 limits for the attribute states to reflect water quality in the region. Rather his recommendations at Table 6 demonstrate what the numbers should be if the error he has identified in the transposition of criteria from Matheson *et al*[38].

How will the Schedule 30 plans work?

56. B+LNZ's evidence focuses on the advantages of community-led approaches to freshwater management. Mr Kessels gives examples of projects where community-based ecosystem management approaches have been undertaken. In addition, B+LNZ is aware of a number of initiatives that are underway and being closely watched. I am told there is a pilot study being undertaken in Northland and Auckland that is intended to assess performance of community-led initiatives over time.

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[37] Not under appeal as I understand it.
[38] See paragraphs 87 – 89.

57. Nonetheless, it is accepted the complexity of ecosystem management approaches, notably the lag between action and effect of those actions, can create uncertainty[39]. However, that wicked problem is not limited to community-led initiatives – management responses always take time.

58. As noted by Mr Kessels an ecosystem management approach recognises interconnectedness and, in that way, provides for the integrated management contemplated by Te Mana o te Wai and *ki uta ki tai*. This, in turn, indicates advantages with the catchment collective approach, which is reflected in the Schedule 30 requirements. Those requirements are onerous and will probably be more manageable, especially in the context of monitoring and reporting, if done in part of a group. The advantages described in the s 42A report of a collective approach are supported by B+LNZ[40], along with the opportunities catchment scale mitigation provide to address cumulative effects[41].

59. That is not to say that FFP are second best. An FFP still provides for a property-scale management response to losses and the advantages discussed by Messrs Orchiston and Kessels. FFP provide for the adoption of good management practice at scale that recognises site specific challenges, constraints and responses. It also recognises that for some, a catchment collective approach might not work, while still providing for those benefits.

60. Dr Greer's evidence addresses the efficacy of Council's monitoring network, given the importance placed on monitoring and reporting highlighted by Mr Kessels. This is important because the NPSFM is clear on the monitoring obligations on Council[42] and this has been bought through into the policy framework by POL TANK 24 and 33 – 35.

61. This means that the primary way to identify the water quality outcomes sought[43] and the management actions and contaminant loss reductions to be pursued will be informed by Council's state of the environment

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[39] See Mr Kessels 'evidence at 25.
[40] See, e.g. paragraphs 705 and 860.
[41] See paragraph 876, examples include large-scale retirement, planting, wetland establishment and land use change.
[42] Policy 13 and 14.
[43] Schedule 30.A.2.1(a).

reporting under s 35. Thus, for instance, a catchment collective will need to identify the closest downstream monitoring site identified in Schedule 26 as the site where the 2040 target attribute state applies[44]. It then uses that data to inform the steps it will be taking.

62. Returning to integrated management, the evidence of Mr Kessels is that ecosystem health[45] and the life supporting capacity of ecosystems is provided for in ecosystem management approaches through recognition of the connection within systems rather than a focus on specific attributes[46]. The problem with focusing on the attributes too greatly is the big picture can be missed.

63. For instance, Dr Greer's evidence points to the relationship between DIN and DRP and the absence of a periphyton problem in the region. He also highlights the critical role MCI has in monitoring ecosystem health. He does not discuss fish, but I understand the presence and numbers of fish to be another key indicator of ecosystem health. Accordingly, best I am able to ascertain the key Schedule 26 attributes for ecosystem health would be:

(a) Periphyton attributes (biomass, annual and season cover) and macrophytes;

(b) MCI and QMCI; and

(c) Fish-IBI.

64. I have asked Dr Greer to comment on this approach when he is called.

65. It is submitted this approach fits well with the evidence of work B+LNZ has been undertaking with farmers to educate and empower them to manage the ecosystem health of waterways, for instance the assessment tools discussed by Mr Orchiston[47]. As he notes, these tools are not intended to replace expert advice but can indicate if further work

[44] See clause 3.11(1)(b) NPSFM.
[45] Mr Kessels uses the term *ecological health* but I understand that to be, for our present purposes, the same thing.
[46] See paragraphs 25 – 27.
[47] See paragraph 116.

is required. It allows self-checks of stream health that highlight the status of key indicators of ecological health.

66. The members of a collective or farmers operating with a FFP can use the stream health checks to identify issues that on-farm actions can address. The responses can then improve losses from agricultural activities, as discussed by Mr Kessels from paragraph 43, in the context of best practice mitigation at a farm scale.

LAND USE CHANGE

67. B+LNZ considers that changes in land use have the potential to increase the risk to the identified values in PC9. It does not favour the sector averaging approach in the notified plan.

68. Dr Greer explains that while agriculture is the predominant use through most of the catchments the link to degraded attribute states is not clear[48]. For B+LNZ this gives it comfort that it can support the risk-based scale proposed in the s 42A report and a restriction on land uses moving up (i.e. increasing the risk) the scale, triggering a requirement for resource consent. It considers that application would need to demonstrate that any such change will not compromise the Plan's values.

69. In B+LNZ's submission it supported the current structure of rule TANK 5. It did not submit on rule TANK 6. B+LNZ has not called any evidence on its submission point seeking to increase the threshold in which the controlled activity consent is required. That is, at least in part, due to the proposed amendments in the s 42A reports.

70. The policy framework gives inadequate guidance on the term of consents and review provisions when granting consents for land use change and subsequent activities. B+LNZ have proposed a new policy[49] to provide that guidance. It is submitted this will be particularly important for consideration of cumulative effects if there are a number of consents granted, particularly given the priority catchment approach.

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[48] See e.g. paragraphs 42 (excessive macrophyte growth) and 56 and 57 (DIN and DRP) c.f. 48 (clarity) and 58 (E.coli).
[49] Marked as POL TANK XX2.

It is submitted that in between these two submission points noted above there is sufficient scope for B+LNZ to seek changes through these submissions to that table in line with the s 42A report's recommendations.

71. Additionally, B+LNZ has proposed changes to POL TANK 21. The 'avoid' directive in (d) is different to the obligations to 'take into account' matters at (a) – (c). While the structure of the policy provides for a distinction between the two sets of considerations, in my view, it would be easier to split the policy into two to highlight the *avoid* directive where increased losses will compromise meeting Schedule 26 targets. This would be a bright line test that prevents degradation of water quality. However, this does lead to another issue.

72. There are some concerns with the activity status for TANK rule 5, given the 'avoid' policy. It is not clear to me how the rule can implement that policy if there is no ability to decline consent if the change will result in increased nitrogen losses that cannot be mitigated. I am not aware of any evidence that establishes how conditions could address this issue and in its absence a change in activity status would appear necessary.

73. B+LNZ also sought amendments to rule TANK 5 to incorporate land use change for farmers operating with a FFP under rules TANK 1 and 2 within that rule. Schedule 30 requires an FFP be developed to be consistent with the attributes and limits in Schedule 26 and PC9's policy framework[50]. It is submitted there is no reason that those who are implementing on-farm actions with an FFP should not also be able to rely on rule TANK 5. In my submission this is consistent with the principle that regulatory burden should be commensurate to environmental risk.

STOCK DRINKING WATER AS A PRIORITY TAKE

74. B+LNZ submitted on the need for recognition for stock drinking water. It sought changes to the policy framework and non-specific changes to the permitted activity rules (rules TANK 7 and 8).

[50] See Schedule 30A.2 and 4.

75. Relevant provisions for stock water takes are:

(a) Section 14(3)(b) provides for the taking and using of water for the reasonable needs of stock. This is recognised by the Plan and noted by the s 42A report writers. In *Carter Holt Harvey v Waikato Regional Council*[51] the Court said that the right to take water under s 14(3)(b) was not absolute and is qualified by:

(i) The right to take or use the water being required;

(ii) The needs being reasonable;

(iii) The taking not or not being likely to have an adverse effect on the environment.

(b) The NPSFM hierarchy of obligations identifies the exception for the taking of drinking water for individuals reasonable domestic needs in s 14(3)(a) but is silent on subparagraph (b). It is unfortunate that the NPSFM has failed to explicitly recognise this part of s 14 in its architecture. Instead, provision of animal drinking water is an 'other value' to be considered, which does not reflect its position in s 14. This creates confusion as to the place for consideration of animal welfare issues and the fundamental role that growing food plays in the provision for the health needs of people

(c) OBJ LW1(5) Regional Policy Statement recognises the regional value of water for animal drinking purposes in the integrated management of the region's freshwater resources.

76. It is submitted the best way for you to address this issue is recognising the exception in s 14(3)(b), any take must not have an adverse effect on the environment, is key. B+LNZ favours the approach proposed by the s 42A report that provides for the taking of water for stock drinking provided it complies with the conditions of the permitted activity rule[52]. It is not thought that any changes to the policy framework are necessary

[51] [2011] NZEnvC 380.
[52] That is, surface water (rule TANK 7) (a) and (c) – (g) and groundwater (rule TANK 8) (a) and (c) – (f).

given the provision of freshwater for stock in the catchment objectives' reference to *primary production*[53].

77. This means, practically, you can come back to asking whether the permitted activity regime for agricultural uses is sufficient to improve or maintain the values identified for the TANK catchments. The access of stock to water or its provision from human-made sources is an integral part of pastoral land uses and consideration of which, I submit, will be part of any farm plan or catchment collective plan. If you are satisfied that through the priority catchment and Schedule 30 farm plan and community-led approaches that the appropriate outcomes can be achieved, in my submission it is appropriate to recognise stock drinking water as a priority take and adopt the approach proposed by the s 42A report.

EVIDENCE

78. B+LNZ will be calling:

(a) Gerry Kessels – ecologist and collaborative catchment process expert

(b) Tom Orchiston – environment capability manager B+LNZ; and

(c) Dr Michael Greer – ecologist.

C Thomsen
Counsel for Beef+Lamb New Zealand Ltd
9 June 2021

[53] As defined at 9.180 Regional Resource Management Plan - *The use and development of land for the production of primary products including agricultural, horticulture, pastoral and forestry products*.

Appendix 1

The plan making process incorporating the amendments to section 32 from the 2013 RMA amendments

A regional plan is a form of subordinate legislation and therefore attracts the normal administrative law requirements of certainty and clarity in its drafting. Rules have the force of regulation, but objectives and policies do not.

Regional Plan - *Day*

The process for regional plan making has been addressed in numerous decisions. The most often cited explanation of the regional planning process is set out in *Day* v *Manawatu-Wanganui Regional Council* [54]:

Regional Plans

1. The purpose of a regional plan is to assist a regional council to carry out its functions in order to achieve the purpose of the Act (s63).

2. When preparing its regional plan the regional council must give effect to any national policy statement or New Zealand Coastal Policy Statement (s 67(3)).

3. The regional plan must not be inconsistent with any other regional plan for the region or a consideration order or a determination of the Chief Executive of the Ministry of Fisheries about aquaculture permits (s67(4)).

4. When preparing its regional plan the regional council shall:

   (d) Have regard to any proposed regional policy statement in the region (s66(2));

   (e) Give effect to any operative regional policy statement (s67(3)(c));

   (f) Have regard to the extent to which the plan needs to be consistent with the regional policy statements and plans or proposed regional policy statements and plans of adjacent regional councils (s66(2)(d)).

5. A regional plan must also record how it has allocated a natural resource under s 30(1)(fa) or (fb) and (4), if it has done so (s67(4)).

6. When preparing its regional plan, the regional council shall also:

   (a) Have regard to the Crown's interest in land of the Crown in the CMA (s66(2)(b));

   (b) Have regard to any management plans and strategies under other Acts, and to any relevant entry in the Historic

[54] [2012] NZEnvC 182 at [1-13].

Places Register and to various fisheries regulations (s66(2)(c);

(c) Take into account any relevant planning document recognised by an iwi authority (s66(2A)(a)); and

(d) Not have regard to trade competition (s66(3)).

7. A regional council must prepare a regional plan in accordance with its functions under s30, the provisions of Part 2, any direction given by the Minister for the Environment, and its duty under s32 [and s 32AA][55] and any regulations (s66).

8. A regional plan must also state its objectives, policies to implement the objectives and the rules (if any) (s 67(1)) and may (s67(2)) state other matters.

9. The rules (if any) are for the purpose of carrying out its functions (other than those in s30(1)(a) and (b)) and achieving the objectives and implementing the policies of the plan (s67(1)(c) and s68(1)).

10. In making a rule the regional council shall have regard to the actual or potential effect on the environment of activities (s68(3)).

General Requirements – *Colonial Vineyards v Marlborough District Council*[56]

1. A district plan should be designed in accordance with[57], and assist the territorial authority to carry out its functions[58] so as to achieve, the purpose of the Act.[59]

2. When preparing its district plan the territorial authority must give effect to a national policy statement, New Zealand coastal policy statement or regional policy statement.[60]

3. When preparing its district plan the territorial authority shall have regard to any proposed regional policy statement.[61]

4. In relation to regional plans:

(a) the district plan must not be inconsistent with an operative regional plan for any matter specified in s30(1) or water conservation order[62]; and

[55] Section 32AA was enacted after *Day* was decided.
[56] [2014] NZEnvC 55.
[57] Section 74(1).
[58] Section 31.
[59] Sections 72 and 74(1)(b).
[60] Section 75(3)(a)-(c).
[61] Section 74(2).
[62] Section 75(4).

(b) the district plan shall have regard to any proposed regional plan on any matter of regional significance or matter the regional council has primary responsibility under part 4.[63]

5. When preparing its district plan the territorial authority:

(a) shall have regard to any management plans and strategies under any other Acts, and to any relevant entry on the New Zealand heritage list and to fisheries regulations (to the extent that they have a bearing on resource management issues in the region)[64], and to consistency with plans and proposed plans of adjacent authorities;[65]

(b) must take into account any relevant planning document recognised by an iwi authority;[66] and

must not have regard to trade competition.[67]

6. The district plan must be prepared in accordance with any regulation.[68]

7. The formal requirement that a district plan must[69] also state its objectives, policies and the rules (if any) and may[70] state other matters.

8. A territorial authority has obligations to prepare an evaluation report in accordance with section 32 and have particular regard to that report.[71]

9. A territorial authority has obligations to prepare a further evaluation report under s32AA where changes are made to the proposal since the section 32 report was completed. [72]

10. *The Colonial Vineyards* case was a District Plan case that usefully expanded on the matters addressed in *Day* by discussing the requirements under s 32 that applied to both District and Regional Planning decisions. But the principles contained in it

[63] Section 74(2)(a).
[64] Section 74(2)(b).
[65] Section 74(2)(b).
[66] Section 74(2)(b).
[67] Section 74(3).
[68] Section 74(1)(f).
[69] Section 75(1).
[70] Section 75(2).
[71] Section 74(1)(d) and (e).
[72] Section 32AA.

Objectives

11. The objectives in a district plan (change) are to be evaluated by the extent they are the most appropriate way to achieve the purpose of the Act.[73]

Provisions[74]

12. The policies are to implement the objectives, and the rules are to implement the policies.[75]

13. Each provision is to be examined, as to whether it is the most appropriate method for achieving the objectives of the district plan, by:

14. (a) identifying other reasonably practicable options for achieving the objectives;[76]

15. (b) assessing the efficiency and effectiveness of the provisions in achieving the objectives, including:[77]

    (i) identifying and assessing the benefits and costs of the environmental, economic, social and cultural effects that are anticipated from the implementation of the provisions, including opportunities for economic growth and employment that are anticipated to be provided or reduced;[78]

    (ii) quantifying those benefits and costs where practicable;[79] and

    (iii) assessing the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions.[80]

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[73] Section 32(1)(a).
[74] Defined in section 32(6) for a proposed plan or change as the policies, rules or other methods that implement or give effect to, the objectives of the proposed plan or change.
[75] Section 75(1).

[76] Section 32(1)(b)(i).
[77] Section 32(1)(b)(ii).
[78] Section 32(2)(a).
[79] Section 32(2)(b).
[80] Section 32(2)(c).

Rules

16. In making a rule the territorial authority shall have regard to the actual or potential effect on the environment of activities including, in particular, any adverse effect.[81]

Other Statutes

17. The territorial authority may be required to comply with other statutes.

On Appeal

18. On appeal the Court must have regard to the decision of the territorial authority[82].

Legal Relationship of Plan Provisions

19. The underlying rationale for rules is to assist the Council to undertake its functions under the Act and to achieve its purpose. The functions of the Council are specified at s 30 and there is an obligation in making a rule to have regard to any actual and potential effects on the environment of an activity83. Rules must be capable of supporting enforcement action under the Act.

20. There is a descending hierarchy in s 67 requiring policies to implement objectives and, in turn, the rules to implement the policies. An objective is an outcome to be achieved. A policy is usually a course of action to implement / achieve the objective. The rules set the framework for how that course of action will be executed and are either permissions or triggers for further consideration.

21. Neither ss 67 or 68 require objectives and policies to be validated by rules. In fact, the relationship is in reverse. It is the objectives and policies that must provide the basis for a rule.

[81] Section 76(3).
[82] Section 290A.
[83] Section 30(1)(b).

APPENDIX 2

PART 2

1. The purpose of the Act is to promote the sustainable management of natural and physical resources. Sustainable management requires the use, development and protection of natural and physical resources be managed in a way, or at a rate that enables people in the communities to provide for the social, economic and cultural wellbeing and for their health and while:

   (a) Sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations;

   (b) Safeguarding the life supporting capacity of air, water, soil and ecosystems; and

   (c) Avoiding, remedying or mitigating the adverse effects of activities on the environment.

2. The use of the word "while" links the two parts of the definition and means "at the same time as"[84]. For the purpose of interpretation, one part is addressing development interests, and the other addressing intergenerational and environmental interests. However, the definition should be read as an "integrated whole"[85].

3. The definition requires management of natural and physical resources to be carried out in a way that achieves the objectives in s 5(2)(a), (b), and (c)[86]. Another way of viewing s 5(2)(a), (b), and (c) is as cumulative safeguards which must be met before the Act's sustainable management purpose is met[87].

4. Section 5 has been held by the Supreme Court to state a "guiding principle" intended to be applied by those performing functions under the Act, rather than a specifically worded purpose intended as an aid to interpretation[88]. By giving effect to a plan that has been prepared in accordance with part 2 there is no need to refer back to it when determining a plan change[89]. The exception is if a plan being given effect to is invalid, incomplete (including in respect of the obligations under s 8) or uncertain[90].

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[84] *Hall v Rodney District Council* Planning Tribunal Auckland A78/95, 15 August 1995 at 32 and *King Salmon* at [24](c).
[85] *Environmental Defence Society Inc v New Zealand King Salmon Company Ltd* at [24](c).
[86] *Hall v Rodney District Council* at 32.
[87] *Foxley Engineering Ltd v Wellington City Council* Planning Tribunal, W 12/94, 16 March 1994 at 40.
[88] *Environmental Defence Society Inc v New Zealand King Salmon Company Ltd* [2014] NZSC 38 at [24](a).
[89] *King Salmon* at [85].
[90] *King Salmon* at [88].

5. Sections 6 and 7 expand on s 5 and identify certain matters that are to be considered when judging if a proposal achieves the purpose of the Act while performing the council's functions described in part 4[91]. Section 8 occupies a special position under the Act and is integral to performance of functions under the Act.

Part 2 - s 6

6. Relevantly, s 6(a), (c) and (e) require:

   (a) The recognition and provision for the preservation of natural character and wetlands, lakes, rivers and their margins;

   (c) Protection of areas of significant and indigenous vegetation and significant habitats for indigenous fauna;

   (e) Recognition and provision for the relationship of Maori with ancestral water.

7. These are all matters of national importance and have been extensively discussed by the Court. All are relevant for the exercise of Council's functions under s 30 and the making of the Plan.

8. The preservation of natural character of lakes and rivers is of particular importance here. This is because the health and wellbeing of water has a significant impact on natural character. Where water quality is degraded, whether it be from point source or diffuse nutrients, there can be adverse effects on natural character from the presence of periphyton, algae, and other adverse effects. Sediment can impact on water clarity and along with pathogens impact on swimmability. Excess levels of nutrients in waterways can lead to nuisance biological growth, which in turn can impact on recreation and aesthetics.

9. Wetlands, the margins of rivers and lakes, areas of indigenous vegetation and habitats of indigenous fauna also rely on good water quality.

Part 2 - s *7*

10. Relevant subsections of s 7 include 7 (a), (aa), (d), (f), (g), and (h) and require decision-makers to have regard to:

    (a) Kaitiakitanga;

    (aa) The ethic of stewardship;

    (c) The maintenance and enhancement of amenity values;

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[91] *King Salmon* [at [25]; *New Zealand Rail v Marlborough District Council* [1994] NZRMA 70 at 85; *Trio Holdings v Marlborough District Council* (1996) ELRNZ 353 at 354-355.

(d) Intrinsic values of ecosystems;

(f) Maintenance and enhancement of the quality of the environment;

(g) Any finite characteristics of natural and physical resources;

(h) The protection of the habitat of trout and salmon.

11. The ethic of stewardship has not been the subject of much judicial comment and is not defined in s 2 of the Act. However, it can be considered an extension of kaitiakitanga (s 7(a))[92].

12. Subsections 7(c) and (f) require decision-makers to have regard to the "maintenance and enhancement" of amenity values and the quality of the environment. "Maintain" includes the meaning of protect, with protect meaning to "keep safe from harm or injury"[93]. There appears to be less discussion on the meaning of "enhance", but it is generally defined to mean increase or further improve the quality of[94].

13. Intrinsic values are defined in the Act as, in relation to ecosystems, those aspects of ecosystems and their constituent parts which have values in their own right, including:

(a) their biological and genetic diversity; and

(b) the essential characteristics that determine an ecosystem's integrity, form, functioning and resilience[95].

Part 2 – s 8

14. In achieving the purpose of the Act, decision-makers are to take into account the principles of the Treaty of Waitangi in relation to managing the use, development and protection of natural and physical resources.

15. The principles of the Treaty of Waitangi can be summarised as[96]:

(i) The Crown has an obligation to actively protect Maori interests;

(ii) The Crown and Maori have mutual obligations to act reasonably and in good faith;

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[92] Westlaw, Resource Management, A7.03.
[93] *Port Otago v Dunedin City Council* C004/02 at [41]-[42].
[94] https://en.oxforddictionaries.com/definition/enhance accessed 5 June 2021.
[95] See s 2.
[96] *Carter Holt Harvey Ltd v Te Runanga o Tuwharetoa Ki Kawerau* [2003] 2 NZLR 349 at [27].

(iii) The Treaty provides a basis for changing relationship and should always be progressively adapted;

(iv) There is a principle of mutual benefit that should be applied;

(v) The Treaty has the basic objective of two peoples living together in one country and this concept lays the foundation for the principle of partnership; and

(vi) The Crown has guaranteed rangatiratanga to all iwi, and the Crown would not allow one iwi an unfair advantage of another.

(vii) The Crown has an obligation to recognise rangatiratanga. This may involve the tribal right to manage resources in a manner compatible with Maori custom.

16. The obligation to take into the account the principles extends to local authorities exercising functions and powers under the Act[97].

[97] *Ngāti Maru Ki Hauraki Inc v Kruithof* [2005] NZRMA 1 (HC) at [57].

BEFORE COMMISSIONERS APPOINTED
BY THE HAWKE'S BAY 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 Hawke's Bay Regional Council Plan Change 9- Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments
AND	
IN THE MATTER	of submissions under clause 6 First Schedule
BY	**BEEF + LAMB NEW ZEALAND LIMITED** **Submitter**

MEMORANDUM OF COUNSE FOR BEEF+LAMB NEW ZEALAND LIMITED IN ANTICIPATION OF HEARING

8 June 2021

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MAY IT PLEASE THE COMMISSIONERS:

1. Beef+Lamb New Zealand Limited (B+LNZ) is a submitter to PC 9. It is presenting its case on Friday 11 June.

2. The purpose of this memorandum is to provide the Commissioners with a copy of the key PC 9 provisions B+LNZ is seeking changes to, with those changes marked up. Legal submissions will be filed in accordance with the timetable and will address the justification for the changes. However, it is thought that it might be helpful to give advance notice of the changes that are being proposed, given they were not specified in evidence in chief.

3. The key provisions that changes are sought to are:

   (a) OBJ TANK 4 and 14 to highlight the link between management of water quality and Schedule 26 in the context of the maintenance and improvement of water quality in the NPSFM.

   (b) OBJ TANK 4 also recognises the relationship of the maintenance and improvement of water quality in the NPSFM with the values in OBJ TANK 10 – 13 (catchment objectives).

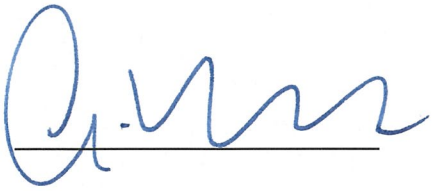
   (c) OBJ TANK 10 – 13 to improve the link with the ecosystem health objectives in Schedule 26 – particularly the excellent-good-fair-poor descriptors of ecosystem health.

   (d) POL TANK 1 has a minor change to reflect the attribute states in Schedule 26, again in the context of the maintenance and improvement of water quality in the NPSFM.

   (e) POL TANK XX and 21 separate the two parts of POL TANK 21, highlighting the 'avoid' requirement if there are effects from land use change that compromise the Schedule 26 outcomes in a separate policy.

   (f) POL TANK XX1 provides explicit policy support for farming under a catchment collective, industry programme or freshwater farm plan.

(g) POL TANK XX2 gives direction that consideration of resource consents for farming should contemplate common expiry dates to assist to address cumulative effects.



CP Thomsen

Counsel for B+LNZ Limited

8 June 2021

Changes to PC9 TANK recommended by Beef + Lamb NZ

Provisions sought to be amended by B+LNZ are:

- OBJ TANK 4
- OBJ TANK 10
- OBJ TANK 11
- OBJ TANK 12
- OBJ TANK 13
- OBJ TANK 14
- POL TANK 1
- POL TANK XX
- POL TANK 21
- New provision POL TANK XX1
- New provision POL TANK XX2

Changes recommended by s42A office in red underline or ~~red strikethrough~~

Changes sought be B+LNZ in blue underline or ~~blue strikethrough~~

Water Quality General

OBJ TANK 4 ~~Land and water use, contaminant discharge and nutrient loss activities are carried out so that~~[201.19] ~~t~~The ~~quality of the~~ TANK freshwater bodies ~~is~~ are managed to ensure that water quality is maintained where objectives are currently being met, or ~~is~~ improved in degraded waterbodies where objectives are not currently being met so that ~~they meet~~ the values in OBJ TANK 10-15 and ~~water quality attribute states~~ in Schedule 26 are provided for by 2040 ~~provided that:~~ and progress is made over the life of this Plan towards the long term target attribute states by the mixture of regulatory and non-regulatory provisions in this Plan. ~~Maintenance of a state is at the measured state[1].~~

~~a) For any specific water body where the attribute state is found to be higher than the target attribute state that given in Schedule 26, the higher state is to be maintained; and~~

~~b) Progress is made over the life of this Plan towards the long term target attribute states by the mixture of regulatory and non-regulatory provisions in this Plan. Maintenance of a state is at the measured state[2].~~

Catchment Objectives

OBJ TANK 10 ~~In combination with meeting the water quality states specified in Schedule 26, t~~The use and development of land, the discharge of contaminants and nutrients, and the taking, using damming and diverting of freshwater ~~is carried out~~ in the **Ahuriri** freshwater catchments shall be managed so that the mauri, water quality and water quantity are maintained where objectives are currently being met and ~~enhanced~~ ~~where necessary to enable~~ improved in degraded waterbodies where objectives are not currently met so that the values in Schedule 26.2 are provided for, and:

a) sediment in the Ahuriri estuary ~~sediments to be healthy and~~ does not accumulate excessively;
b) ~~healthy~~ ecosystems that contribute to the health of the estuary are healthy;
c) Ecosystem health is fair in the Ahuriri catchment;
d) ~~healthy and diverse~~ indigenous aquatic plant, fish and bird populations are diverse;
e) the domestic water needs of people and communities ~~to~~ are safely met~~meet their domestic water needs~~;
f) primary production water is available for community social and economic well-being; and ~~provide for~~;
g) ~~contribution to the healthy functioning of the~~ Te Whanganui a Orotū (Ahuriri)[126.15] estuary ecosystem is in a healthy functioning state and enables people to safely carry out a wide range of social, cultural and recreational activities including swimming and the collection of mahinga kai in the estuary.

OBJ TANK 11 ~~In combination with meeting the water quality states specified in Schedule 26, t~~The use and development of land, the discharge of contaminants and nutrients, and the taking, using,[29.53] damming and diverting of freshwater ~~is carried out~~ in the **Ngaruroro River catchment** shall be managed so that the mauri, water quality and water quantity are maintained in the mainstem above the Whanawhana Cableway and in the Taruarau River, and are improved in the tributaries

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~~[1] The state is as measured according to the method specified for each attribute. It does not allow for decline to a lower state within any band specified in the NPSFM:2014 (as amended 2017)~~

~~[2] The state is as measured according to the method specified for each attribute. It does not allow for decline to a lower state within any band specified in the NPSFM:2014 (as amended 2017)~~

and lower reaches where ~~necessary~~ degraded ~~to enable~~ so that the values in Schedule 26.3 are provided for, and;

a) ~~healthy~~ ecosystem health is excellent in the Upper Ngaruroro freshwater catchments (headwaters) and good in the Lower Ngaruroro and tributaries;
b) ~~healthy and diverse~~ indigenous aquatic plant, animal and bird populations are diverse especially whitebait, torrent fish and macroinvertebrate communities;
c) bird habitat on braided river reaches is protected;
d) there is a healthy trout fishery;
e) people ~~to~~ can safely carry out a wide range of social, cultural and recreational activities especially swimming and cultural practices of Uu and boating, including jet-boating in the braided reaches of the Ngaruroro;
f) ~~protection of~~ the natural character, instream values and hydrological functioning of the Ngaruroro mainstem and Taruarau and Omahaki tributaries are protected;
g) ~~collection of~~ mahinga kai to provide for social and cultural well-being can be collected;
h) the domestic water needs of people and communities ~~to~~ are safely met~~meet their domestic water needs~~;
i) the primary production water needs and ~~water required~~ and requirements for associated processing and other urban activities to provide for community social and economic well-being can be met;

and ~~provide for~~;

j) contribution to water flows and water quality in the connected Heretaunga Plains Aquifers can be provided for;
k) ~~contribution to the healthy functioning of~~ Waitangi Estuary ecosystem is in a healthy functioning state and ~~to~~ enables people to safely carry out a wide range of social, cultural and recreational activities and the collection of mahinga kai in the estuary.

OBJ TANK 12 ~~In combination with meeting the water quality states specified in Schedule 26, t~~The use and development of land, the discharge of contaminants and nutrients, and the taking, using damming and diverting of freshwater ~~is carried out~~ in the **Tūtaekurī River** catchment shall be managed so that the mauri, water quality and water quantity are maintained in the upper reaches of the mainstem and are improved where degraded in the tributaries and lower reaches ~~where necessary to enable~~ so that the values in Schedule 26.1 are provided for, and:

a) ~~healthy~~ ecosystem health is excellent in the Upper Tūtaekurī catchments (headwaters) and good in the Lower Tūtaekurī and tributaries;
b) ~~healthy and diverse~~ indigenous aquatic and bird populations are diverse especially whitebait, torrent fish, macroinvertebrate communities; ~~a healthy~~
c) there is a healthy trout fishery;
d) people ~~to~~ can safely carry out a wide range of social, cultural and recreational activities, especially swimming and cultural practices of Uu and boating;
e) ~~protection of the~~ natural character, instream values and hydrological functioning of the Tūtaekurī mainstem and Mangatutu tributary are protected;
f) ~~collection of~~ mahinga kai to provide for social and cultural well-being can be collected;
g) the domestic water needs of people and communities ~~to~~ are safely met ~~meet their domestic water needs~~;
h) the primary production water needs and ~~water required~~ requirements for associated processing and other urban activities to provide for community social and economic well-being are met;

and ~~provide for~~;

i) ~~contribution to the healthy functioning of~~ Waitangi Estuary ecosystem is in a healthy functioning state and ~~to~~ enables people to safely carry out a wide range of social, cultural and recreational activities and the collection of mahinga kai in the estuary.

OBJ TANK 13 ~~In combination with meeting the water quality states specified in Schedule 26, t~~The use and development of land, the discharge of contaminants and nutrients, and the taking, using damming and diverting of freshwater ~~is carried out~~ in the **Karamū and Clive Rivers** catchment shall be managed so that the mauri, water quality and water quantity are maintained where objectives are currently being met and ~~enhanced~~ ~~where necessary to enable~~ improved in degraded waterbodies where objectives are not currently met so that the values in Schedule 26.4 are provided for, and:

a) ~~healthy~~ ecosystem health is fair in the Karamū and Clive Rivers;
b) ~~healthy and diverse~~ indigenous aquatic and bird populations are healthy and diverse, especially black patiki, tuna and whitebait, and ~~healthy~~ macroinvertebrate communities;
c) people ~~to~~ can safely carry out a wide range of social, recreational, and cultural activities, including swimming and cultural practices of Uu and rowing and waka ama in the Clive/Karamū;
d) ~~collection of~~ mahinga kai to provide for social and cultural well-being can be collected;
e) the domestic water needs of people and communities ~~to~~ are safely met~~meet their domestic water needs~~;
f) the primary production water needs and ~~water required~~ requirements for associated processing and other urban activities to provide for community social and economic well-being can be met;

and ~~provide for~~;

g) ~~contribution to the healthy functioning of t~~The Waitangi Estuary ecosystem is in a healthy functioning state and ~~to~~ enables people to safely carry out a wide range of social, cultural and recreational activities and the collection of mahinga kai in the estuary.

OBJ TANK 14 ~~In combination with meeting the water quality states specified in Schedule 26, t~~The use and development of land, the discharge of contaminants and nutrients, and the taking and using of freshwater ~~is carried out so~~ shall be managed so that the mauri, water quality, water quantity and groundwater levels are maintained where objectives are currently being met ~~a~~ and improved where objectives are not currently met in the **Groundwater** connected to the Ngaruroro, Tūtaekurī and Karamū rivers and their tributaries ~~is~~ are managed ~~to enable~~ so that the values in Schedule 26 are provided for, and:

a) the domestic water needs of people and communities ~~to~~ are safely meet ~~their domestic water needs~~ and ~~to enable~~ the provision of safe and secure supplies of water for municipal use is enabled;
b) the primary production water needs and water ~~required~~ requirements for associated processing and other urban activities to provide for community social and economic well-being are met;

and ~~provide for~~;

c) the maintenance of groundwater levels are at an equilibrium that accounts for annual variation in climate and prevents long term decline or seawater intrusion;
d) contribution to water flows and water quality in connected surface waterbodies.

Priority Management Approach

POL TANK 1 The Council will regulate land use activities and will work with mana whenua, ~~with~~ landowners, local authorities, industry and community groups, ~~mana whenua~~ and other stakeholders ~~will regulate or~~ to manage land use activities ~~and surface and groundwater bodies~~ so that the 2040 target water quality attribute states described in Schedule 26 ~~attributes~~ are maintained ~~at their current state~~ or where ~~required~~ degraded improved ~~show an improving trend towards the water quality targets shown in Schedule 26~~ by focussing on:

a) water quality improvement in priority sub-catchments (as described in Schedule 28) where water quality is not meeting specified freshwater quality targets and not providing for the values in Schedule 26;
b) sediment management as a key contaminant pathway to also address phosphorus and bacteria losses;
c) the significant environmental stressors of excessive sedimentation and macrophyte growth in lowland rivers and nutrient loads entering ~~the~~ Te Whanganui ā Orotu (Ahuriri) and Waitangi estuaries;
d) the management of riparian margins;
e) the management of urban stormwater networks and the reduction of contaminants in urban stormwater;
f) the protection of water quality for domestic use and registered drinking water supplies. ~~and municipal water supply~~. 201.32, 135.18, 195.31, 233.10
g) 195.45

Land Use Change and Nutrient Losses

POL TANK XX Council will regulate production land use change to manage the potential adverse effects of increases in diffuse discharge of nitrogen on freshwater quality objectives and on the maintenance or achievement of the relevant attribute targets in Schedule 26, and will avoid land use change that will result in increased nitrogen loss that contributes to water quality target attribute states in Schedule 26 for dissolved nitrogen not being met.

POL TANK 21 When making decisions and setting conditions on resource consent applications for change in production land use, ~~T~~the Council must ~~will~~ ~~regulate production land use change to manage the remedy or mitigate the potential impact of increases in diffuse discharge of nitrogen on freshwater quality objectives by regulating land and water use changes that modelling indicates are likely to result in increased nitrogen loss (modelled on an annual, whole of property or whole of farm or collective enterprise basis) and in making decisions on resource consent applications, the Council will take into account~~:

a) Have regard to whether freshwater quality objectives or targets are being met in the catchment where the activity is to be undertaken as a result of modelled nitrogen losses from the land use change;
b) ~~w~~Where any relevant TANK Industry Programme or Catchment Collective is in place, have regard to whether ~~the extent to which~~ the proposed change~~d~~ in production land use activity is consistent with achieving the Industry Programme or Collective outcomes, mitigation measures and timeframes;
c) Have regard to whether any mitigation measures proposed by the applicant ~~required~~, (including those where model results are not available) and timeframes by which they are to be implemented ~~that are necessary to~~ will ensure the actual or potential nitrogen

contaminant loss occurring from the property, in combination with other nitrogen contamination losses in the catchment will be consistent with meeting 2040 freshwater ~~quality~~ target attribute states in Schedule 26 ~~objectives~~ consequential, including performance in relation to industry good practice, efficient use of nutrients and minimisation of nutrient losses~~;~~.

~~and will;~~

~~avoid land use change that will result in increased nitrogen loss that contributes to water quality objectives and target attribute states in Schedule 26 for dissolved nitrogen not being met.~~
210.37, 210.42, 180.31, 135.27, 195.46, 54.73 et al conseq

Industry Programmes ~~and~~ Catchment ~~Management~~Collectives, and Freshwater Farm Plans

POL TANK XX1 The Council will enable farm operators within an Industry Programme or Catchment Collective, or that have a **Freshwater Farm Plan** in place, approved under Schedule 30, to undertake farming activities that will contribute to the 2040 target water quality attribute states described in Schedule 26 being maintained or where degraded improved.

POL TANK XX2 When considering applications for the use of production land or the change in use of production land, the Council will set common expiry dates in each of the TANK catchments to enable effective and efficient management consistent with the achievement of the target attribute states set out in Schedule 26 by 2040, and will set consent durations that provide a periodic opportunity to review the cumulative effects of productive land use and to take into account potential effects of changes in:

a) knowledge about the water bodies;
b) knowledge about the effects of diffuse discharges on water quality, including likely attenuation of nitrate nitrogen between the root zone and any surface waterway;
c) patterns of productive land use;
d) the Priority Catchment status of the relevant catchment;
e) the number, location and extent of Catchment Collectives, farm operators in Industry Programmes, and farm operators with Freshwater Farm Plans;
f) development of new technology to avoid, remedy or mitigate the adverse effects of productive land use on freshwater quality; and
g) climate change effects.

#197

Before the Proposed Plan Change 9 (PPC9) Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments Hearings Panel

In the matter of	of the Resource Management Act
And	Water quality and ecology

Summary of primary evidence of Dr Michael John Crawshaw Greer on behalf of Beef + New Zealand (water quality and freshwater ecology)

Date: 11th June 2021

BACKGROUND

1 I have been instructed by Beef + Lamb New Zealand (Beef + Lamb) to prepare evidence in respect of technical matters related to the Objectives and Schedules (26) in Proposed Plan Change 9 – Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments (PPC9)

2 In my statement of primary evidence I address the following matters:

2.1 Whether the Freshwater Quality Objectives in Schedule 26 are aligned with the wording of the relevant Catchment Objectives;

2.2 The areas in the TANK catchments where Freshwater Quality Objectives are not being met and the primary land-uses in those areas;

2.3 The ability of Hawke's Bay Regional Council's (HBRC's) monitoring network to detect future changes in water quality caused by changing practices on sheep and beef farms; and

2.4 The technical rigour of the individual Freshwater Quality Objectives in Schedule 26 and my recommended changes to the schedule.

3 I have read the addendum to the S42A report released since lodgement of my statement of primary evidence (including the statements of reply evidence of Dr Alexandra Natalie Haidekker[1] and Ms Anna Louise Madarasz-Smith[2]. The technical analysis provided in that document has not changed my opinion on the matters set out in para. 2. Accordingly, this summary largely reflects that provided in my statement of primary evidence.

ALIGNMENT BETWEEN SCHEDULE 26 AND VALUES

4 The ambiguity of the wording of the values in OBJ TANK 10 to OBJ TANK 13, combined with the inconsistencies in the level of environmental protection provided by the objectives in Schedule 26 means that it is unclear how one would assess whether the ecosystem health values are provided for, or if the Schedule 26 freshwater objectives actually provide for the values.

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[1]Statement of Reply Evidence of Alexandra Natalie Haidekker for Hawke's Bay Regional Council in the Matter of the Resource Management Act 1991 and in the Matter of Proposed Plan Change 9 to the Hawke's Bay Regional Resource Management Plan

[2] Statement of Reply Evidence of Anna Louise Madarasz-Smith for Hawke's Bay Regional Council in the Matter of the Resource Management Act 1991 and in the Matter of Proposed Plan Change 9 to the Hawke's Bay Regional Resource Management Plan

5 The macroinvertebrate objectives in Schedule 26 suggest that the intent of PPC9 is to achieve a value of excellent ecosystem health in the Upper Ngaruroro and Upper Tūtaekurī Rivers Freshwater Quality Management Units (FQMUs), good ecosystem health in the Lower Ngaruroro and Lower Tūtaekurī Rivers FQMUs and fair ecosystem health in the Lower tributaries FQMU. If this is the case then it is my opinion that it should be explicitly stated in the clauses of OBJ TANK 11 to OBJ TANK 13. Furthermore, the objectives in Schedule 26 should be updated to be consistent with those values.

BENCHMARKING AGAINST FRESHWATER QUALITY OBJECTIVES

6 A number of the Schedule 26 Freshwater Objectives are not being met throughout the TANK catchments. However, while agriculture is the predominant land-use in most FQMUs, in many (but not all) instances its contribution to objectives not being met appears to be limited and/or of little ecological consequence. Specifically:

6.1 Through most of the TANK catchments macroinvertebrate communities are indicative of good or excellent aquatic ecosystem health. However, agriculture and cropping may be driving degraded macroinvertebrate community health throughout the lowland tributaries in the area.

6.2 The dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP) Schedule 26 objectives are not met throughout much of the TANK catchments and, in catchments without significant cropping, agriculture is the most likely cause of this. However, non-compliance with the DIN and DRP objectives does not appear to affect ecosystem health in any meaningful way, as they are not directly linked to periphyton or macrophyte growth in rivers or estuarine eutrophication (through a specific target load reduction).

6.3 Agriculture may be the reason why the visual clarity objectives are not met through much of the Ngaruroro and Tūtaekurī Tributaries and Lower Ngaruroro and Lower Tūtaekurī Rivers FQMUs and why *E. coli* targets are not met through much of the Lowland Tributaries and Ngaruroro and Tūtaekurī Tributaries FQMUs.

REVIEW OF EXISTING MONITORING NETWORKS

7 It is likely that HBRC's existing monitoring network in the TANK catchments is sufficiently robust that changes in water quality and ecology associated with

shifting land-use practices should be detectable in most sub-catchments. However, it is probable that changes in a minority of sub-catchments can only be assessed by applying mass-balance approaches to water quality data collected at nearby sites which means the current network can not detect any variability in water quality trends between those catchments or any changes in their aquatic ecology.

REVIEW OF THE SCHEDULE 26 FRESHWATER OBJECTIVES

8 My recommended changes to Schedule 26 are summarised in Table 1 of my statement of primary evidence, and for the sake of brevity I do not repeat them here. However, my main concerns with the current objectives are around the use of largely untested provisional guidelines, the incorrect selection of nutrient criteria and the use of periphyton cover instead of the compulsory biomass attribute.

COMMENTS ON WATER QUALITY COMPONENTS OF SCHEDULE 30

9 Clause 2.1(b) of Schedule 30: Section B requires that environment plans for each Catchment Collective or Industry Programme include statements about specified water quality outcomes in Schedule 26. In my opinion such statements will need to include:

9.1 An assessment of whether the value of aquatic ecosystem health is being provided for at the closest water quality monitoring site based on key ecological indicators (invertebrates, fish, periphyton and macrophytes); and

9.2 If the value of aquatic ecosystem health is not provided for, an assessment of the likely contaminants causing this.

10 This assessment will ensure that environment plans to prioritise actions that reduce those contaminants which are having the greatest environment impact.

11 I cannot comment on the water quality benefits of land management outside of the riparian zone as it is outside my area of expertise (Mr Gerry Kessels and Mr Thomas Orchiston can comment on this further). However, in my opinion water quality in the TANK catchments is likely to improve towards the Schedule 26 objectives as long as:

11.1 The environment plans lead to the widespread adoption of good management practice; and

11.2 Good management practice is effective at reducing contaminant losses from farm.

Before the Proposed Plan Change 9 (PPC9) Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments Hearings Panel

In the matter of of the Resource Management Act

And Water quality and ecology

Statement of primary evidence of Dr Michael John Crawshaw Greer on behalf of Beef + New Zealand (water quality and freshwater ecology)

Date: 7th May 2021

INTRODUCTION

1 My full name is Dr Michael John Crawshaw Greer. I am employed as a Senior Scientist (Freshwater) by Aquanet Consulting Limited.

2 I was instructed by Beef + Lamb New Zealand (Beef + Lamb) to prepare evidence in respect of technical matters related to the Objectives and Schedules (26) in Proposed Plan Change 9 – Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments (PPC9).

QUALIFICATIONS AND EXPERIENCE

3 I hold the qualifications of a PhD degree in Ecology (2014) and a Bachelor of Science in Zoology from the University of Otago (2010).

4 I have worked for local government, the Department of Conservation and NIWA. I have over 9 years of work experience in freshwater ecology and water quality. Since the 4th of March 2018 I have been employed by Aquanet Consulting Ltd. Prior to that I was employed by the Greater Wellington Regional Council (GWRC) as a Senior Environmental Scientist and Environment Canterbury as an Ecology Scientist.

5 Since joining Aquanet I have been engaged by 15 different regional, district or city councils; the Department of Conservation and various private companies/corporations to provide a variety of technical and scientific services in relation to water quality and aquatic ecology.

6 I have authored or co-authored a number of reports that have informed or are informing the development and implementation of regional plan change processes:

6.1 For Environment Canterbury: I was the lead author of the report that formed the basis of the inanga spawning provisions in Plan Change 4 to the Land and Water Regional Plan (LWRP), and the technical report underpinning the water quality standards in Part B of Plan Change 5 of the LWRP.

6.2 For GWRC I am the technical lead for the Surface Water Quality and Ecology expert Panel for Te Whanganui-a-Tara Whaitua process and am the lead author of the technical report outlining the expert panel process and outputs.

7 Since 2017 I have been acting on behalf of the GWRC during the council hearing and environment court appeal processes for the Proposed Natural Resources Plan Proposed Natural Resources Plan (PNRP) for the Wellington Region. This has involved writing and presenting evidence for council and environment court hearings, contributing to mediation and attending expert conferencing on matters relating to the freshwater quality and aquatic ecosystem health, stream reclamation and drain management provisions in the PNRP. I also acted on behalf of Federated Farmers New Zealand during the environment court appeals on Plan Change 10 (Lake Rotorua Nutrient Management) to the Bay of Plenty Regional Natural Resources Plan, and as part of that process engaged in expert conferencing on the nutrient load limits set in the plan.

8 I have worked as a technical advisor on behalf of the consenting authority, the applicant and/or submitters on well over 120 resource consent applications, compliance assessments and/or prosecution cases for a wide range of activities, including stream reclamation, water abstraction, water storage and discharges to land and water.

9 My work routinely involves providing assessment of effects on water quality and/or aquatic ecology, recommending or assessing compliance with resource consent conditions, and designing or implementing water quality/aquatic ecology monitoring programmes at the scale of a specific activity and at a wider catchment or regional scale. As part of my previous role at GWRC I designed the Urban Streams Monitoring Programme which is run in conjunction with Wellington City Council and led the Rivers Water Quality and Ecology monitoring programme. While at Aquanet I have designed the monitoring programmes for the Levin and Foxton Beach Global Stormwater consents and contributed to the monitoring protocols behind the Department of Conservation's Freshwater Tier 1 Biodiversity Monitoring Programme Pilot.

10 I have authored or co-authored a number of catchment and region-wide water quality reports for the GWRC (Whaitua Te Whanganui-a-Tara and Ruamāhanga Whaitua), Environment Southland (Whole Region), and Environment Canterbury (Lower Waitaki Water Zone and Waimakariri Water Zone).

11 Between 2015 and 2017 I sat on the New Zealand Fish Passage Advisory Group. During that time, I secured funding from regional councils around the country for the development of *The New Zealand Fish Passage Guidelines and* drove the inclusion of *minimum design standards for fish passage at instream structure*s that can be carried over directly into regional plans.

12 I am a member of New Zealand Freshwater Sciences Society.

CODE OF CONDUCT

13 I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing my evidence and will continue to comply with it while giving oral evidence before the Hearing Commissioners. My qualifications as an expert are set out above. Except where I state I rely on the evidence of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from my expressed opinions.

SUMMARY

14 My name is Dr Michael John Crawshaw Greer.

15 I have been asked by Beef + Lamb to provide water quality and ecology evidence in relation to their submission on the Freshwater Quality Objectives in Schedule 26 of PPC9.

16 My statement of evidence addresses the following matters:

16.1 Whether the Freshwater Quality Objectives in Schedule 26 are aligned with the wording of the relevant Catchment Objectives;

16.2 The areas in the TANK catchments where Freshwater Quality Objectives are not being met and the primary land-uses in those areas;

16.3 The ability of Hawke's Bay Regional Council's monitoring network to detect future changes in water quality caused by changing practices on sheep and beef farms; and

16.4 The technical rigour of the individual Freshwater Quality Objectives in Schedule 26 and my recommended changes to the schedule.

17 From a technical perspective the ambiguity of the wording of the values in OBJ TANK 10 to OBJ TANK 13, combined with the inconsistencies in the level of environmental protection provided by the objectives in Schedule 26 means that it is unclear:

17.1 How one would assess whether the ecosystem health values are provided for; and

17.2 Whether some of the Schedule 26 freshwater objectives actually provide for the values.

18 If it is the intent of the PPC9 to achieve a value of excellent ecosystem health in the Upper Ngaruroro and Upper Tūtaekurī Rivers FMQU, good ecosystem health in the Lower Ngaruroro and Lower Tūtaekurī Rivers FMQUs and fair ecosystem health in the Lower tributaries (as the macroinvertebrate objectives suggest), then it is my opinion that it should be explicitly stated in the clauses of OBJ TANK 11 to OBJ TANK 13. Furthermore, where the objectives in Schedule 26 should be updated to be consistent with those values.

19 Water quality data in the latest state of the environment report from HBRC suggest that a number of the Schedule 26 Freshwater Objectives

are not being met throughout the TANK catchments. However, while agriculture is the predominant land-use in most Freshwater Quality Management Units (FMQUs) in many (but not all) instances its contribution to objectives not being met appears to be limited and/or of little ecological consequence. Specifically:

19.1 Through most of the TANK catchments macroinvertebrate communities are indicative of good or excellent aquatic ecosystem health. However, agriculture and cropping may be driving degraded macroinvertebrate community health throughout the lowland tributaries in the area. A likely explanation for this is excessive macrophyte growth bought about by a lack of riparian shading. This increased macrophyte growth may not be a direct effect of ongoing agricultural land-use, but rather the result of prior vegetation clearance and legacy sediment effects.

19.2 While the Schedule 26 pH targets are not meet at most State of the Environment sites in the TANK catchments, this is likely the result of natural processes rather than the effects of land-use.

19.3 The Schedule 26 ammonia objectives are not met in a number of streams due to occasional spikes causing the maximum concentration threshold to be exceeded. However, agriculture's contribution to this is difficult to ascertain given that ammonia is more commonly associated with point-source rather than diffuse discharges.

19.4 The dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP) Schedule 26 objectives are not met throughout much of the TANK catchments, and in catchments without significant cropping agriculture is the most likely cause of this. However, non-compliance with the DIN and DRP objectives does not appear to affect ecosystem health in any meaningful way, as they are not linked to periphyton or macrophyte growth.

19.5 The Schedule 26 visual clarity objectives are generally met in the Upper Ngaruroro and Upper Tūtaekurī Rivers and Lowland Tributaries FMQUs. However, agriculture may the reason why the relevant clarity objectives are not met through much of the Ngaruroro and Tūtaekurī Tributaries and Lower Ngaruroro and Lower Tūtaekurī Rivers FMQUs. Similarly, agriculture is the most likely cause of the Schedule 26 *E. coli* targets not being met through much of the Lowland Tributaries and Ngaruroro and Tūtaekurī Tributaries FMQUs.

19.6 Agriculture does not appear to be causing the Schedule 26 periphyton cover, turbidity or nitrate objectives to be exceeded through most of the TANK catchments.

20 It is likely that HBRC's existing monitoring network in the TANK catchments is sufficiently robust that changes in water quality and ecology associated with shifting land-use practices should be detectable in most sub-catchments. However, it is probable that changes in the following sub-catchments can only be assessed by applying mass-balance approaches to water quality data collected at nearby sites (parenthesised N, T and Ks denote sub-catchments in the Ngaruroro River, Tūtaekurī River and Karamū stream catchments respectively):

- Whanaukini Stream (N);
- Otamauri Stream (N);
- Mangatahi Stream (N);
- Kikiwhero Stream (N);
- Otakarara Stream (T);
- Waikonini Stream (T);
- Waiiti Stream (T);
- Irongate Stream (K);
- Louisa Stream (K); and
- Mangarau Stream (K).

21 This means that the current network can probably not detect any variability in water quality trends between the catchments listed above, nor can it be used to detect any changes in their aquatic ecology.

22 My recommended changes to Schedule 26 are summarised in Table 1. My main concerns with the current objectives are around the use of largely untested provisional guidelines (macrophytes, cyanobacteria, temperature), the incorrect selection of nutrient criteria for periphyton growth from Matheson *et al.* (2016) and the use of periphyton cover instead of biomass, which is a compulsory attribute in the National Policy Statement for Freshwater Management.

23 The recommended changes to Schedule 26 set out in Table 1 would increase the number of streams meeting the DIN and DRP objectives. However, this is unlikely to affect periphyton growth in the TANK catchments as it is already low in most places despite the current DIN and DRP objectives being exceeded.

Table 1: Recommended changes to the freshwater objectives in Schedule 26 and whether those changes are supported by HBRC's suggested amendments (Appendix 1B of the S42A report).

Attribute	FMQU	Recommended change	Change consistent with HBRC's suggested amendments
DIN	Upper Ngaruroro and Upper Tūtaekurī Rivers	Change to 0.1 mg/L (average conc.)	No
	Lower Ngaruroro and Lower Tūtaekurī Rivers	Change to 0.63 mg/L (average conc.)	
	Ngaruroro and Tūtaekurī Tributaries		
	Lowland Tributaries	Change to reflect current state	
TP	Upper Ngaruroro and Upper Tūtaekurī Rivers	Change to 0.014 mg/L (average conc.; currently DRP)	
DRP	Lower Ngaruroro and Lower Tūtaekurī Rivers	Change to 0.011 mg/L (average conc.; currently DRP)	
	Ngaruroro and Tūtaekurī Tributaries		
	Lowland Tributaries	Change to reflect current state	
Temperature	All	Delete	Yes
Turbidity			
pH			
E. coli	Upper Ngaruroro and Upper Tūtaekurī Rivers	Change to • Median ≤130/100mL • 95th Percentile ≤540/100mL • % exceedances over 260/100 mL <20% • % exceedances over 540/100 mL <5%	
	Lower Ngaruroro and Lower Tūtaekurī Rivers	Change to • Median ≤130/100mL • 95th Percentile ≤1000/100mL • % exceedances over 260/100 mL <30% • % exceedances over 540/100 mL <10%	
Deposited sediment	Upper Ngaruroro and Upper Tūtaekurī Rivers	Delete seasonal objective of 15% cover for salmonid spawning	
	Lowland Tributaries	Delete for naturally soft-bottomed streams	
Periphyton biomass	Upper Ngaruroro and Upper Tūtaekurī Rivers	Amend to ≤50 mg chl-a/m^2	No
	Lower Ngaruroro and Lower Tūtaekurī Rivers	Amend to ≤120 mg chl-a/m^2	Yes
	Ngaruroro and Tūtaekurī Tributaries	add ≤120 mg chl-a/m^2	No
Cyanobacteria	All	Delete	No
Macrophytes	Lowland Tributaries		
Macroinvertebrates	Lowland Tributaries	Only stipulate MCI-sb for naturally soft-bottomed streams	Yes

SCOPE OF EVIDENCE

24 My statement of evidence addresses the following matters:

24.1 Whether the Freshwater Quality Objectives (the objectives) in Schedule 26 are aligned with the wording of the relevant Catchment Objectives (OBJ TANK 10 – OBJ TANK 13);

24.2 The areas in the TANK catchments where the objectives are not being met and the primary land-uses in those areas;

24.3 The ability of Hawke's Bay Regional Council's monitoring networks to detect future changes in water quality caused by changing practices on sheep and beef farms; and

24.4 The technical rigour of the individual objectives in Schedule 26 and any recommended changes to the schedule.

25 In preparing my evidence I have considered the following:

25.1 The relevant literature on the effects of water quality on aquatic ecosystem health and human health. A list of these documents are provided in para. 115 to para. 143;

25.2 The relevant parts of the Hearing Report on Proposed Plan Change 9 - Tūtaekurī Ahuriri Ngaruroro Karamū Catchment Area[1] (The S42A report) report including:

25.2.1 Appendix 1B Recommended Changes to PPC – Schedules;

25.2.2 Appendix 9 Technical Memo – Water quality attributes – Schedule 26; and

[1] Hearing Report on Proposed Plan Change 9 - Tūtaekurī Ahuriri Ngaruroro Karamū Catchment Area. 15 April 2021. Hawke's Bay Regional Council Publication No. 5550

25.2.3 The Hawke's Bay Regional Council (HBRC) technical report that provides the technical background on how the Freshwater Quality Objectives in Schedule 26 were chosen (Haidekker, 2019)[2].

26 My conclusions are limited to technical matters and I do not provide recommendations on the PPC9 policy framework. My evidence is also limited to the matters of water quality and aquatic ecology in rivers. I do not consider any matters related to estuarine or wetland water quality or ecology except where there is a direct link with the rivers objectives in Schedule 26.

WHETHER THE SCHEDULE 26 FRESHWATER QUALITY OBJECTIVES PROVIDE FOR THE VALUES IDENTIFIED IN OBJ TANK 11 TO OBJ TANK 13

27 In 2015 the Ministry for the Environment (MfE) released a guidance document outlining the approach regional councils should use to implement the National Objective Framework (NOF) in the National Policy Statement for Freshwater Management (NPS-FM) 2014 (MfE, 2015). This approach involved:

27.1 Identifying **values** – Values are intrinsic qualities or uses that people and communities appreciate about freshwater bodies and wish to see recognised in the on-going management of those freshwater bodies.

27.2 Identifying **attributes** that need to be managed to provide for each value – Attributes are characteristics or properties of fresh water that need to be managed for a particular value.

[2] Haidekker, S. (2019) Supporting water quality information for the development of limits and targets by the TANK Group: Rivers and Streams. Hawke's Bay Regional Council Technical Report RM19-252. Napier, New Zealand: Hawke's Bay Regional Council.

27.3 Choosing f**reshwater objectives** for each attribute at a level that provides for each value – A freshwater objective is an environmental outcome that describes the environmental state required for the identified values for fresh water to be achieved.

27.4 Setting **limits** that control the maximum amount of resource use to a level that enables freshwater objectives to be met – A limit is a specific quantifiable amount that links the freshwater objective (the desired state) to use of the freshwater resource.

27.5 Determining **methods** that ensure that limits and freshwater objectives are met.

28 While there is uncertainty about the applicability of the approach set out above to the NOF in the NPS-FM 2020, especially given the new terms introduced in that document (visions, environmental outcomes, etc.), the logic of setting freshwater objectives at a level that provides for the identified values is still relevant from a scientific standpoint.

29 It is my understanding from reading PPC9 and the S42A report that OBJ TANK 11 to OBJ TANK 13 set out the values for each Freshwater Quality Management Unit (FMQU), while Schedule 26A sets freshwater objectives in order to achieve those values.

30 An assessment of the appropriateness of this approach from a policy perspective is outside of the scope of my evidence. However, from a technical perspective the ambiguity of the wording of the values in OBJ TANK 10 to OBJ TANK 13, combined with the inconsistencies in the level of environmental protection provided by the objectives in Schedule 26 means that it is unclear:

30.1 How one would assess whether the ecosystem health values are provided for; and

30.2 Whether some of the Schedule 26 freshwater objectives actually provide for the values.

31 Applying the term “healthy” to aquatic ecosystems, aquatic life and aquatic plants in the clauses of OBJ TANK 11 to OBJ TANK 13 makes it difficult to determine when the value is met. The four-stage NPS-FM attribute states (A-D) for aquatic ecosystem health are based on the poor-fair-good-excellent scale that has been used describe macroinvertebrate community health in New Zealand for many years (Stark and Maxted, 2007). Thus, applying this terminology to the values related to water quality and ecology in OBJ TANK 11 to OBJ TANK 13 would make the intent a lot clearer and would enable more effective reporting against the values.

32 The macroinvertebrate community is an important component of the stream ecosystem. Macroinvertebrates are a critical part of the food web and are affected by physical, chemical and biological conditions. In addition, their sedentary nature and relatively long life span means that they represent local conditions and show the effects of both short and long-duration stressors. Sensitivity to pollution and other physico-chemical stressors differs between macroinvertebrate taxa, and the composition of the invertebrate community in a stream can provide valuable information about how the state and trends in water quality and habitat are impacting ecosystem function. Consequently, benthic macroinvertebrates are one of the most widely used biological indicators of river and stream ecosystem health.

33 The Macroinvertebrate Community Index (MCI) objectives in Schedule 26 of PPC9 and Appendix 1B of the S42A report suggest that the desired level of ecosystem health is excellent in Upper Ngaruroro and Upper Tūtaekurī Rivers (UNUTR) FMQU, good in the Ngaruroro and Tūtaekurī Tributaries (NTT) and Lower Ngaruroro and Lower Tūtaekurī Rivers FMQUs (LNLTR), and fair in the Lowland Tributaries (LT) FMQU. However, other objectives in Schedule 26 contradict this, with the periphyton biomass objective for the Upper Tūtaekurī River set at the NPS-FM 2020 B attribute state, when the A state aligns with the corresponding ‘excellent’ MCI and the periphyton cover objectives for that river.

34 If it is the intent of the PPC9 to achieve a value of excellent ecosystem health in the UNUTR FMQU, good ecosystem health in the NTT and LNLTR FMQUs and fair ecosystem health in the LT FMQU, then it is my opinion that it should be explicitly stated in the clauses of OBJ TANK 11 to OBJ TANK 13. Furthermore, the objectives in Schedule 26 should be updated to be consistent with those values (see para. 82 to par. 111)

BENCHMARKING AGAINST FRESHWATER QUALITY OBJECTIVES AND IDENTIFICATION OF POTENTIAL DRIVERS WHERE THEY ARE NOT MET

35 The following sections of my evidence (para. 37 to para. 59 and Table 2) benchmark water quality data from HBRC's State of the Environment (SoE) monitoring network and NIWA's National River Water Quality Network (NRWQN) monitoring networks against the Schedule 26 objectives, and provides a qualitative narrative assessment of the contribution of different land-uses to objectives not being met.

36 Due to time constraints all water quality (except pH for the NRWQN monitoring site on the Ngaruroro River) and landcover data[3] used in this assessment have been sourced from Haidekker and Madarasz-Smith (2020). This means that the Schedule 26 objectives for deposited sediment, dissolved oxygen, temperature and periphyton biomass cannot be benchmarked due to data limitations.

37 Data from the SoE site on the Poporangi Stream and the NRWQN site on the Ngaruroro River at Chesterthorpe have also not benchmarked as flow binned summary statistics for those sites are not provided in Appendix A of Haidekker and Madarasz-Smith (2020). While data are also not provided for the NRWQN site on the Ngaruroro River at Kuripapango, it is the only site on the Ngaruroro River on the UNUTR FMQU and provides the only indication of natural state in that catchment. As such, I have drawn on data presented in tables and text of Haidekker and

[3] All landcover figures are generalised estimates and may not reflect upstream landcover at a specific SoE site

Madarasz-Smith (2020) to bench mark this site. This was not done for the other two sites mentioned above due to time constraints and the presence of SoE sites close by meaning that it was not necessary to describe the general state of water quality in the relevant FMQUs.

Macroinvertebrates

38 The macroinvertebrate community is an important component of the stream ecosystem and are one of the most widely used biological indicators of river and stream ecosystem health (see para.32 and para. 33).

39 MCI scores are generally indicative of good or excellent macroinvertebrate community health throughout the upper parts of Ngaruroro and Tūtaekurī river catchments (Haidekker and Madarasz-Smith, 2020), with the relevant Schedule 26 objectives met at all sites in the UNUTR and NTT FMQUs (Table 2) and at all but the most downstream sites in the LNLTR FMQU (Table 2). In contrast, there is evidence of degraded macroinvertebrate community health throughout the lowland parts of the TANK catchments, with the relevant Schedule 26 objectives not being met at the most downstream sites in the LNLTR FMQU (objective set at good community health) and at all but one site in the LT FMQU (objective set at fair community health) (Table 2).

40 The specific drivers of degraded macroinvertebrate community health in the lower parts of the TANK catchments cannot be determined with certainty from the available (at time of writing) data. Nevertheless, it is not unexpected given that lowland streams are often the most degraded in the catchment due to increasing agricultural and urban intensity in the downstream direction (i.e., most intensive land and large urban centres occur on low gradient land close to the coast). Both urban and agricultural land-use can lead to habitat modification, increased contaminant concentrations and greater sediment input (Piggott *et al.*, 2012; Walsh *et al.*, 2005). Thus, it is common to see poorer macroinvertebrate community health in the lower parts of river catchments (Niyogi *et al.*, 2007).

41 One possible explanation for degraded macroinvertebrate community health in the LT FMQU that has been identified by HBRC[4] is excessive macrophyte growth bought about by a lack of riparian shading. This explanation is supported by the local studies (Matheson *et al.*, 2017), my own benchmarking against the Schedule 26 macrophyte objective for the LT FMQU (Table 2), and an assessment of the available dissolved oxygen data (minimum concentrations at certain sites < 3 mg/L). At high densities macrophytes can reduce habitat availability for invertebrates, reduce stream hydraulic capacity, increase sediment deposition and alter daily oxygen and pH patterns (Hearne and Armitage, 1993; Kaenel and Uehlinger, 1998; Wilcock and Nagels, 2001; Wilcock *et al.*, 1999). Thus, they can be important drivers of poor macroinvertebrate community health when present at nuisance levels (Matheson *et al.*, 2012).

42 Increased macrophyte growth in the LT FMQU may not be a direct effect of ongoing land-use (there is a high level of uncertainty around the effects of nutrient availability on macrophyte growth (Matheson *et al.*, 2012)), but rather the result of prior vegetation clearance and legacy sediment effects (Matheson *et al.*, 2017). Nevertheless, a high proportion of the land-cover in the LT FMQU is in agriculture (>50% sheep and beef in at all SoE sites) and cropping (>28 for sites on the Clive River and the Herehere Stream sites) and the ultimate cause is likely to be those land-uses (Table 3). Thus, the potential for future improvements in MCI in the LT FMQU is likely to be dependent on improved riparian management practices on land used for agriculture and horticulture.

43 The predominant land-use upstream of the SoE sites in the LNLTR FMQU that are not meeting the Schedule 26 objective is agriculture (>30% in sheep and beef) (Table 3). Thus, degradation in MCI from the desired good state is likely due to that land-use or some as yet unexplained natural mechanism.

[4] https://www.hastingsdc.govt.nz/assets/Document-Library/Publications/Water-Symposium/dr-andy-hicks.pdf

Table 2:Assessment of SOE and NRWQN sites against the current Schedule 26 objectives.

Zone	Site	pH	Clarity	Turbidity	DIN	DRP	NH_4-N	NO_3-N	*E.coli*	(P)eriphyton/ (M)acrophytes	Invertebrates
Upper Ngaruroro and Upper Tūtaekurī Rivers	Tūtaekurī R. @ Lawrence Hut	×	✓	✓	✓	×	✓	✓	✓	✓(P)	✓
	Ngaruroro R. @ Kuripapango	×	✓	✓	✓	✓	✓	✓	✓	?(P)	✓
Lower Ngaruroro and Lower Tūtaekurī Rivers	Ngaruroro R. @ Whanawhana	✓	✓	✓	✓	✓	✓	✓	✓	✓(P)	✓
	Ngaruroro R. D/S Hawkes Bay Dairies	×	×	×	✓	✓	✓	✓	✓	✓(P)	✓
	Ngaruroro R. @ Fernhill	×	×	×	✓	✓	✓	✓	✓	×(P)	×
	Tūtaekurī R. U/S Mangaone	×	×	✓	×	✓	×	✓	✓	✓(P)	✓
	Tūtaekurī R. @ Brookfields Br.	×	×	✓	×	×	×	✓	✓	✓(P)	×
Ngaruroro and Tūtaekurī Tributaries	Mangaone R. @ Rissington	×	×	✓	×	×	×	✓	×	✓(P)	✓
	Mangatutu S. @ Mangatutu Stn Br.	×	×	✓	×	×	×	✓	×	✓(P)	✓
	Ohara S. @ Big Hill Rd	✓	✓	✓	✓	✓	✓	✓	✓	✓(P)	✓
Lowland tributaries	Maraekakaho S. @ Maraekakaho	✓	✓	✓	✓	×	✓	✓	✓	?	×
	Ohiwia S. @ Broughtons Br.	×	✓	✓	×	×	×	✓	✓	?	×
	Waitio S. @ Ohiti Rd	×	✓	✓	✓	×	✓	✓	✓	✓(M)	✓
	Tūtaekurī Waimate S. @ Chesterhope	✓	✓	✓	✓	×	×	✓	✓	?	×
	Awanui S. @ Flume	✓	×	✓	×	×	×	✓	×	×(M)	×
	Poukawa S. @ Stock Rd	✓	✓	✓	✓	×	×	✓	✓	×(M)	×
	Karewarewa S. @ Paki Paki	✓	✓	✓	×	×	×	✓	×	×(M)	×
	Herehere S. @ Te Aute Rd	×	✓	✓	✓	×	×	✓	×	✓(M)	×
	Raupare S. @ Ormond Rd	✓	✓	✓	✓	×	×	✓	×	×(M)	×
	Clive R. U/S Whakatu Rail Br.	×	×	✓	×	×	×	✓	×	?	×
	Taipo S. @ Church Rd	✓	×	✓	✓	×	×	✓	×	✓(M)	×

Table 3:Predominant land-uses upstream of HBRC SoE sites.

Zone	Site	Predominant land-uses
Upper Ngaruroro and Upper Tūtaekurī Rivers	Tūtaekurī R. @ Lawrence Hut	• 77% native cover[1] • 21% exotic forest
	Ngaruroro R. @ Kuripapango	• **12% sheep and beef** • 82% native cover
Lower Ngaruroro and Lower Tūtaekurī Rivers	Ngaruroro R. @ Whanawhana	• **12% sheep and beef** • 82% native cover
	Ngaruroro R. D/S Hawkes Bay Dairies	• **33% sheep and beef**[2] • 56% native cover
	Ngaruroro R. @ Fernhill	• **33% sheep and beef** • 56% native cover
	Tūtaekurī R. U/S Mangaone	• **53% sheep and beef**[3] • 25% native cover • 18% exotic forest
	Tūtaekurī R. @ Brookfields Br.	• **54% sheep and beef**[4] • 24% native cover • 18% exotic forest
Ngaruroro and Tūtaekurī Tributaries	Mangaone R. @ Rissington	• **61% sheep and beef**[3] • 17% native cover • 18% exotic forest
	Mangatutu S. @ Mangatutu Stn Br.	
	Ohara S. @ Big Hill Rd	• **62% sheep and beef**[2] • 21% native cover
Lowland tributaries	Maraekakaho S. @ Maraekakaho	
	Ohiwia S. @ Broughtons Br.	
	Waitio S. @ Ohiti Rd	
	Tūtaekurī Waimate S. @ Chesterhope	• **59% sheep and beef**[4] • 30% cropping
	Awanui S. @ Flume	• **61% sheep and beef** • 28% cropping • 7% urban
	Poukawa S. @ Stock Rd	
	Karewarewa S. @ Paki Paki	
	Herehere S. @ Te Aute Rd	
	Raupare S. @ Ormond Rd	
	Clive R. U/S Whakatu Rail Br.	
	Taipo S. @ Church Rd	• **>50% urban**[5]

[1] based of landcover data for the Ngaruroro River at Whanawhana
[2] based of landcover data for the Ngaruroro River at Fernhill
[3] based of landcover data for the Tūtaekurī River at Puketapu
[4] based of landcover data for the Tūtaekurī River at the coast
[5] based on a visual assessment of landcover maps. Breakdowns not provided in Haidekker and Madarasz-Smith (2020)

Periphyton

44 Periphyton are primary producers and an important foundation of many river and stream food webs, particularly in rivers with hard, cobbly substrate. Periphyton also stabilise substrata and serve as habitat for many other organisms. However, an over-abundance of periphyton can reduce ecological habitat quality (Matheson *et al.*, 2012). Large standing crops of periphyton can smother stream-bed substrate, thereby reducing the amount of suitable habitat available for fish and invertebrates. High densities of periphyton can also cause large daily fluctuations in dissolved oxygen concentrations and pH. Therefore, it is important to manage rivers

and streams to reduce the risk of nuisance growths. Periphyton biomass covering the riverbed (measured in milligrams of chlorophyll a per metre squared of riverbed) is the most commonly used periphyton measure for assessing ecosystem health and is a compulsory attribute in the NPS-FM 2020. However, the periphyton Weighted Composite Cover (periWCC) is now a frequently used metric for quantifying visual periphyton cover and is also included in the Schedule 26.

45 Nuisance periphyton blooms do not appear to be a significant issue in the UNUTR, NTT or LNLTR FMQUs, with only one site on the lower Ngaruroro River slightly exceeding the Schedule 26 objective for periphyton cover[5] (Table 2).

Macrophytes

46 Macrophytes, which encompass macro-algae (charophytes), mosses and liverworts (bryophytes), ferns and angiosperms, are a common occurrence in waterbodies, and are found across a broad range of habitat types. These plants are a natural component of the biodiversity and functioning of stream and river systems – in particular, those with stable, slow flows. However, excessive macrophyte growth, generally associated with introduced rather than indigenous species (Matheson *et al.*, 2012), is detrimental to ecosystem function. Due to a lack of empirical data, robust macrophyte cover and volume thresholds for the onset of detrimental effects on ecosystem health do not currently exist (Matheson *et al.*, 2012). However, HBRC have adopted Matheson *et al.'s* (2012) provisional guideline for the protection of instream ecological condition in Schedule 26 (cross sectional area/volume (CAV) < 50%).

47 As previously stated in para. 41, nuisance macrophyte growths are ubiquitous in the LT FMQU (Table 2), and the cause of this is likely to be associated with agriculture (>50% land cover in sheep in beef at all sites) and cropping (>28 land cover Clive River and the Herehere Stream sites)

[5] Note – The Schedule 26 periphyton biomass objective can not be benchmarked from the available (at time of writing) data.

as they are the predominant land-uses in this area (Table 3). However, previous vegetation clearance and sediment input may well be a more important driver than current land-use practices (Matheson *et al.*, 2017).

Water Quality

Visual clarity

48 The Schedule 26 visual clarity objectives are generally met in the UNUTR and LT FMQUs but not the NTT or LNLTR FMQUs (Table 2). Given that the most upstream SoE sites on both the Ngaruroro and Tūtaekurī rivers meet the objective, degraded (beyond the objectives) visual clarity in the NTT and LNLTR FMQUs is unlikely to be the result of natural processes and may be caused by sediment input from land used for agriculture (>30% upstream landcover in sheep and beef farming) (Table 3).

49 That the visual clarity objectives were met at most SoE sites in the LT FMQU is not unexpected. Water velocity in lowland streams is typically slow and stable, meaning that sediment quickly settles on the stream bed, rather than travelling downstream in suspension where it can influence visual clarity. Nevertheless, land-use upstream of the four SoE sites in that FMQU that do not meet the target is predominately agriculture (>50% land cover in sheep in beef at all sites) and cropping (>28 land cover Clive River and the Herehere Stream sites) (Table 3), which are likely the cause of reduced visual clarity there.

Turbidity

50 Agriculture does not appear to be affecting whether the rivers in the TANK catchments meet the Schedule 26 turbidity objectives, with only two SoE sites (both on the Ngaruroro River in the LNLTR FMQU) failing to meet relevant thresholds (Table 2). However, given that the most upstream sites in the Ngaruroro River meet the relevant turbidity objective, degradation at the aforementioned sites is more likely to be the result of sediment input from agriculture (>30% upstream landcover in sheep and beef) rather than natural processes (Table 3).

pH

51 The pH of a river is strongly influenced by geology and source of water (Davies-Colley *et al.*, 2013); in agricultural catchments the mechanism by which anthropogenic activities can influence pH is through increased periphyton and/or macrophyte growth caused by elevated nutrient concentrations (land-use intensification), increased light availability (removal of riparian vegetation) and reduced summer low flows (water abstraction).

52 Throughout the TANK catchments there is a significant amount of the agriculture (~30-65% of land cover in sheep and beef farming) (Table 3). However, there is little evidence of excessive plant growth in the UNUTR, NTT or LNLTR FMQUs that could explain the occasionally high pH observed in those areas (Table 2). Furthermore, both SoE sites in the upper Ngaruroro and upper Tūtaekurī rivers regularly exceed the Schedule 26 pH objective, despite the vast majority of the upstream catchment being in native bush (Table 3). This suggests that in the UNUTR, NTT and LNLTR FMQUs occasional pH measurements above the Schedule 26 objective may be due to natural processes.

53 In the LT FMQU, most SoE sites meet the relevant Schedule 26 pH objective despite the excessive macrophyte growth there (para. 47 and Table 2). Indeed, only four sites in that FMQU, appear to not be meeting the objective; these are located on the Ohiwia, Waito and Herehere streams and the Clive River. Exactly why those streams experience high pH is unclear as periphyton and macrophyte data from the Waito and Herehere streams suggest excessive plant growth is not the driver. Nevertheless, if there is a human cause it is likely due to the indirect effects of agriculture (>50% land cover in sheep in beef at all sites) and cropping (>28% of landcover upstream of the Clive River and the Herehere Stream sites) (Table 3).

Ammonia and nitrate

54 The Schedule 26 ammonia objectives are generally not met throughout all FMQUs in the TANK catchments (Table 2) due to occasional spikes

causing the maximum concentration threshold to be exceeded. High instream ammonia concentrations are generally the result of point sources, while nitrate is more commonly associated with diffuse discharges. Thus, the contribution of agriculture to the objectives not being met is difficult to ascertain. Furthermore, the benchmarking results presented in Table 2 should be considered provisional as pH and temperature adjustment was not undertaken as part of that exercise, and the NPS-FM 2020 ammonia toxicity attribute states presented in Haidekker and Madarasz-Smith (2020) suggest that such an adjustment may improve compliance with the objectives at some sites.

55 The available data suggests that all SoE sites in the TANK catchments are meeting the Schedule 26 nitrate standards (Table 2). Accordingly, there is no evidence to suggest that land-use is affecting compliance with these thresholds.

Dissolved inorganic nitrogen and dissolved reactive phosphorus

56 It is important to note upfront that the non-compliance with the dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP) Schedule 26 objectives does not appear to affect ecosystem health in any meaningful way, as they are not linked to periphyton or macrophyte growth (see para. 86 to para. 90). The benchmarking presented in Table 2 provides a crude demonstration of this. The only site that does not meet the Schedule 26 periphyton objective meets the DIN and DRP targets, while a further four sites fail to meet the DIN and DRP objectives but meet the periphyton objective.

57 The DIN and DRP Schedule 26 objectives are not met through much of the TANK catchments (Table 2). In most catchments, agriculture is the most likely cause of this, as it is the predominant land-use in most FMQUs (generally >30% landcover in sheep and beef where objectives not met) (Table 3). However, there are exceptions. There is a significant amount of cropping in the Awanui Stream, Clive River and Herehere Stream catchments (>28% landcover) which is thought to generate far larger nitrogen and phosphorus loads per unit area than sheep and beef farming in the TANK catchments (Williamson and Diack, 2018).

E. coli

58 The Schedule 26 *E. coli* targets appear to be met through much of UNUTR and LNLTR FMQUs, but not and LT and NTT FMQUs (Table 2). Where the targets are not being met, agriculture is the most likely cause; sheep and beef farming being far and away the most predominant source of potential faecal contamination in most catchments (Table 3). The only exception to this is Taipo Stream where there is some risk of wastewater contamination within the urban part of the catchment. Note – this assessment should be considered provisional as the available (at time of writing) data did not allow for benchmarking against the exact statistics set out in Schedule 26.

Conclusions

59 Water quality data in the latest SoE report from HBRC suggest that a number of the Schedule 26 objectives are not being met throughout the TANK catchments. However, while agriculture is the predominant land-use in most FMQUs in many (but not all) instances its contribution to objectives not being met appears to be limited and/or of little ecological consequence. Specifically:

59.1 Through most of the TANK catchments macroinvertebrate communities are indicative of good or excellent aquatic ecosystem health. However, agriculture and cropping may be driving degraded macroinvertebrate community health throughout the LT FMQU. A likely explanation for this is excessive macrophyte growth bought about by a lack of riparian shading. This increased macrophyte growth may not be a direct effect of ongoing agricultural land-use, but rather the result of prior vegetation clearance and legacy sediment effects.

59.2 While the Schedule 26 pH targets are not meet at most SoE sites in the TANK catchments, this is likely the result of natural processes rather than the effects of land-use.

59.3 The Schedule 26 ammonia objectives are not met in a number of streams due to occasional spikes causing the maximum concentration threshold to be exceeded. However, agricultures contribution to this is difficult to ascertain given that ammonia is more commonly associated with point source rather than diffuse discharges.

59.4 The DIN and DRP Schedule 26 objectives are not met through much of the TANK catchments and in catchments without significant cropping agriculture is the most likely cause of this. However, non-compliance with the DIN and DRP objectives does not appear to affect ecosystem health in any meaningful way, as they are based on the wrong nutrient criteria in Matheson *et al.* (2016) (see para. 85 to para. 91) and, therefore, not linked to periphyton or macrophyte growth. This is supported by the absence of a widespread periphyton problem in the UNUTR NTT and LNLTR FMQUs, despite the DIN and DRP objectives not being met.

59.5 The Schedule 26 visual clarity objectives are generally met in the UNUTR and LT FMQUs. However, agriculture may the reason why the relevant clarity objectives are not met through much of the NTT and LNLTR FMQUs. Similarly, agriculture is the most likely cause of the Schedule 26 *E. coli* targets not being met through much of the LT and NTT FMQUs.

59.6 Agriculture does not appear to be causing the Schedule 26 periphyton cover, turbidity or nitrate objectives to be exceeded through most of the TANK catchments.

ABILITY OF EXISTING MONITORING NETWORKS TO DETECT EFFECTS OF CHANGING LAND-USE PRACTICES ON SHEEP AND BEEF FARMS

60 In this section of my evidence, I assess whether HBRC's existing SoE monitoring network (including the NRWQN sites) is sufficiently robust

to detect the effects of changes in land-use practices (including from sheep and beef farming) on water quality and ecology.

61 This assessment is based purely on the spatial distribution of sites. Due to time constraints, I am unable to assess the representativeness of the network (i.e., how effective it is at picking up changes in different stream types), as that would require a detailed monitoring network review. As such, this assessment considers whether the network can detect changes in water quality and/or ecology in each sub-catchment, rather than whether it can accurately describe the state of water quality and ecology in the different stream types.

Ngaruroro River catchment

62 Based on the spatial distribution of SoE sites, the existing monitoring network in the Ngaruroro catchment appears to be sufficiently robust to allow for the detection of shifts in water quality and ecology bought about changes in land-use practices at the sub-catchment scale. However, it is likely that changes in the Whanaukini, Otamauri, Mangatahi and Kikiwhero stream sub-catchments can only be detected based on longitudinal differences between sites on the main stem of the Ngaruroro River (using mass-balance approaches). This means that it is unlikely that variability in water quality trends between those sub-catchments can be determined using the existing monitoring network, and that changes in aquatic ecology are unlikely to be detected[6]. My full assessment of the monitoring network in the Ngaruroro catchment is set out in para. 63 to para. 68 and outlined in Table 4.

63 The NRWQN site on the Ngaruroro River at Kuripapango acts as a reference site and allows for changes in water quality and ecology not associated with shifts in land-use practices to be detected (e.g., changes caused by natural climate variability etc.).

[6] Unlike water quality, it is not possible to determine changes in ecology in a sub-catchment by applying mass-balance approaches to data at receiving environment sites.

64 The SoE site at Ngaruroro River at Whanawhana allows for changes in the effects of the limited upstream sheep and beef farming on water quality and ecology to be detected.

65 The SoE sites in the Ohara and Poporangi streams should be sufficient to detect the water quality and ecology effects of changing land practices in the wider Poporangi Stream catchment. However, there is not a SoE site on Whanaukini Stream or downstream of its confluence with the Poporangi Stream. Thus, any difference in water quality, aquatic ecology or land-use practice between the Whanaukini Stream and the rest of the Poporangi Stream catchment may not be detected from the existing monitoring network.

66 The SoE site on the Ngaruroro River at Hawkes Bay Dairies provides an indication of the state of water quality and ecology in that reach. Along with the SoE site at Whanawhana and those on the Ohara and Poporangi streams it could also be used to detect the water quality effects of changing land-use practices in upstream sub-catchments with out monitoring sites through the use of mass-balance approaches (i.e., the Whanaukini and Otamauri streams). However, any variability in water quality trends between those catchments will not be detected using this approach, nor will any changes in aquatic ecology.

67 With the exception of the Kikowhiro and Mangatahi streams sub-catchments, there are SoE sites in all major sub-catchments downstream of the Hawkes Bay Dairy SoE site on the Ngaruroro River. There are also two sites on the Ngaruroro River itself. These sites provide excellent spatial coverage and should allow for the water quality and ecological effects of changing land-use practices to be detected throughout the mainstem of lower Ngaruroro River and every sub-catchment that flows into it except the Kikowhiro and Mangatahi streams.

68 As the Kikowhiro and Mangatahi streams are the only major non-monitored inputs between the SoE sites on the Ngaruroro River at Hawkes Bay Dairy and Fernhill, it is likely that changes in water quality in those sub-catchments could be assessed by applying mass-balance approaches to water quality and flow data from the existing monitoring network.

However, this approach cannot account for differences in water quality trends between those catchments nor can it be used to detect changes in aquatic ecology.

Tūtaekurī River catchment

69 The resolution of the monitoring network in the Tūtaekurī River catchment is much lower than in the Ngaruroro River catchment, meaning that its ability to detect changes in water quality and ecology across major sub-catchments is less.

70 Of the five major sub-catchments downstream of SoE site on the Tūtaekurī River Lawrence Hut, only two are monitored; the Mangatutu Stream and the upper Mangaone Stream. Accordingly, it is likely that the water quality effects of shifts in land-use practices in the Otakarara, Waikonini and Waiiti[7] stream catchments can only be assessed from the existing network by applying mass-balance approaches to data collected from sites on the main stem of the Tūtaekurī River. Furthermore, changes in aquatic ecology in those catchments are unlikely to be detected at all. Para. 71 to para. 74 provide a detailed assessment of the monitoring network in the Tūtaekurī catchment (additional detail can be found in Table 4).

71 The SoE site on the Tūtaekurī River at Lawrence Hut is almost in reference (natural) state and it is likely that changes in water quality and ecology not associated with shifts in land-use practices can be detected from data collected there.

72 The SoE sites in the Mangatutu and upper Mangaone streams will likely allow for the detection of any changes in water quality and aquatic ecology bought about by shifts in land-use practices in those sub-catchments. However, there is not a site on the Waiiti Stream or downstream of its confluence with the Mangaone. Therefore, the existing monitoring network may not allow for any differences in water quality,

[7] Flows in the Mangaone Stream below the monitoring site

aquatic ecology or land-use practice between that catchment and the wider Mangaone Stream to be detected.

73 The SoE site on the Tūtaekurī river upstream of its confluence with the Mangaone stream allows for changes in the water quality and ecology effects of upstream agricultural land-use to be identified. Furthermore, using mass-balance approaches, data from that site and others in the catchment could be used to assess the water quality effects of changing land-use practices in unmonitored upstream sub-catchments (i.e., the Otakarara and Waikonini streams). As previously stated that approach, however, does not allow for differences in water quality trends between catchments to be detected, and it cannot be used to detect changes in aquatic ecology.

74 The most downstream site on the Tūtaekurī River (Brookfields Bridge) provides an indication of state of water quality and ecology that reach. It is also possible that it may allow for any changes in water quality in the Waiiti Stream sub-catchments to be assessed through mass-balance approaches. However, this is by no means certain given the number of small sub-catchments discharging between the Brookfield Bridge site and the Mangaone Stream.

Karamū River Catchment and Ahuriri Estuary catchment

75 As with the Ngaruroro catchment, the monitoring network in the Karamū River network is sufficiently robust that changes in water quality and aquatic ecology associated with changes in land-use practices should be detectable in most sub-catchments. Only three major sub-catchments, the Irongate, Louisa and Mangarau streams, are not monitored, and it is likely that changes in water quality (but not ecology) in those streams can be assessed by applying mass-balance approaches to data from other SoE sites in the catchment.

76 The monitoring sites on the Awanui, Poukawa, Herehere and Karewarewa and Raupaere streams provide a high level of spatial coverage and allow for the water quality and ecology effects of changing land-use practices to be detected in almost every sub-catchment.

77 The SoE site on the Clive River provides an indication of state of water quality and ecology in that reach and in concert with the sites on the Awanui, Poukawa, Herehere and Karewarewa and Raupaere streams should be useful in assessing the water quality (but not ecology) effects of changing land-use practices in the Irongate, Louisa and Mangarau streams.

78 There is only one monitoring site in the Ahuriri Estuary catchment. However, given the small size of the catchment and the even distribution of land-use throughout this is adequate in my opinion.

Conclusions

79 It is likely that HBRC's existing monitoring network in the TANK catchments is sufficiently robust that changes in water quality and ecology associated with shifting land-use practices should be detectable in most sub-catchments. However, it is probable that changes in the following sub-catchments can only be assessed by applying mass-balance approaches to water quality data collected at nearby sites (parenthesised N, T and Ks denote sub-catchments in the Ngaruroro River, Tūtaekurī River and Karamū stream catchments respectively):

- Whanaukini Stream (N);
- Otamauri Stream (N);
- Mangatahi Stream (N);
- Kikiwhero Stream (N);
- Otakarara Stream (T);
- Waikonini Stream (T);
- Waiiti Stream (T);
- Irongate Stream (K);
- Louisa Stream (K); and
- Mangarau Stream (K).

80 This means that the current network can probably not detect any variability in water quality trends between the catchments listed above, nor can it be used to detect any changes in their aquatic ecology.

81 Table 4 summarises the assessment presented in para. 62 to para. 78.

Table 4: List of sub-catchments in the TANK catchments, and whether changes in water quality and ecology in those sub-catchments can be detected at existing monitoring sites.

Tank catchment	Sub-catchment	Changes in water quality and/or ecology detectable from data collected at:	Changes in water quality and/or ecology detectable
Ngaruroro River	Upper Ngaruroro R.	Ngaruroro R. @ Kuripapango	Water quality and ecology
	Mainstem Ngaruroro R.	• Ngaruroro R. @ Whanawhana • Ngaruroro R. D/S Hawkes Bay Dairies • Ngaruroro R. @ Fernhill • Ngaruroro R. @ Chesterthorpe	
	Poporangi S. (exc. Whanaukini S.)	• Ohara S. @ Big Hill Rd • Poporangi S. @ Big Hill Rd	
	Whanaukini S.	Δ between: • Ngaruroro R. @ Whanawhana • Ngaruroro R. D/S Hawkes Bay Dairies	Water quality (changes cannot be isolated from nearby sub-catchments)
	Otamauri S.		
	Mangatahi S.	Δ between • Ngaruroro R. D/S Hawkes Bay Dairies • Ngaruroro R. @ Fernhill	
	Kikiwhero S.		
	Maraekakaho S.	Maraekakaho S. @ Maraekakaho	Water quality and ecology
	Ohiwia S.	Ohiwia S. @ Broughtons Br.	
	Poukawa S.	Poukawa S. @ Stock Rd	
	Waitio S.	Waitio S. @ Ohiti Rd	
	Tūtaekurī Waimate S.	Tūtaekurī Waimate S. @ Chesterhope	
Tūtaekurī River	Upper Tūtaekurī R.	Tūtaekurī R. @ Lawrence Hut	
	Mainstem Tūtaekurī R.	• Tūtaekurī R. U/S Mangaone • Tūtaekurī R. @ Brookfields Br.	
	Mangatutu S.	Mangatutu S. @ Mangatutu Stn Br	Water quality and ecology
	Otakarara S.	Δ between: • Tūtaekurī R. @ Lawrence Hut • Tūtaekurī R. U/S Mangaone	Water quality (changes cannot be isolated from nearby sub-catchments)
	Waikonini S.		
	Mangaone S. (exc. Waiiti S.)	Mangaone R. @ Rissington	Water quality and ecology
	Waiiti S.	Δ between • Tūtaekurī R. U/S Mangaone • Tūtaekurī R. @ Brookfields Br.	Potentially water quality (changes cannot be isolated from downstream sub-catchments)
Karamū River	Mainstem Awanui S./ Karumū R./ Clive R.	• Awanui S. @ Flume • Clive R. U/S Whakatu Rail Br.	Water quality and ecology
	Poukawa	Poukawa S. @ Stock Rd	
	Karewarewa	Karewarewa S. @ Paki Paki	
	Irongate S.	Δ between • Awanui S. @ Flume • Clive R. U/S Whakatu Rail Br.	Water quality (changes cannot be isolated from nearby sub-catchments)
	Louisa S.		
	Mangarau S.		
	Herehere S.	Herehere S. @ Te Aute Rd	Water quality and ecology
	Raupare S.	Raupare S. @ Ormond Rd	
Ahuriri Estuary	Taipo S.	Taipo S. @ Church Rd	

REVIEW OF THE SCHEDULE 26 FRESHWATER OBJECTIVES AND RECOMMENDED CHANGES

82 In my opinion, the Schedule 26 objectives for the following attributes are appropriate from a technical perspective, and have been set at a level that provides for the values in OBJ TANK 11 to OBJ TANK 13:

- PeriWCC – Noting that the primary measure should be periphyton biomass (see para. 100 to para. 106);
- Visual clarity;
- Dissolved oxygen;
- $ScBOD_5$;
- Nitrate;
- Ammonia; and
- Heavy metals and metalloids, pesticides and organic contaminants, radioactive contaminant.

83 Based on S42A report (Appendix 1B) it does not appear that HBRC are proposing any major amendments to these attributes, and the minor amendments they are suggesting are appropriate in my opinion.

84 The remaining objectives in Schedule 26 have either been set based on incomplete science, or at a level that does not support a value of excellent ecosystem health in the UNUTR FMQU, good ecosystem health in the NTT and LNLTR FMQUs or fair ecosystem health in the LT FMQU. My reasoning for this is set out para. 85 to para. 111.

DIN and DRP

85 The process by which the DIN and DRP objectives in Schedule 26 have been selected appears to have been fundamentally flawed, and this has resulted in the selection of thresholds that were never designed to be used as nutrient criteria for the management of periphyton growth.

86 Section 2.1.4 of Haidekker (2019) states that the nutrient criteria that have been included in Schedule 26 were selected from the DIN and DRP guidelines in Matheson *et al.* (2016), and that this approach is consistent with guidance from MfE that nutrient guidelines based on broad scale

models can be used to set nutrient criteria for periphyton growth (MfE, 2018).

87 Haidekker (2019) is right in that the use of the recommended nutrient criteria in Matheson *et al.* (2016), is consistent with the MfE's guidance. However, the freshwater objectives in Schedule 26 do not reflect those nutrient criteria. Instead, they are periphyton growth risk thresholds used as inputs in Bayesian Belief Network (BBN) model developed by Matheson *et al.* (2012).

88 Inputs to BBNs are often decided based on expert opinion, and the periphyton growth risk thresholds in Matheson *et al.* (2012) were developed by simple visual inspections of bivariate plots between nutrient concentrations and long green filamentous periphyton cover. As such their use in a regional plan as nutrient criteria is not consistent with the guidance from the MfE used to justify their inclusion in Schedule 26 (Haidekker, 2019). Furthermore, they were based on relationships with long green filamentous periphyton cover, rather than the periWCC (which is in Schedule 26) or periphyton biomass (a compulsory attribute in the NPS-FM 2020).

89 The actual Matheson *et al.* (2016) nutrient criteria that correspond to the periphyton biomass objectives recommended in para. 102 are provided in Table 5 along with comparisons with the existing Schedule 26 nutrient criteria. (Note – biomass is a compulsory attribute in the NPS-FM while periphyton cover is not).

Table 5: The Matheson et al. (2016) nutrient criteria that correspond to the periphyton biomass objectives recommended in para. 102 compared to the current Schedule 26 objectives for DIN and DRP. Nutrient criteria are designed to achieve 85% compliance with periphyton biomass objectives.

FMQU	Peri. biomass objective	Schedule 26 P obj.	Correct P criteria from Matheson (2016)	Diff.	Schedule 26 N obj.	Correct N criteria from Matheson (2016)	Diff.
Upper Ngaruroro and Upper Tūtaekurī Rivers	≤50 mg chl-a/m^2	0.003 mg/L DRP	0.014 mg/L total P	>350%	0.05	100	100%
Lower Ngaruroro and Lower Tūtaekurī Rivers	≤120 mg chl-a/m^2	0.015 mg/L DRP	0.011 mg/L DRP	-37%	0.15	0.63	~400%
Ngaruroro and Tūtaekurī Tributaries					0.3		~200%

90 As I have not had time to do an in depth assessment of what appropriate nutrient criteria would be for the TANK catchments, I am not able to conclude one way or the other whether the nutrient criteria set out in Table 5 will achieve the periphyton biomass objectives recommended in para. 102. However, they are far more robust than what are currently included in Schedule 26, and likely reflect the best available thresholds at this time. However, I still recommend that HBRC continue to work on refining them in the future given that the DRP thresholds appear unnecessarily stringent given that periphyton objectives through much of the TANK catchments are being met at much higher concentrations (Table 7).

91 The Schedule 26 objectives for DIN and DRP in the LT FMQU are based the ANZECC (2000) default triggers, with the critical value being estuarine ecosystem health (Haidekker, 2019). It is entirely unclear how the current thresholds provide for the estuarine ecosystem health or any of the other in-stream objectives in Schedule 26 (i.e., macrophyte growth) given that they are not based on controlling plant growth or maintaining a given nutrient load into the estuary. As such, I recommend they be set at current state until such time as relevant thresholds can be developed that provide for the values in PPC9.

92 I note that in HBRC's changes to Schedule 26, they have replaced the existing DRP criteria with attribute states from the NPS-FM 2020 despite PPC9 plan being notified after that document became operative. While the NPS-FM 2020 includes DRP attribute states, it also requires that exceedance criteria be set for periphyton growth. The thresholds set out in Table 5 act as the latter.

93 Given that the mechanism through which DRP effects broader ecosystem health is through plant growth, any attempt to incorporate the NPS-FM 2020 attribute state into this plan change should ensure that the target attribute state aligns with the periphyton nutrient exceedance criteria set out in Table 5 (or current state for the LT FMQU). The approach used to develop the generic attribute state thresholds in the NPS-FM 2020 relies on simple correlative relationships between nutrients and a range of biotic endpoints but fails to consider the mechanisms behind those relationships. The approach used to develop those endpoints has been proposed (by

submitters) in regional plan hearings for at least three years but has consistently been rebuffed. Indeed, the original journal article outlining the approach has yet to meet the standard for peer review publication despite being presented at hearings for several years.

Temperature

94 The freshwater objectives presented for temperature are not commonly used in regional plans, and it was previously decided not to include them in the NPS-FM 2014. Accordingly, it is my opinion that they should not be included in Schedule 26 until such time as their applicability becomes clearer. From my reading of Appendix 1B of the S42A report this change is also supported by HBRC, as temperature is not included in their amended version of Schedule 26 (at 2040).

Turbidity

95 Visual clarity is not only a more robust measure of suspended sediment than turbidity (turbidity measurements are instrument dependent and turbidity units are relative not standardised), but also more meaningful to the public and has greater mechanistic effects (i.e., directly affects the visual capability of fish and the amenity value of the stream) (Franklin *et al.*, 2019). That, combined with MfE's decision to remove the turbidity attribute state from the draft NPS-FM 2020 and replace it with visual clarity attribute means that there is little benefit in including both a turbidity and visual clarity attribute in Schedule 26. Thus, it is my opinion the turbidity objectives should be deleted. This change appears to be supported by HBRC as turbidity is not included in their amended version of Schedule 26 (Schedule 1B of the S42A report).

pH

96 It does not appear that the pH objectives in Schedule 26 are relevant or achievable given the frequency at which they are not met at reference sites (see para. 51). As such I recommend they be deleted until such time as more applicable catchment specific targets are developed. I understand

from Appendix 1B of the S42A report, that this change is also supported by HBRC.

E. coli

97 It is unclear how the statistics cited for the *E. coli* freshwater objectives have been selected as they do not align with any standard in use now or at the time they were written. However, based on the current Schedule 26 *E. coli* objectives, it appears that their intent is to achieve something akin to the NPS-FM 2020 A attribute state in the UNUTR FMQU and attribute state B everywhere else. If this is the intent of the plan then the following objective should be set:

- UNUTR FMQU
  - Median ≤130/100mL;
  - 95th Percentile ≤540/100mL;
  - % exceedances over 260/100 mL <20%; and
  - % exceedances over 540/100 mL <5%.
- All other FMQUs
  - Median ≤130/100mL;
  - 95th Percentile ≤1000/100mL;
  - % exceedances over 260/100 mL <30%; and
  - % exceedances over 540/100 mL <10%.

98 This change is consistent with HBRC's suggested amendments in the S42A report (Appendix 1B).

Deposited sediment

99 The deposited sediment objectives set out in Schedule 26 are sourced from guidelines developed by Clapcott *et al.* (2011), and Appendix 1B of the S42A report does not suggest a change to this general approach. In principal, I support the objectives as they stand. However, to give effect to those guidelines and the intent of the NPS-FM 2020 a number of amendments need to be made:

99.1 The macroinvertebrate objectives for the LT FMQU specifically require the soft-bottom version of the MCI be used;

indicating that HBRC acknowledge that at least some streams within that FMQU may naturally have a bed dominated by fine sediment. This is supported by the River Environmental Classification (REC)[8] data for that FMQU which shows many of streams meeting the NPS-FM 2020 definition of naturally soft-bottomed. Given that the NPS-FM 2020 does not require potentially unachievable deposited fine sediment cover objectives to be set in naturally soft-bottomed streams, Schedule 26 objectives should not be set there. From my reading of Appendix 1B of the S42A report, this change is also supported by HBRC, as their amended Schedule 26 lists "hard-bottomed streams" in the monitoring sites column for this attribute.

99.2 It is unclear why Schedule 26 sets a seasonal (May to October) deposited sediment cover objective of 15% in the UNUTR FMQU for the protection of salmonid spawning. The background technical documents supporting PPC9 suggest this is aligned with the Clapcott *et al.* (2011) guidelines. However, this is not correct; the 20% cover guideline in Clapcott *et al.* (2011) is for the protection of benthic biodiversity and salmonid spawning. As such, it is my opinion that the secondary deposited sediment cover for UNUTR FMQU should be deleted. This appears to be supported by HBRC based on Appendix 1B of the S42A report.

Periphyton biomass

100 It is unclear why periphyton biomass outcomes have only been set in Schedule 26 for the Lower Ngaruroro River and Upper Tūtaekurī River given that it has been a compulsory attribute in the NPS-FM since the 2014 (periphyton cover has never been included in that document). From the reading of the supporting technical documentation for PPC9

[8] The REC is a database of catchment spatial attributes, summarised for every segment in New Zealand's network of rivers

(Haidekker, 2019), it appears that HBRC have only applied a biomass objective where they monitor for it. However, the NPS-FM process requires councils to set objectives and then design a monitoring programme based on how those objectives have been set; not vice a versa. Accordingly, it is my opinion that periphyton biomass objectives should be set for every FMQU (except in LT where plant communities are dominated by macrophytes).

101 It is important to note that setting additional periphyton biomass objectives does not necessarily have to increase HBRC's monitoring effort in the TANK catchments. My benchmarking of periphyton cover data indicates periphyton is only a problem at sites on the lower reaches of the Ngaruroro River where HBRC already have a monitoring site (Table 2). For all other sites, where there is a low risk of periphyton growth, the NPS-FM 2020 explicitly allows HBRC to continue monitoring against a periphyton biomass objective using visual cover assessments.

"At low risk sites monitoring may be conducted using visual estimates of periphyton cover. Should monitoring based on visual cover estimates indicate that a site is approaching the relevant periphyton abundance threshold, monitoring should then be upgraded *to include measurement of chlorophyll-a.)"*

102 In order to support a value of excellent ecosystem health in the UNUTR FMQU and good ecosystem health in the NTT and LNLTR FMQUs (assumed value based on Schedule 26 macroinvertebrate objectives) and to be consistent with the Schedule 26 periphyton cover objectives the following periphyton biomass objectives should be set:

- UNUTR FMQU ≤50 mg chl-a/m^2;
- NTT FMQU ≤120 mg chl-a/m^2; and
- LNLTR FMQU ≤120 mg chl-a/m^2 (consistent with the suggested amendments in Appendix 1B of the S42A report).

103 The suggested objective for the UNUTR FMQU differs from what is currently in Schedule 26, which sets the threshold at ≤120 mg chl-a/m^2 for the Upper Tūtaekurī River. However, Appendix 1B of the S42A report

applies that objective to a site in the lower Tūtaekurī River. Thus, it appears that the earlier reference to the upper catchment may have been a typographical area. Nevertheless, it is worth noting that the current periphyton biomass objective for the Upper Tūtaekurī River contradicts the periphyton cover objective for that FMQU and does not provide for an excellent level of ecosystem health (a biomass as ≤50 mg chl-a/m^2 is recommended to protect benthic biodiversity (Biggs, 2000)).

Cyanobacteria

104 Benthic cyanobacteria grow attached to the substrate of rivers and streams. In New Zealand rivers the dominant bloom-forming benthic cyanobacteria genus is *Microcoleus* (formally thought to be *Phormidium* (Heath *et al.*, 2010; Wood *et al.*, 2007). *Microcoleus* blooms are primarily associated with river or stream environments where they form leathery dark brown or black mats, but they can also establish in lakes and ponds (Quiblier *et al.*, 2013). *Microcoleus* can produce four lethal neurotoxins, known collectively as anatoxins, which cause convulsions, coma, rigors, cyanosis, limb twitching, hyper salivation and/or death. The presence of anatoxins in *Microcoleus* mats is widespread. McAllister *et al.* (2016) found 67% *Microcoleus* dominated mats samples collected from across New Zealand contained anatoxins. However, the concentration of all four variants is highly spatially and temporally variable (Heath *et al.*, 2011; Wood *et al.*, 2012, 2010).

105 The human health risks associated with benthic cyanobacteria are less well known than the risks associated with their planktonic counterparts in lakes, and the MfE/MoH (2009) guidelines are the only existing numeric thresholds against which the potential health risks associated with benthic cyanobacteria can be assessed. The MfE/MoH (2009) guidelines recommend coverage thresholds for potentially toxigenic cyanobacteria as part of three-tier surveillance, alert and action sequence for managing the public health risk associated with benthic cyanobacteria.

106 Schedule 26 of PPC9 sets a freshwater objective for benthic cyanobacteria cover of < 20% for all FMQUs. This guideline is aligned with the ‘alert’ threshold in the MfE/MoH (2009) guidelines, and signals that a

proliferation event is not necessarily likely and detaching mats are not likely to be washed on the shoreline where they could pose a health risk (MfE/MoH, 2009). Although the guideline value of <20% cover is a useful public health notification tool it still requires significant refinement and is not appropriate for inclusion in PPC9.

107 Since the release of the MfE/MoH (2009) interim guidelines in 2009, knowledge of benthic cyanobacteria has advanced significantly. Accordingly, MfE, with the support of regional councils, has commissioned a team of researchers to review and update the guidelines. One of the possible updates to the guidelines is a shift from the coverage-based assessments currently used to assess the risk to human health, to toxicity-based assessments (Wood *et al.*, 2018).

108 MfE has also been working with researchers to develop a benthic cyanobacteria attribute for inclusion in the NPS-FM. Research undertaken as part of the attribute development has advanced the understanding of benthic cyanobacteria toxin production and the risks to human health significantly. If a benthic cyanobacteria attribute is included in the NPS-FM, it is mostly likely to be toxicity based rather than coverage based (Dr Mark Heath pers. comm. 2018).

109 Given the strong possibility that the eventual thresholds for cyanobacteria the NPS-FM and updated MoH/MfE guidelines will be toxicity based rather than cover based, it is unwise to incorporate the existing coverage based guidelines in to PPC9. It is important to note that even if future cyanobacteria guidelines remain cover based, they are likely to be significantly altered from what is in Schedule 26.

Macrophytes

110 Due to a lack of empirical data, robust macrophyte cover and volume thresholds for the onset of detrimental effects on ecosystem health do not currently exist (Matheson *et al.*, 2012). Currently, Matheson *et al.'s* (2012) review of the New Zealand instream plant and nutrient guidelines provides the only numeric cover and volume thresholds against which the potential effects of macrophytes can be assessed. Matheson *et al.* (2012)

presents a macrophyte CAV guideline of less than 50% of the channel for the protection of instream ecological condition, which has been adopted into Schedule 26. However, this threshold is provisional, and requires significant refinement (Matheson *et al.*, 2012). As such it is my opinion that it should not be included PPC9.

Macroinvertebrate community health

111 In my opinion the level at which the Schedule 26 macroinvertebrate objectives have been set for each FMQU is appropriate, and I agree that the amendments to the specific numbers and metrics proposed in Appendix 1B of the S42A are aligned with the latest attribute states in the NPS-FM 2020. However, for those streams in the LT FMQU that are not naturally soft bottomed, the macroinvertebrate objectives should reference the hard-bottomed version of the MCI, as the NPS-FM 2020 does not allow for the use of the soft-bottomed variant in streams with high deposited fine sediment cover caused by land-use. Based on Appendix 1B of the S42A report such a change appears to be supported by HBRC.

Conclusions

112 My recommended changes to Schedule 26 are summarised in Table 6 and HBRC SoE sites are re-bench marked against the recommended amended objectives in Table 7. The main result of the recommended changes to Schedule 26 is a significant increase in the number of streams meeting the DIN and DRP objectives Table 7. However, this is unlikely to affect periphyton growth in the TANK catchments as it is already low in most places despite the current DIN and DRP objectives being exceeded.

Table 6: Recommended changes to the objectives in Schedule 26 and whether those changes are supported by HBRC's suggested amendments (Appendix 1B of the S42A report).

Attribute	FMQU	Recommended change	Change consistent with HBRC's suggested amendments
DIN	Upper Ngaruroro and Upper Tūtaekurī Rivers	Change to 0.1 mg/L (average conc.)	No
	Lower Ngaruroro and Lower Tūtaekurī Rivers	Change to 0.63 mg/L (average conc.)	
	Ngaruroro and Tūtaekurī Tributaries		
	Lowland Tributaries	Change to reflect current state	
TP	Upper Ngaruroro and Upper Tūtaekurī Rivers	Change to 0.014 mg/L (average conc.; currently DRP)	
DRP	Lower Ngaruroro and Lower Tūtaekurī Rivers	Change to 0.011 mg/L (average conc.; currently DRP)	
	Ngaruroro and Tūtaekurī Tributaries		
	Lowland Tributaries	Change to reflect current state	
Temperature	All	Delete	Yes
Turbidity			
pH			
E. coli	Upper Ngaruroro and Upper Tūtaekurī Rivers	Change to • Median ≤130/100mL • 95th Percentile ≤540/100mL • % exceedances over 260/100 mL <20% • % exceedances over 540/100 mL <5%	
	Lower Ngaruroro and Lower Tūtaekurī Rivers	Change to • Median ≤130/100mL • 95th Percentile ≤1000/100mL • % exceedances over 260/100 mL <30% • % exceedances over 540/100 mL <10%	
Deposited sediment	Upper Ngaruroro and Upper Tūtaekurī Rivers	Delete seasonal objective of 15% cover for salmonid spawning	
	Lowland Tributaries	Delete for naturally soft-bottomed streams	
Periphyton biomass	Upper Ngaruroro and Upper Tūtaekurī Rivers	Amend to ≤50 mg chl-a/m^2	No
	Lower Ngaruroro and Lower Tūtaekurī Rivers	Amend to ≤120 mg chl-a/m^2	Yes
	Ngaruroro and Tūtaekurī Tributaries	add ≤120 mg chl-a/m^2	No
Cyanobacteria	All	Delete	No
Macrophytes	Lowland Tributaries		
Macroinvertebrates	Lowland Tributaries	Only stipulate MCI-sb for naturally soft-bottomed streams	Yes

Table 7:Assessment of HBRC SOE sites against the recommended changes to the Schedule 26 objectives.

Zone	Site	pH	Clarity	Turbidity	DIN	DRP	NH_4-N	NO_3-N	*E.coli*	Periphyton	Invertebrates
Upper Ngaruroro and Upper Tūtaekurī Rivers	Tūtaekurī R. @ Lawrence Hut	N/A	✓	N/A	✓	×	✓	✓	✓	✓	✓
	Ngaruroro R. @ Kuripapango		✓		✓	✓	✓	✓	✓	?	✓
Lower Ngaruroro and Lower Tūtaekurī Rivers	Ngaruroro R. @ Whanawhana		✓		✓	✓	✓	✓	✓	✓	✓
	Ngaruroro R. D/S Hawkes Bay Dairies		×		✓	✓	✓	✓	✓	✓	✓
	Ngaruroro R. @ Fernhill		×		✓	✓	✓	✓	✓	×	×
	Tūtaekurī R. U/S Mangaone		×		✓	✓	×	✓	✓	✓	✓
	Tūtaekurī R. @ Brookfields Br.		×		✓	×	×	✓	✓	✓	×
Ngaruroro and Tūtaekurī Tributaries	Mangaone R. @ Rissington		×		✓	×	×	✓	×	✓	✓
	Mangatutu S. @ Mangatutu Stn Br.		×		✓	×	×	✓	×	✓	✓
	Ohara S. @ Big Hill Rd		✓		✓	✓	✓	✓	✓	✓	✓
Lowland tributaries	Maraekakaho S. @ Maraekakaho		✓		✓	✓	✓	✓	✓	N/A	×
	Ohiwia S. @ Broughtons Br.		✓		✓	✓	×	✓	✓		×
	Waitio S. @ Ohiti Rd		✓		✓	✓	✓	✓	✓		✓
	Tūtaekurī Waimate S. @ Chesterhope		✓		✓	✓	×	✓	✓		×
	Awanui S. @ Flume		×		✓	✓	×	✓	×		×
	Poukawa S. @ Stock Rd		✓		✓	✓	×	✓	✓		✓
	Karewarewa S. @ Paki Paki		✓		✓	✓	×	✓	×		×
	Herehere S. @ Te Aute Rd		✓		✓	✓	×	✓	×		×
	Raupare S. @ Ormond Rd		✓		✓	✓	×	✓	×		×
	Clive R. U/S Whakatu Rail Br.		×		✓	✓	×	✓	×		×
	Taipo S. @ Church Rd		×		✓	✓	×	✓	×		×

NOTE TO THE HEARING PANEL REGARDING HBRC'S SUGGESTED AMENDMENTS TO SCHEDULE 26

113 In my opinion, the following objectives in the amended version of Schedule 26 proposed in the S42A report (Appendix 1B) are appropriate:

- PeriWCC;
- Visual clarity;
- Dissolved oxygen;
- $ScBOD_5$;
- Nitrate;
- Ammonia;
- Heavy metals and metalloids, pesticides and organic contaminants, radioactive contaminant;
- Temperature;
- Turbidity;
- pH;
- *E. coli*;
- Deposited sediment; and
- Macroinvertebrates.

114 The other objetcives are not appropriate in my opinion for the reasons set out in para. 85 to para. 111.

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Date: 07/05/2021

Dr Michael John Crawshaw Greer

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BEFORE THE INDEPENDENT COMMISSIONERS
APPOINTED BY THE HAWKE'S BAY REGIONAL COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Proposed Plan Change 9 to the Hawke's Bay Regional Council's Regional Resource Management Plan - Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments

AND

IN THE MATTER of the First Schedule to the Act

ON BEHALF OF **BEEF + LAMB NEW ZEALAND**
Submitter

SUMMARY EVIDENCE OF GERARDUS HENRICUS ANTHONIUS KESSELS

11 June 2021

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QUALIFICATIONS AND EXPERIENCE

1. My full name is Gerardus (Gerry) Henricus Anthonius Kessels.

2. My full qualifications and experience are outlined in my Evidence in Chief. I am an independent contracting ecological and environmental planning consultant. I hold a Bachelor of Science degree majoring in zoology, completed in 1988 and a Master of Resource and Environmental Planning (first class honours, specialising in collaborative management and wetland ecology) completed in 1999, both from Massey University. I have 31 years of experience in the fields of freshwater and terrestrial ecology, ecological restoration and resource management planning.

3. I have read the Code of Conduct for Expert Witnesses in the Environment Court's 2014 Practice Note and agree to comply with it.

SUMMARY OF MY EVIDENCE IN CHIEF

4. This summary of my Evidence in Chief evidence provides my review of the efficacy of collaborative, catchment based, and landowner focussed mechanisms to deliver integrated management of natural resources, enhance ecosystem health and biodiversity as they relate to my areas of expertise in achieving the objectives of Proposed Plan Change 9 to Hawke's Bay Regional Council's (HBRC) Regional Resource Management Plan (RRMP) in Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments (hereafter '**TANK**').

5. I consider the approaches and methods which are likely most effective for the management of farming activities in relation to achieving freshwater ecosystem health and biodiversity require catchment planning that is owned by the community through collaborative processes, rather than imposed through more traditional regulatory or 'command and control' approaches.

6. The potential benefits of collaborative processes can be wide ranging and have long lasting impacts. These approaches and methods have the following matters in common:

   (a) They enable flexibility, adaptation, and innovation.

   (b) They seek to engage farmers and provide a sense of ownership of the solutions / practices;

(c) They are spatially appropriate and scalable to allow for local solutions (on-farm and sub-catchment) to address regional problems; and

(d) They enable an effective management and mitigation focus on achievement of desired ecosystem health and biodiversity enhancement outcomes, especially where multiple stressors and diffuse effects are involved.

7. The proposed implementation methods and rule set of TANK are likely to encourage and incentivise best practice in terms of enabling widespread collaborative management through instigation of Catchment Collective Freshwater Plans and Freshwater Farm Plans. In particular, I regard Schedule 30 to be a comprehensive mechanism to allow Council to achieve the policy direction and water quality attribute standards of Schedule 26.

8. There are a large number of existing examples of community based, ecosystem management approaches to addressing water quality and freshwater ecosystem and biodiversity health, which appear to be assisting national and regional policy directives in New Zealand. I have had experience with some of these catchment group initiatives and found that the good management practice outcomes resulting are generally consistent with best practice. In some circumstances I have also seen innovation and collaboration with research scientists leading to new, innovative landuse mitigation and management measures being developed.

9. Fenmemor et al (2011)[1] state, on the basis of a review of the Motueka integrated catchment management (ICM) research programme, that: "*A primary observation from this research is that catchment management is more likely to achieve agreed objectives when it empowers stakeholders, taking into account their aspirations and values, and adapting as those aspirations and values change. Unless an effective social context and decision-making framework is provided, complex or wicked problems like land and water management are unlikely to be addressed or resolved. This*

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[1] Fenemor, C Phillips, W Allen, RG Young, G Harmsworth, B Bowden, L Basher, PA Gillespie, M Kilvington, R Davies-Colley, J Dymond, A Cole, G Lauder, T Davie, R Smith, S Markham, N Deans, B Stuart, M Atkinson & A Collins (2011) Integrated catchment management—interweaving social process and science knowledge, New Zealand Journal of Marine and Freshwater Research, 45:3, 313-331,

not only risks environmental damage, but also a lost opportunity for social cohesion. It may also reduce the potential for social cohesion in the future."

10. Catchment collective groups, when supplemented by regional council existing water quality and environmental monitoring programmes, do provide opportunities to better understand indicators of land management actions. Indicators of success should involve monitoring of a range of water quality and ecological health metrics. But also, indicators can be quantification of the location and/or intensity of the action management actions such as the area of riparian planting, kilometres of stream bank fenced, number of farms adopting sediment reduction practices).

11. I supportive of the approach of Schedule 30 of TANK. Schedule 30 provides a clear list of requirements of Catchment Collective Freshwater Plan Requirements and Freshwater Farm Plans (FFPs), with opportunities for Industry Programmes to support farmers at an individual or collective level. The requirement for a governance structure to be implemented, and identification of environmental outcomes to be developed in respect to achieving Schedule 26 through targeted mitigation measures, are sufficiently comprehensive to address the critical governance and catchment specific ecological health improvement measures required to allow agricultural communities to work towards assisting Council in reaching the desired outcomes of Plan Change 9.

12. In addition, by using these plans as a measuring platform of land management practices, and as a part of the wider matrix of information sources and data, they will likely provide a valuable contribution to monitoring and understanding land management actions, and to applying adaptive management approaches where further actions can be targeted at both local and catchment-wide scales.

13. In terms of having certainty that the collaborative approach encouraged by TANK will lead to effective outcomes, I note that the section 42A report makes specific mention of Policy 26, which lists the ways in which Council can enforce or encourage compliance should landowners not wish to go down the Schedule 30 route, or should a plan not be approved by Council. I agree with this analysis and would support any amendments to Schedule 30 that require the members of a Catchment Collective to agree to participate in Council's conflict resolution service should issues arise.

14. The audit requirements in Section D of Schedule 30 are important to ensure that adaptive management and (at worst), enforcement of non-compliance, can be effectively identified and addressed. To this end, I consider minor rewording of Schedule 30 to provide a clearer linkage between the reporting and review requirements of Section A(5) and Section D would provide assistance to landowners and Council staff by providing a steer towards adaptive management approaches. In my experience implementation of plans on the ground which allow flexibility and room for innovation, will likely provide greater ownership and more effective and enduring mitigation solutions.

Mr Gerry Kessels **DATED** this 11TH of June 2021

BEFORE THE INDEPENDENT COMMISSIONERS
APPOINTED BY THE HAWKE'S BAY REGIONAL COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Proposed Plan Change 9 to the Hawke's Bay Regional Council's Regional Resource Management Plan - Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments

AND

IN THE MATTER of the First Schedule to the Act

ON BEHALF OF **BEEF + LAMB NEW ZEALAND**
Submitter

EVIDENCE IN CHIEF OF GERARDUS HENRICUS ANTHONIUS KESSELS

7 May 2021

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TABLE OF CONTENTS

QUALIFICATIONS AND EXPERIENCE

1. My full name is Gerardus (Gerry) Henricus Anthonius Kessels.

2. I am an independent contracting ecological and environmental planning consultant.

3. I hold a Bachelor of Science degree majoring in zoology, completed in 1988 and a Master of Resource and Environmental Planning (first class honours, specialising in collaborative management and wetland ecology) completed in 1999, both from Massey University.

4. I am a member of the Freshwater Sciences Society of New Zealand, the New Zealand Ecological Society, the Ornithological Society of New Zealand, the Waikato Botanical Society and an affiliate member of the New Zealand Planning Institute.

5. I am a certified Independent Hearing Commissioner with a current 'Making Good Decisions' certificate.

6. I have 31 years of experience in the fields of freshwater and terrestrial ecology and resource management planning. This includes five years with the Department of Conservation (DOC), three years with Opus International Consultants and 18 months contracted to Tonkin & Taylor as a Principal Ecologist. I am currently Principal Ecologist and Managing Director of Kessels & Associates Ltd (trading as Bluewattle Ecology).

7. Much of my professional career has been involved in undertaking ecological investigations, monitoring and assessments and restoration planning within New Zealand, and principally in the Waikato region. I have been involved in many studies and projects relating to freshwater, land use activities, biodiversity, the restoration of riparian margins of streams and lakes, and wetland/ lake biodiversity and water quality, particularly for the rural sector and local government.

8. My Master's thesis investigated conserving biodiversity through collaborative management, investigating interactions between ecosystems and DOC's management of the Whangamarino Wetland.

9. I have been contracted by the Waikato Regional Council (WRC) on numerous occasions to study and assess the effects of agricultural-related activities on the ecological values of streams, rivers, lakes and wetlands within the Waikato region. I have been involved in the preparation of several rural and urban integrated catchment management plans for WRC, Hamilton City Council and Thames Coromandel District Council. I am currently assisting Central Hawkes Bay District Council with biodiversity matters as part of their preparation of the Proposed Central Hawkes Bay District Plan.

10. I was the Waikato, King Country and Western Coromandel Regional Representative for Queen Elizabeth the Second National Trust for the Waikato Region for five years, during which time I assisted many landowners in protecting and restoring degraded freshwater and terrestrial ecosystems in the Waikato and Waipā catchments.

11. I have undertaken many riparian and wetland assessment and restoration plans for rural landowners, tangata whenua, non-government organisations and government organisations such as DOC and territorial authorities. For example, currently I am assisting Matahuru marae restore a wetland and stream side ecosystems at Lake Waikare.

12. I have been involved in policy development pertaining to biodiversity and natural resource matters, acting directly for the councils, or for organisations summiting during the plan consultation and appeal processes. I have been involved in policy and regulatory mechanisms concerning biodiversity and land use for district plans for Central Hawkes Bay District Council, Kapiti Coast District Council, Hamilton City Council, Waikato District Council, Franklin District Council, Hauraki District Council, Thames Coromandel District Council, Waipa District Council and Waitomo District Council.

13. In preparing this evidence I have reviewed reports, and statements of evidence of other experts relevant to my area of expertise, including:

    (a) Proposed Plan Change 9 Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments;

(b) Hawke's Bay Biodiversity Strategy 2016[1];

(c) The National Policy Statement for Freshwater Management 2020[2];

(d) Final TANK Section 32 Report 2 May 2020; and

(e) The officers s42A report.

14. 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

15. This brief of evidence provides my review of the efficacy of collaborative, catchment based, and landowner focussed mechanisms to deliver integrated management of natural resources, enhance ecosystem health and biodiversity as they relate to my areas of expertise in achieving the objectives of Proposed Plan Change 9 to Hawke's Bay Regional Council's (HBRC) Regional Resource Management Plan (RRMP) in Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments (hereafter '**TANK**').

16. I consider the approaches and methods which are likely most effective for the management of farming activities in relation to achieving freshwater ecosystem health and biodiversity require 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, providing the basis for an integrated and collaborative process.

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[1]Hawke's Bay Biodiversity Strategy 2015-2050, 2016. https://www.hbrc.govt.nz/assets/Document-Library/Strategies/biodivstratNovember2015v3.pdf (Accessed 3 May 2020)

[2] Ministry for the Environment, 2020. National Policy Statement for Freshwater Management 2020.

EXECUTIVE SUMMARY

17. I have found through my research studies and experience that sub catchment scale, community based approaches to restoration, mitigation and monitoring of water quality and biodiversity values lends itself to more effective, collaborative solutions, than top down, 'command and control' approaches.

18. In particular, the potential benefits of collaborative processes can be wide ranging and have long lasting impacts. These approaches and methods have the following matters in common:

    (a) They enable flexibility, adaptation, and innovation.

    (b) They seek to engage farmers and provide a sense of ownership of the solutions / practices;

    (c) They are spatially appropriate and scalable to allow for local solutions (on-farm and sub-catchment) to regional problems; and

    (d) They enable an effective management and mitigation focus on achievement of desired ecosystem health and biodiversity enhancement outcomes, especially where multiple stressors and diffuse effects are involved.

19. I support the tailored, integrated sub catchment management approach of the TANK plan change. Rigid policy and compliance structures do not provide the necessary mechanisms to enable sustainable and effective management of diverse farming systems and catchments.

20. The proposed implementation methods and rule set of TANK are likely to encourage and incentivise best practice in terms of enabling widespread collaborative management through instigation of Catchment Collectives and farm environment plans at sub-catchment levels.

21. Creating implementation methods and rules which allow for greater input into the mitigation and monitoring requirements by landowners in sub catchments and farm environment plans is likely to result in the implementation of a wider, more flexible sub catchment focused and more site-appropriate range of riparian and edge of field mitigation tools. This approach will also create greater opportunities to measure the effectiveness of these local measures. A better platform for increased and more

measurable positive outcomes, particularly for hill country lands, as well as a more rapid and enduring uptake, will likely be the result of this approach.

22. Establishing networks of monitoring key indicators of success within sub catchments will also mean that information gathered across sub catchments is able to support a process of continuous learning and provides the opportunity for farmers, schools, iwi, councils, researchers and rural professionals to share knowledge and resources, as well as validating the broader HBRC monitoring network.

COMMAND AND CONTROL VERSUS COLLABORATIVE APPROACHES

23. Policy which focuses on 'command and control' type regulatory approaches[3], are unlikely to deliver on integrated and holistic sustainable management of natural resources as effectively as a mix of implementation and regulatory methods that allow for more community and sub catchment focused initiatives. I have found through my research studies (Kessels (2000)[4] and Kessels (2004)[5]) and experience, such as working with various landowner and mana whenua groups, that sub catchment scale, community-based approaches to ecological restoration, mitigation and monitoring (or ecosystem management approaches) lends itself to more effective, collaborative solutions as opposed to top down, 'command and control' approaches.

24. Holling et al (1998)[6] suggest there is a crisis in resource management and advocate rethinking resource management science because of its non-linear, multi-sectoral, multi-scale and dynamic complexities. They advocate systems approaches and adaptive management. The 1980 World Conservation Strategy states that long-term management of natural

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[3] Which can be defined as an approach to public policy is one where political authorities mandate people, by enacting a law, to bring about a behaviour, and use an enforcement machinery to get people to obey the law through required to meet standards. A standard is generally a mandated level of performance enforced through a piece of legislation.

[4] Kessels, G.H.A. 2000. Conserving Biodiversity through collaborative management. An investigation of interactions between ecosystems and societal systems and the Whangamarino Wetland. Masters thesis. Massey University, Palmerston North, NZ.

[5] Kessels, G. 2004. In Search Off The Right Mix: An investigation of tools for biodiversity management. Report for Local Government New Zealand, Kessels & Associates.

[6] Holling, CS, Berkes, F and Folke, C. 1998. Science, sustainability, and resource management". In Linking social and ecological systems: management practices and social mechanisms for building resilience, Edited by: Berkes, F and Folke, C. 342–362. Cambridge: Cambridge University Press

resources depends on the support and co-operation of local people (WCEC 1987)[7]. This statement has been validated by research studies of community driven catchment-based ecosystem health restoration initiatives in New Zealand, some of which I present in paragraphs 28-35 below. The fact that collaborative approaches have been promoted in New Zealand in the National Policy Statement - Freshwater 2020 NPS-FW), and amendments to the Resource Management Act (RMA), suggest these approaches are effective.

25. Ecosystem management approaches to natural resource management is a viable alternative approach to command and control. An ecosystem management approach rests on understanding that the inherent complexity 'lag' and cumulativeness between action and effects in terms of land use on ecosystems creates a great deal of uncertainty in predicting outcomes of management actions. In the New Zealand policy context, ecosystem management approaches assist in strengthening the relationship between ecological health and life supporting capacity of ecosystems (referring to Part 2 of the RMA and NPS-FW as priority value as primary policy drivers). In a practical sense, policy approaches that necessitate flexibility, anticipation, and adaptation, rather than reaction and control (Lister 1998)[8], are more likely to achieve more enduring positive outcomes. The Motueka integrated catchment management provides a useful example of this approach, which I refer to in greater detail in paragraph 36.

26. Ecosystem management is based on a collaboratively developed vision of desired future ecosystem conditions at a local level (Lucy 1994)[9]. The spatial extent of the management unit is defined by ecological and not political boundaries. It integrates ecological, economic and social factors in a particular management unit, which in turn is a pathway to provide ownership and empowerment of the local people to share in the

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[7] World Commission on Environment and Development (WCED). 1987. Our Common Future. UNEP, New York (Australian edition).

[8] Lister, N.E. 1998. A Systems Approach to Biodiversity Conservation Planning. Environmental Monitoring and Assessment Vol. 49: pp 123- 155.

[9] Lucy, W.H. 1994. If Planning Includes Too Much, Maybe It Should Include More. API Journal Vol. 60 No. 3. pp305-318.

management and monitoring of the natural resources in their area (Sunde et al, 1999)[10].

27. Ecosystem management, as an alternative approach to more prescriptive natural resource management approaches, draws on the connection of freshwater ecological health rather than a focus on specific attributes. In providing for ecological health, life supporting capacity is safeguarded. Ecological health takes a broader perspective that recognises the interconnectedness of ecosystem processes.

BENEFITS & EXAMPLES OF ECOSYSTEM MANAGEMENT APPROACHES

28. There are a large number of existing examples of community based, ecosystem management approaches to addressing water quality and freshwater ecosystem and biodiversity health, which appear to be assisting national and regional policy directives in New Zealand.

29. New Zealand Landcare Trust, for example, works with more than 150 land care groups in New Zealand, and many of these are effective at improving freshwater ecosystem health and enhancing biodiversity (NZ Landcare Trust, 2019)[11].

30. In the Whangape catchment of the Waikato region, Beef and Lamb New Zealand (B+LNZ) and Waikato Regional Council (WRC) have supported community catchment initiatives since at least 2016. This led to farmers becoming more involved, building understanding, and "being empowered to address the issues" (Hungerford, 2019)[12].

31. Drawing on my own experiences, whilst acting as a regional representative for QEII National Trust I become aware of the efforts tangata whenua, landowners, WRC, the Waitomo District Councils, the Department of Conservation and the tourism industry made collaboratively to address sediment runoff issues, which were affecting the glow-worm population of the caves. This was largely achieved by Iwi, regulatory agencies and stakeholders working collectively to implement mitigation and monitoring

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[10] Sunde, C; Taiepa, T; & Horsley, P. 1999. Nature Conservation Management Initiatives for Whanganui Iwi and the Department of Conservation. School of Resource and Environmental Planning, Massey University.
[11] http://www.landcare.org.nz/Landcare-Community (accessed February 2019)
[12] Hungerford, R. 2019. Evaluation report on sub catchment planning. Report prepared for Waikato Regional Council by momentum research and evaluation ltd.

measures relating to runoff and leaching from above-ground land use practices on upstream farms (Pavlovich 2001)[13].

32. The Whatawhata Integrated Catchment Management Project (ICM) demonstrates the potential combined benefits which can arise from collaborative models (in this case environmental and economic). Commencing in 1996, the Whatawhata ICM project involved multiple stakeholders, including 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)[14].

33. 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.

34. Significant improvements were 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).

35. In addition, researchers of the Whatawhata ICM project concluded that participants of collaborative processes were likely to have improved access

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[13] Pavlovich 2001. The Twin Landscapes of Waitomo: Tourism Network and Sustainability through the Landcare Group. Journal of Sustainable Tourism 9(6):491-504

[14] 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.

to the four capitals: human, natural, financial/physical and social than traditional approaches (Botha, 2019)[15].

REQUIREMENTS FOR SUCCESSFUL COLLABORATIVE APPROACHES

36. Fenmemor et al (2011)[16] state, on the basis of a review of the Motueka integrated catchment management (ICM) research programme, that: "*A primary observation from this research is that catchment management is more likely to achieve agreed objectives when it empowers stakeholders, taking into account their aspirations and values, and adapting as those aspirations and values change. Unless an effective social context and decision-making framework is provided, complex or wicked problems like land and water management are unlikely to be addressed or resolved. This not only risks environmental damage, but also a lost opportunity for social cohesion. It may also reduce the potential for social cohesion in the future.*"

37. Sinner & Newton (2018)[17] provide further New Zealand based evidence and examples of effective management of diffuse contaminant leaching and run off at a community based, sub catchment scale, concluding that: "*because outcomes at a sub catchment and catchment scales are the result of multiple stressors originating from multiple properties, RMA[18] policies and rules aimed at individual properties may not achieve the objectives specified in regional plans. WMGs[19] offer a way through this problem, and many groups have emerged around New Zealand over the past 15 to 20 years to address local issues. To use this approach more widely under the National Policy Statement for Freshwater Management, however, will require a more deliberate and structured approach, so that the combined actions of all the groups in a given catchment will achieve the community's desired outcomes for that catchment.*"

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[15] 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.

[16] Fenemor, C Phillips, W Allen, RG Young, G Harmsworth, B Bowden, L Basher, PA Gillespie, M Kilvington, R Davies-Colley, J Dymond, A Cole, G Lauder, T Davie, R Smith, S Markham, N Deans, B Stuart, M Atkinson & A Collins (2011) Integrated catchment management—interweaving social process and science knowledge, New Zealand Journal of Marine and Freshwater Research, 45:3, 313-331,

[17] Sinner, J; Newton M. 2018. Water Management Groups: Preliminary Guidance. Prepared for Ministry for the Environment. Cawthron Report No. 3199. 15 p.

[18] Resource Management Act 1991

[19] Water management groups

38. Sinner & Newton (2018) also provide preliminary guidance advice for regional councils how community based, water management groups can be structured, and what regional council plans should contain to improve the likelihood that groups will achieve the freshwater outcomes sought by their communities.

39. The results of these two key pieces of research show that key elements required to support and empower a water management group (or a Catchment Collective as defined in TANK) can be summarised as:

- Ensuring the group structure is at a sub catchment scale and representative of all stakeholders within that sub catchment, and that ideally the group has legal status;
- Specification of more than one outcome, e.g. a range of water quality and habitat standards, for every water management group confluence point;
- Policies and methods which provide clear criteria or conditions for a group to be recognised and what its environment plan must contain;
- A regional plan should specify that a group's environment plan must be approved by the regional council prior to implementation;
- The environment plans need to contain several key elements including – goals, mapping of land use and effects of each land use practice, mitigation actions, monitoring and reporting strategies, review and auditing processes, an adaptive management approach to account for the complex and non-static ecosystem management dynamics at play, and consequences for non-achievement.

CREATING CERTAINTY OF ACHIEVING THE DESIRED OUTCOMES

40. Measuring the efficacy of a catchment collective approach in terms of achieving the desired objectives of regional plans has been limited to date in New Zealand (Doehring et al, 2020)[20]. However, catchment collective groups, when supplemented by regional council existing water quality and

[20] Doehring, K., Young, R.G, Robb, C. 2020. Demonstrating efficacy of rural land management actions to improve water quality - How can we quantify what actions have been done? Journal of Environmental Management. Vol. 270.

environmental monitoring programmes, do provide opportunities to better understand indicators of land management actions.

41. In this regard, it is important that catchment collective groups have sound administrative and management structures, and that they can demonstrate measurable improvements they may make to ecosystem health and biodiversity improvement at sub catchment levels. Indicators of success should involve monitoring of a range of water quality and ecological health metrics. But also, indicators can be quantification of the location and/or intensity of the action management actions such as the area of riparian planting, kilometres of stream bank fenced, number of farms adopting sediment reduction practices). These indicators need to quantify actions that occur at varying intensity and scale (Doehring et al, 2020).

42. I see no constraints to catchment collective groups being able to undertake this type of monitoring effectively. As Sinner & Newton (2018) note: "*One approach to managing these diffuse effects is to allocate limits for individual pollutants to individual properties. This is usually based on models that may not accurately reflect physical processes and cumulative effects, leaving environmental outcomes in doubt and land users questioning the models (Duncan 2014). Another approach is to require land users to adopt specific 'good management practices'. This provides some certainty of actions and costs but delivers uncertain environmental outcomes and, without other controls, may allow further intensification. Hence, both approaches have limitations and may not deliver what the community expects. Collective management offers a way to focus more on achievement of desired outcomes, especially where multiple stressors are involved. By assigning environmental responsibilities to a water management group rather than an individual landowner, land users have more flexibility to identify place-specific mitigations. Members are accountable to each other as well as to the wider community, creating peer pressure to improve performance."*

BEST PRACTICE MITIGATION AT A FARM SCALE

43. I am in support of the identification and adoption of mitigations at the farm scale applied through Farm Environmental Plans (FEPs), with direct input by individual landowners key. This approach should be integrated across a catchment and ideally applied to co-ordinate with sub-catchment management plans developed by Catchment Collective groups.

44. Management of contaminant losses from farms often needs to occur at the individual farm scale using tailored FEPs to be effective. A targeted approach to a range of management and mitigation measures that also involves critical source and high ecological value area identification and management is likely to an effective approach to attenuating a broader range of contaminants on hill country farms in many situations.

45. There are a range of proven on-farm management methods, riparian buffer zone and edge-of-field mitigation methods available which can be applied at an FEP or sub catchment scale by a community catchment group. Doole et al (2016)[21] suggest that for drystock farms the greatest efficiency and long-term gains in reducing contaminant discharges is best achieved when specific mitigations are:

- Chosen on the basis of suitability to the farm;
- Implemented on the basis of cost-effectiveness; and
- Implemented in critical source areas.

46. Edge-of-field mitigation measures, combined with tailored riparian buffer zones, when applied strategically at a farm and sub-catchment scale, and combined with on farm management activities, can provide effective alternative approaches to attenuate the runoff of sediment and nutrients, within productive farming landscapes, while enhancing biodiversity values (Parkyn 2004)[22]. These include a range of riparian management options, including:

- Headwater or riparian wetlands: Fenced wetlands as hotspots for nutrient removal;
- Rotational grazing: Filter strips with varied stock grazing practices, such as occasional light grazing by sheep;
- Forested or planted native or production trees: a buffer of native trees to return ecological function to the stream and provide water quality benefits; and
- Multi-tier system: a combination of buffers where native forest trees may be used beside the stream to enhance ecological function and

[21] Doole, G.; Quinn, J.M. Wilcock, B.J. Hudson, N. 2016. Simulation of the proposed policy mix for the Healthy Rivers Wai Ora process. Prepared for the Technical Leaders Group of the Healthy Rivers/Wai Ora Project. Report No. HR/TLG/2016-2017/4.5

[22] Parkyn, S. 2004. Review of Riparian Buffer Zone Effectiveness. MAF Technical Paper No: 2004/05. Ministry of Agriculture and Forestry, Wellington, NZ.

biodiversity, a buffer of production trees may occur outside of that and at the outer edge beside agricultural land a grass filter strip may be used.

47. There are also a range of edge-of-field mitigation measures which can be adopted by individual farmers, or at a sub catchment level. They include: detention bunds, constructed wetlands, sedimentation ponds and traps, swales, and water distribution networks. Edge-of field measures are most effective when they are combined, for example sedimentation and wetland combinations.

48. Doole (2015)[23], provides a useful description and tabulation of the efficacy of a range of different edge-of-field mitigation strategies (Table 14). This shows that for detention bunds, efficacy for N reduction is 10% and 30% for P reduction. For small constructed wetlands the efficacy is 20% reduction for N and 35% for P, while for medium constructed wetlands the efficacy is 40% reduction for N and 70% for P.

49. Constructed wetlands are an effective mitigation tool for reducing sediment and nutrient inputs to waterways. For example, effective removal of N inflows in the wetlands of the Tutaeuaua sub-catchment of Taupo was attributed to denitrification in that wetland (Collins et al 2005)[24].

50. Like collective approaches, FEPS are likely to be more effective and implemented by individual landowners if they are actively involved throughout the FEP process. As Doehring et al (2020) conclude, the success of these land management actions: "..*will depend on gaining landowner confidence and addressing concerns about confidentiality."*

51. In addition, by using FEPs as a recording platform of land management practices, and as a part of the wider matrix of information sources and data, these plans can provide a valuable contribution to monitoring and understanding land management actions, and to applying adaptive

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[23] Doole, G. 2015. Description of mitigation options defined within the economic model for Healthy Rivers Wai Ora Project. Description of options and sensitivity analysis. Prepared for the Technical Leaders Group of the Healthy Rivers/Wai Ora Project. Report No. HR/TLG/2015-2016/4.6

[24] Collins, R.: Elliott, S; Adams, R. 2005. Overland flow delivery of faecal bacteria to a headwater pastoral stream. Journal of Applied Microbiology 99:126-132

management approaches where further actions can be targeted at local scales (Doehring et al, 2020).

TANK PLANNING PROVISIONS SUPPORT COLLABORATIVE APPROACHES

52. The TANK plan change supports collaborative approaches to the management of land use in relation to water quality and biodiversity values of the catchments it covers. I support the approach in broad terms.

53. TANK, through Objective 1(c), provides for for an integrated, holistic and coordinated approach to the management of the Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments: 1 (c): "*support good decision making by resource users including rural and urban communities through marae and hapū initiatives, community or other catchment management programmes and monitoring initiatives, urban stormwater programmes, landowner collectives, farm management plans and industry good practice programmes.*"

54. Policies 1,2,3,4 and 5 outline the priority management approach taken where water quality targets shown in Schedule 26 are not being met.

55. Policies 23,24,25 provides for Industry Programmes and Catchment Management and requires HBRC to support and encourage their establishment and implementation.

56. TANK provides a Permitted Activity pathway for productive land use through 'Catchment Collectives' and Farm Plans subject to meeting the requirements of Schedule 30 and:
    - To be provided by Council on request.
    - Information on the implementation of the mitigation measures supplied to Council on request.

57. In terms of having certainty that the collaborative approach encouraged by TANK will lead to effective outcomes, I note that the section 42A report makes specific mention of Policy 26 (which lists the ways in which Council can enforce or encourage compliance) as follows: "*The policy [Pol TANK 26] recognises that issues may arise within Collectives as much as they might arise in relation to compliance with plan rules. The research into the barriers to the success of collective management identified management of conflict and compliance as key areas that required specific attention. This*

policy addresses that need and reflects that Council may provide conflict resolution services in situations where Collectives may need assistance. Each Collective will need to develop conditions of membership (and these may be based on industry or council templates). If individuals don't comply with local conditions, this policy provides an avenue for resolution without the collective having to play a policing role over their own neighbours. In addition, the Council will continue to enforce compliance with Rules TANK 1 and 2. The Council can adopt a range of enforcement measures including abatement notices, enforcement orders and prosecutions as necessary in these circumstances." (Paragraphs 892-893). The section 42A report therefore clarifies that Council is able to provide certainty that enforcement measures, both at a catchment collective level and at a farm scale, can be applied to ensure compliance. I agree with this analysis and would support any amendments to Schedule 30 that require the members of a Catchment Collective to agree to participate in Council's conflict resolution service.

58. The policy framework of TANK thus encourages the adoption and implementation of a sub-catchment approach to prioritisation of implementation of mitigation and management measures through supporting and encouraging Catchment Collectives, application of best practicable options and mitigation or offsets at a farm scale via Farm Environment Plans as detailed in Schedule 30, and regulatory backstops should these approaches require enforcement. re the necessary policy provisions to achieve a successful outcome using CC.

NOTE TO THE HEARING PANEL REGARDING S42A RECOMMENDATIONS

59. I note paragraph 907 of the s42A Hearing Report invites submitters to provide evidence on measures that enable industry leaders and landowners to understand water quality issues and to implement necessary measures in a reasonably timely manner. I therefore drafted my evidence with that request in mind.

60. Refer paragraph 57 above.

CONCLUDING STATEMENT

61. My opinions are based on my current understanding and review of the evidence, literature and data referenced in my evidence brief, including reports supplied by Hawkes Bay Regional Council. In particular, I have

relied on the information and evidence of others, particularly where it is relevant, but outside of my areas of expertise. I reserve my final opinions subject to review of further evidence provided by other experts and Council staff, and any subsequent caucusing.

DATED this 7TH of May 2021

Mr Gerry Kessels

#197

BEFORE COMMISIONERS APPOINTED
BY THE HAWKES BAY REGIONAL COUNCIL

IN THE MATTER	Of the Resource Management Act 1991
AND	
IN THE MATTER	of the First Schedule of the Act
AND	
IN THE MATTER	of Hawkes Bay Regional Council Plan Change 9 – Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) Catchments.
AND	
IN THE MATTER	of submissions under clause 6 First Schedule.
BY	**BEEF + LAMB NEW ZEALAND LIMITED** **Submitter**

SUMMARY OF EVIDENCE OF THOMAS SPENCER ORCHISTON

11 MAY 2021

SUMMARY

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1. Sheep and beef farms are complex and diverse systems. There is a high degree of variation in landscapes and natural resources requiring flexibility in farming practices, management and mitigation strategies to achieve the desired outcomes. Approaches that are overly prescriptive can inhibit engagement and innovation and may prevent desired environmental outcomes being achieved. A flexible approach through farm planning or catchment communities can suit a range of farmers and farm systems. A farm planning approach that allows flexibility will build greater resilience, innovation, and adaptability within the primary sector.

2. Matching the appropriate farm system and on-farm management is a key part of pastoral agriculture to optimise farm's long-term productivity and environmental success. Farm planning and Land Use Capability mapping is an effective way to do this through consideration of underlying characteristics such as geology, soil, slope, topography, vegetative cover, erosion potential and climate.

3. Farm plans provide flexibility and a tailored approach to understanding and categorising a farm's natural capital assets. They provide a mechanism to assess environmental risks and strengths, and a way to review these over time. Farm plans developed in this way may also take into account wider business, social and cultural goals.

4. Beef + Lamb New Zealand's approach to farm planning is designed to help farmers ensure the sustainability and profitability of their farming business by understanding and managing their natural resources (including soil, freshwater, biodiversity and climate. It also helps to identify and work towards meeting their own values and objectives as well as the wider community or catchment values and objectives.

5. The B+LNZ environment module is the first part of a wider farm plan that will also include modules such as biosecurity, health and safety, human resources, and animal welfare. However, I understand that Schedule 30 Freshwater Farm Plan is primarily to manage land use as part of the Plan's broader purpose of working toward achievement of freshwater outcomes in Schedule 26.

6. Freshwater ecosystem health may be impacted by farming operations. It is important for farming operations to minimise the associated risks through on-farm actions, mitigation, management and planning.

7. For the sheep and beef sector to continue to meet environmental and freshwater requirements, flexibility around farming practices and mitigation strategies is needed to ensure farm systems can continue to respond to changes, innovate and remain sustainable while also optimising land use.

8. Schedule 30, clauses 2.2 and 2.3 includes appropriate management considerations (such as soil type, phosphorus levels and fertiliser application, riparian management) that must be addressed in farm plans and catchment collectives. These are suitable principles to include in a Freshwater Farm Plan to contribute positively to achieving freshwater outcomes, and they provide suitable flexibility to meet the diverse and complex farm systems.

9. Surveys have shown that with farm plans are significantly more likely to have implemented management principles (such as stock exclusion, buffer zones and riparian planting) and nutrient management practices (such as targeted fertiliser use and nutrient budgeting) compared to farms with no farm plan.

10. Key contaminants of concerns for sheep and beef farms are those that are lost in overland flow these are primarily sediment, phosphorus and faecal bacteria. Adoption and implementation of good farming management principles are an effective way to manage contaminants of concern and have demonstrated impacts on improving freshwater outcomes.

11. For example, identification and careful management of critical source areas (areas where a transport vector meets a contaminant source e.g. ephemeral water flow in a gully, swale or laneway) is an important way to reduce environmental losses to waterways. Reducing the risk of overland flow occurring in critical source areas or minimising mobilisation of a contaminant source will help to reduce the overall risk of losing contaminants to waterways. Management options include retaining vegetation cover in the critical source area, appropriate stock management, non-tillage, stock exclusion at certain times, and maintaining good soil structure.

12. Management of critical source areas during winter grazing activities is an excellent way to mitigate the environmental risk associated with sheep and beef farming activities, with research showing up to 80 percent reduction of sediment and phosphorus loss being able to be achieved by critical source area management and strategic grazing.

13. Individual farm plans should be active and flexible to change and evolve over time. This ensures they remain relevant to the individual farm and landowner as well as communities and catchments by supplying up-to-date information. Flexibility to develop and modify farm plans ensures an evolving understanding and awareness of issues, as well as an ability to capitalise on opportunities that are presented that may contribute to better personal, social, economic, or business outcomes.

14. Community led initiatives and catchment groups that have significant farmer input and leadership, as well as appropriate resourcing and support, are more likely to achieve the objectives reflective of the community's values. While support from external organisations contributes to overall success, groups need to develop their own path (rather than following one prescribed to them) and be led and driven by the community and farmers leaders.

BEFORE COMMISIONERS APPOINTED
BY THE HAWKES BAY REGIONAL COUNCIL

IN THE MATTER	Of the Resource Management Act 1991
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BY	**BEEF + LAMB NEW ZEALAND LIMITED** **Submitter**

BRIEF OF EVIDENCE OF TOM SPENCER ORCHISTON

7 MAY 2021

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TABLE OF CONTENTS:

BACKGROUND

Qualifications and Experience

1. My full name is Thomas Spencer Orchiston.

2. I am employed by Beef + Lamb New Zealand (B+LNZ) as an Environment Capability Manager. This role aims to build the environmental capability of sheep and beef farmers to improve overall environmental outcomes on farms.

3. I hold a Bachelor of Science and a Postgraduate Diploma in Environmental Science from Otago University (2002).

4. I have a certificate in Sustainable Nutrient Management from Massey University (2010) and an AsureQuality Advanced Auditing Skills Certificate (2016).

5. My previous work experience includes 10 years for AgResearch Ltd as a Research Associate involved in soil, water and climate research based projects; 4 Years with Crop and Food Research investigating sustainable and efficient landuse through crop diversification and; 3 years with Landcare Research measuring carbon sequestration and plant biodiversity in indigenous forests and shrublands.

6. I have been an auditor for a farm assurance programme that provided sustainable, high value meat from low chemical input New Zealand farms for export.

7. I have been a part of the New Zealand Institute of Primary Industry Management technical advisory group on farm planning certification.

8. I have been involved in development of B+LNZ refreshed farm plan documentation and training of facilitators to deliver the B+LNZ farm plans.

9. I have completed a Land Use Capability course held in Hawke's Bay.

10. I have been co-author in five peer-reviewed journal articles, lead or co-author of eight conference papers or reports.

SCOPE OF EVIDENCE

11. I have been asked by B+LNZ to prepare evidence in relation to the sheep and beef sector generally and the management solutions to reduce contaminant loss from sheep and beef farming.

12. My evidence discusses:

    (a) The profile of the sheep and beef sector both generally and in Hawkes Bay.

    (b) Externalities of concern to the sheep and beef sector.

    (c) Farm Planning as a Management tool to reduce contaminant loss from sheep and beef farms.

    (d) Catchment Communities to manage cumulative impact and outcomes.

    (e) The drinking water needs of stock.

    (f) Considerations of irrigation as a proxy for risk.

13. In preparing this evidence I have reviewed relevant sections of the Hawkes Bay Regional Councils Proposed Plan Change 9 (PC9), supporting reports and statements of evidence of other experts giving evidence relevant to my area of expertise, and relevant background documents and technical reports, including:

    (a) Relevant sections of the Proposed Plan Change 9 Tūtaekurī, Ahuriri, Ngaruroro and Karamū Catchments.

    (b) The officers s42A Report.

    (c) Ngaruroro, Tūtaekurī, Karamū river and Ahuriri Estuary catchments:State and trends of river water quality and ecology. Report for Hawke's Bay Regional Council.

    (d) B+LNZ submission and further submission.

    (e) Expert evidence of Dr. Michael Greer and Mr. Gerry Kessells

14. 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.

EXECUTIVE SUMMARY

15. Sheep and Beef farms are complex and diverse systems. There is a high degree of variation in landscapes and natural resources requiring flexibility in the way it is managed. Approaches that are overly prescriptive inhibit innovation and prevent desired environmental outcomes being achieved. A flexible approach to farm planning is needed to suit a range of farmers and farm systems.

16. Sheep and beef farming is an integral part of Hawkes Bays and New Zealand's economy. Farming provides valuable jobs and income for the community. Farms can be both profitable and achieve desired commuity environmental values.

17. Matching the appropriate farm system and on-farm management is a key part of pastoral agriculture to optimise farms long-term productivity and environmental success. Consideration of underlying characteristics of the farm such as geology, soil, slope, topography, vegetative cover, erosion potential and climate are a crucial part of ensuring this. Farm Planning is an effective way to do this.

18. Freshwater ecosystem health may be impacted by farming operations. Freshwater ecosystem health assesses a range of physical, chemical and biological parameters to determine the overall state of a waterway. It is important for farming operations to minimise negative impacts and reduce associated risks through on-farm actions, mitigation, management and planning.

19. Key contaminants of concerns for sheep and beef farms are those that are lost in overland flow (these are sediment, phosphorus and faecal bacteria). Thus, identifying and applying farm-specific mitigation strategies to critical source areas is a key strategy to successfully reduce the impact of sheep and beef farming practices on freshwater health.

20. Key tools for this are LUC mapping and farm-specific tailored farm plans that are created with farmer involvement to deepen their understanding of the risks and opportunities associated with farming activities.

21. One-size-fits-all policy approaches are unlikely to achieve the desired outcomes for sheep and beef farms due to the complexity and diversity of the systems.

22. Community led initiatives and catchment groups that have significant farmer input and leadership, as well as appropriate resourcing and support, have the greatest likelihood of achieving the objectives reflective of the community's values. While support from external organisations contributes to overall success, groups need to develop their own path (rather than following one prescribed to them) and be led and driven by the community.

PROFILE OF THE SECTOR

23. The New Zealand sheep and beef sector contributes to 4.2% of gross domestic product and $4.6 billion in household income, including flow on effects (Heilbron, 2020).

24. Its total value of red meat exports and wool for the 2019-20 season was $10.4 billion. Over 90% of production from the sheep and beef sector is exported.

25. The sheep and beef sector provides jobs for over 92,000 people directly employed on-farm, in processing and support services.

26. The Hastings district covers an area of over 5200 km^2 and extends from Whirinaki in the north to Waimarama in the south. In this district there were 333 commercial sheep and beef farms in 2017. The B+LNZ Economic Service defines commercial sheep and beef farms as, among other things, those that are over 750 Stock Units (a stock unit is defined as the feed demand equivalent to a 55 kg ewe rearing one lamb which requires around 595 kg dry matter/yr, e.g. a hill country beef cow equals 5.5 Stock Units).

27. In the Hastings district sheep numbers have remained relatively stable over the past five years at 1.1 million while beef cattle have increased by approximately 18% over the same period (Figure 1). Stock units for sheep have slightly declined and beef stock units have increased (Figure 2).

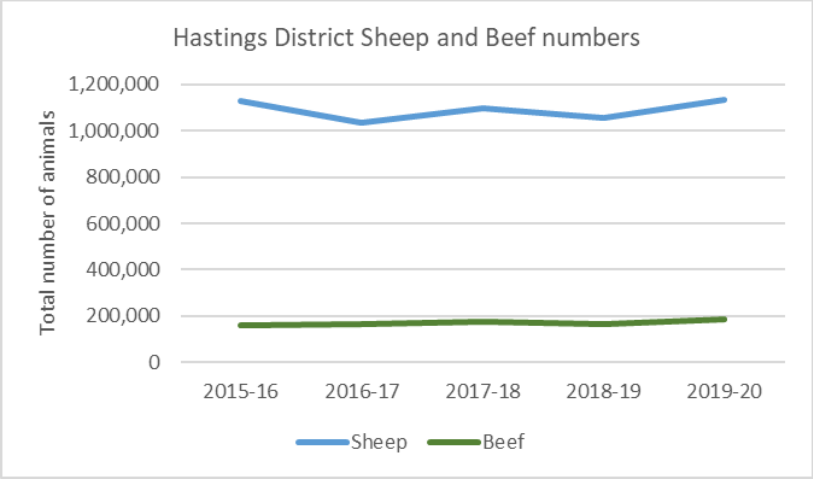

Figure 1: Trend in Livestock numbers, Hastings. Source StatsNZ, B+LNZ Economic Service

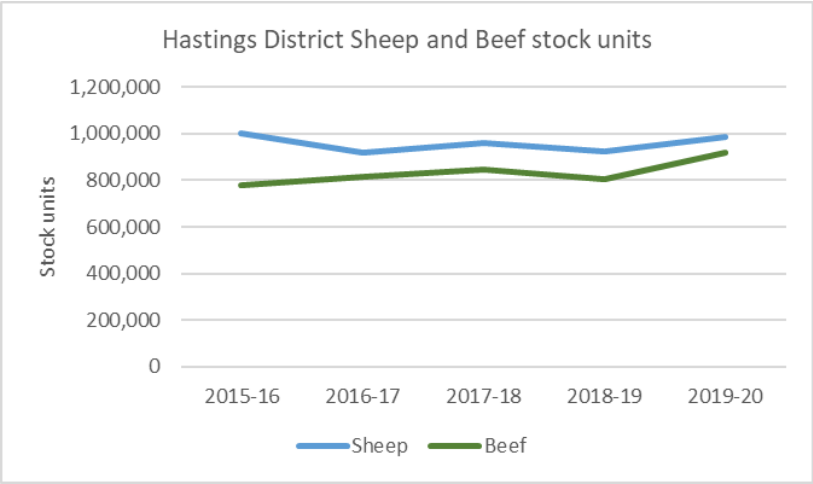

Figure 2: Trend in stock units, Hastings. Source StatsNZ, N+LNZ Economic Service.

28. Appendix 1 describes the B+LNZ Sheep and Beef Farm Survey ("Survey"), the source of data for the following sections.

29. Sheep and beef farms are complex and diverse. Sheep and beef farms are located on a variety of landscapes and operate in a variety of climates. B+LNZ characterises farms into eight Farm Classes, which combine both physical and financial characteristics. The Farm Classes that are relevant in the Hastings District/ Hawke's Bay region are Farm Class 3 - North island Hard Hill Country, Farm Class 4 – North Island Hill Country, and Farm Class 5 – North Island Finishing. These are described in more detail in Appendix 1.

30. There are estimated to be 165, 515 and 465 commercial farms in farms classes 3, 4, and 5, respectively, in the Hawke's Bay (Table 1).

Table 1: Estimated Hawke's Bay Sheep and Beef farms and area, by Farm Class 2019-20

Farm Class	Commercial farms	Grazing hectares	Non-Grazing hectares Forestry, scrub, bush, wetlands etc	Total Area hectares (Survey estimate)	Grazing hectares %
Class 3 North Island Hard hill country	165	144,900	29,500	174,400	83%
Class 4 North Island Hill country	515	269,000	55,100	324,000	83%
Class 5 North Island Intensive finishing	465	164,000	18,100	181,800	90%
All Classes	1,145	577,900	102,700	680,200	85%

Source: B+LNZ Economic Service, StatsNZ

31. The B+LNZ Survey data for the Hawke's Bay shows that the average farm area of Farm classes 3, 4 and 5 in 2018-19 were 1057, 629, and 391 ha, respectively (Table 2).

32. Stocking rates were 8.1, 8.6 and 9.1 SU/ha for farm classes 3, 4, and 5, respectively, in 2018-19 (Table 2; Appendix 2: Stocking rates by Farm Class). This is an equivalent stocking rate of less than 1.5 cows per hectare (Appendix 2: Stocking rates by Farm Class).

33. Of those farms surveyed in the Hawke's Bay region there were no sheep and beef farms that had any form of irrigation.

34. Of those farms surveyed across the whole East Coast region (East Cape to Wairarapa), for the 2018-19 season there was no irrigation on Farm Class 3, minimal irrigation on Farm Class 4 (2.1% of farms) and a small percentage of Farm Class 5 farms with irrigation (6.7%).

35. Irrigation on sheep and beef farms is often a small percentage of the total farm area under irrigation as there is often only a fraction of the farm area that is suitable for irrigation due to topography, soil types and proximity to water supply schemes.

Table 2: Key physical and financial features of commercial sheep and beef surveyed farms in Hawke's Bay 2018-19

Physical, production and financial statistics		Farm Class 3: North Island Hard Hill Country	Farm Class 4: North Island Hill Country	Farm Class 5: North Island Intensive Finishing
Farms in Sample	No.	14	35	25
Total Farm Area	ha.	1,057	629	391
Grazeable Area	ha.	878	522	352
Grazeable Area	% of Total	83	83	90
Irrigation [1]	% of farms	0	0	0
Sheep	No.	4,836	2,709	1,947
Cattle – Beef	No.	574	456	319
Deer	No.	0	19	0
Sheep to Cattle[2] Ratio	% Sheep	62	55	52
Sheep	SU	4,408	2,443	1,682
Cattle – All	SU	2,745	2,037	1,535
Deer	SU	0	33	0
Total	SU	7,153	4,513	3,220
Stocking Rate	SU/eff. ha.	8.1	8.6	9.1
Lambing Performance	%	116.3	126.5	128.5
Calving Performance	%	86.1	83.1	89.5
Wool Revenue	% of total	5%	5%	3%
Sheep Revenue	% of total	60%	54%	49%
Sheep+Wool Revenue	*% of total*	*65%*	*59%*	*52%*
Cattle Revenue	% of total	33%	34%	38%
Dairy Grazing Revenue	% of total	0%	4%	2%
Sub-Total	% of total	98%	96%	93%
[1] Based on farms paying irrigation charges				
[2] All cattle, i.e. beef plus dairy cattle. Stock units.				

36. Total Gross Revenue Output from the pastoral sector in Hastings District for 2018-19 was $260 million, of which almost $214 million was from sheep and beef farms. Further information on Gross Revenue at a Hawke's Bay and East Coast level is provided in Appendix 4: Aggregate Farm Revenue.

37. The sheep and beef sector's ability to adapt has been an important factor in its success since the 1990s. Sheep numbers were 58 million in 1990 and have dropped to 27.4 million in 2017 while beef cattle numbers have dropped from 4.6 million in 1990 to 3.6 million in 2017 (Mackay, Scobie, Rhodes, & Devantier, 2019). This has also resulted in an approximately 30% reduction in greenhouse gas emissions contributed from the sector.

During this time there have also been significant productivity gains that have been possible through innovation and efficiencies such as:

(a) improved animal genetics;

(b) increased fecundity;

(c) improvements in animal management, feeding and welfare; and

(d) optimisation of farming systems to align with the natural capital of the land.

38. Productivity gains include:

(a) Increased average lambing percentage from 100 percent to 130 percent since 1991 (B+LNZ, 2020);

(b) increased lamb carcass weight per ewe and hogget from 9kg to 19kg (+104%) (B+LNZ, 2020);

(c) increased steer weight from 297 kg/head to 312 kg/head (B+LNZ, 2020).

39. Sheep and Beef farms collectively have over 2.8 million hectares of New Zealand's indigenous vegetation including native forest and shrublands (Norton & Pannell, 2018). This represents almost one quarter of the indigenous vegetation in New Zealand.

40. Sheep and beef farms have significant areas in forestry as well as areas set-aside in manuka, scrub, lakes, wetlands and riparian planting. In the East Coast over 15% of the total farm area of Farm Class 3 and 4 sheep and beef farms is forestry and set-aside areas (Appendix 3: Forestry and set-aside areas). For Farm Class 5 this is around 7% of the whole farm area.

41. Case and Ryan (2020) estimated woody vegetation (including indigenous and exotic forest) on sheep and beef farms in New Zealand could offset between 63 and 118 percent of on-farm agricultural greenhouse gas emissions. The total carbon sequestration potential on sheep and beef farms was estimated to be between 10,394 kt CO_2e and 19,665 kt CO_2e (Case & Ryan, 2020).

42. In comparison, a report by the Ministry for the Environment on net emission and removals from vegetation and soil on sheep and beef farmland,

suggested that net removals of carbon dioxide were equivalent to 33 percent of on-farm agricultural emissions (MfE, 2020). This accounted for net emissions from forest harvest and used different sequestration rates to those used in the Case and Ryan (2020) report.

43. There is a high degree of complexity in sheep and beef farms due to a high degree of spatial and temporal variation in:

    (a) physical landscape,

    (b) climate, and

    (c) biological systems (both farmed and native).

44. Add to this the individuality of the farmer and their personal business considerations and we see that each sheep and beef farm has a different set of parameters and constraints which must be considered to ensure good environmental and business outcomes.

45. For the sheep and beef sector to continue to meet environmental and freshwater requirements, flexibility around farming practices and mitigation strategies is needed to ensure farm systems can continue to adapt to climate and market changes and fluctuations while also optimising land use.

EXTERNALITIES OF CONCERN TO THE SHEEP AND BEEF SECTOR

46. Freshwater ecosystem health may be impacted by farming operations. It is important for farming operations to minimise negative impacts and reduce associated risks though on-farm actions, mitigation, management, and planning.

47. Sediment, phosphorus, faecal microbes and nitrogen can all potentially impact on freshwater systems. Overland flow or runoff can carry sediment, phosphorus and faecal microbes to freshwater bodies. Nitrogen is generally carried with water though the soil profile and leaches out of the soil profile to groundwater. Careful land and stock management is needed to reduce the risk of losing these contaminants to waterways.

48. Sediment, phosphorus and faecal microbes carry the greatest risk of loss due to the landscape where sheep and beef farming typically occurs, with stock type and on farm management practices being the other key factors.

49. Sediment and phosphorus loss are often closely linked as the phosphorus can bind to sediment and is subsequently transported. In areas where erosion is a risk, sediment and phosphorus loss are largely driven by the generation of overland flow which acts as a vector to mobilise and transport the contaminants into waterways. As such slope, underlying geology, soil type and vegetative cover are important factors that contribute to the risk as well as patterns of rainfall and runoff generation.

50. Sediment loss can be caused by animal grazing pressure when there has been a loss of ground cover alongside breakdown of soil aggregates into small micro-aggregates and fine particles. Following this, the particles are transported in surface runoff. This sometimes occurs during winter grazing of animals.

51. Phosphorus contamination of surface water from sheep and beef farms is typically the result of eroded sediment from surrounding land but may also be a result of the use of phosphorus containing fertiliser. Consideration of phosphorus containing fertilisers needs to be taken into account in areas where phosphorus enrichment of waterways is an issue, the use of low soluble phosphorus fertilisers can reduce the P loss from overland flow in grazed pastures (McDowell & Catto, 2005).

52. Faecal microbes contain organisms that are part of the gut biome of animals. Sometimes there may be pathogenic organisms present that can be harmful to animal or human health. Other microbes such as *Echerichia coli (E. coli)* may be present and are usually harmless but can act as indicators of faecal contamination and also potential pathogenic risk. These organisms are deposited in dung and can be deposited directly in waterways if animals have unrestricted access to them. When faeces are deposited on pastures the faecal bacteria can be mobilised during rainfall which generates overland flow and is transported in the water to reach waterways. Overland flow is also believed to be a major contributor of the total microbial load delivered to streams (Vinten et al., 2004). Sheep are less attracted to waterways than cattle and are less likely to directly deposit faeces into waterways (Collins et al., 2007).

53. Critical source areas (CSAs) are areas of a catchment where a source of nutrients or contaminants coincides with a transport mechanism, usually water (McDowell & Srinivasan, 2009). CSAs are relatively small areas

where ephemeral flow accumulates and has enough energy to mobilise and transport a disproportionate amount of sediment, nutrients or contaminants (Betteridge et al., 2012). Once the contaminants have been entrained in a flow pathway, they may be transported to waterways in overland flow. These areas are often low-lying parts of farms such as gullies and swales but may also be represented by non-paddock features such as laneways.

54. Careful management of CSAs is an important way to reduce environmental losses to waterways. Reducing the risk of overland flow occurring in CSA or minimising mobilisation of a contaminant source will help to reduce the overall risk of losing contaminants to waterways. Management options include retaining vegetation cover in the CSA, appropriate stock management, non-tillage, stock exclusion at certain times, and maintaining good soil structure.

55. Contaminant losses from sheep and beef farms can often occur over short time scales from relatively small areas where high contaminant concentration and rapid transport processes coincide (Monaghan et al., 2007). Management of CSAs is an excellent way to mitigate the environmental risk associated with sheep and beef farming activities, with up to 80 percent reduction of sediment and phosphorus loss being able to be achieved by CSA management (McDowell, van der Weerden, & Campbell, 2011; Monaghan, Laurenson, Dalley, & Orchiston, 2017).

56. In his evidence, Dr. Michael Greer states in pargraph 58 that where *E. coli* targets are not being met that *"agriculture is the most likely cause; sheep and beef farming being far and away the most predominant source of potential faecal contamination in most catchments"*.

57. *E. coli* is predominantly lost via overland flow pathways. These pathways are most often associated with CSAs. The mitigation tools to address the risk of *E. coli* loss are best developed at an individual farm scale via a farm plan with potential mitigations including:

    a. leaving CSAs ungrazed for certain grazing activities (e.g. winter crop grazing).

    (a) gully retirement;

(b) strategic riparian margin plantings or rank grass based on predominant flow pathways;

(c) strategic grazing of crops and pastures during high-risk periods.

58. Blanket fencing rules are unlikey to achieve the desired effect, are costly, and do not account for the diversity and complexity of sheep and beef farms.

59. The Tūtaekurī is in a high priority zone for sediment loss and erosion. The Ngaruroro catchment is also affected to some extent by sediment loss. In these areas, farm planning will help farmers plan for longer term goals around stock exclusion, land use and sediment control options. Enabling farmers to have flexibility in their farm planning while providing sufficient support though community and farmer led catchment groups will help to minimise land use driven sediment inputs to waterways in the TANK area.

60. The faecal contamination in the TANK area is likely contributed to by septic tanks, urban areas and agricultural activities (Rutherford, 2009). Ngaruroro and Tūtaekurī catchments generally had low levels of faecal bacteria *(E. coli)* and are suitable for primary recreation. The Ngaruroro mainstem is in excellent condition in the middle to upper catchment.

61. The Karamū and Ahuriri catchments both have reduced ecosystem health with nutrient enrichment and faecal contamination (Haidekker and Madarasz, 2020).

62. As noted by Dr Michael Greer in his evidence (paragraphs 41 and 42) there is reduced macroinvertebrate community health in the lower Tūtaekurī that may be partly explained by the lack of riparian shading. This reduced macroinvertebrate community health is not necessarily a reflection on the broader land use in the catchment and may be effectively mitigated by increasing the amount of riparian margin plantings. Riparian planting increases shading which reduces temperatures, thereby making it more habitable for macroinvertebrate life. Farm plans would be an effective mechanism to create on-farm change that could increase riparian planting. If this is done on a catchment scale, long-term improvements in macroinvertebrate community health would be observed.

HOW TO EFFECTIVELY MANAGE AND REDUCE CONTAMINANT LOSS FROM SHEEP AND BEEF FARMS

63. Natural capital has been defined as the *"stocks of natural assets that yield a flow of valuable ecosystem good and services into the future"* (Dominati, Patterson, & Mackay, 2010), (Costanza & Daly, 1992). In terms of farm systems, they include the farm's soils and geology, climate and air, freshwater, and living things (biodiversity).

64. Matching the appropriate farm system and on-farm management is a key part of pastoral agriculture to optimise farms for long-term productive and environmental success through careful consideration of underlying characteristics of the farm such as geology, soil, slope, topography, vegetative cover, erosion potential and climate.

65. B+LNZ has an environmental strategy that has emphasis on four key areas:

    (a) cleaner water;

    (b) thriving biodiversity;

    (c) healthy soils;

    (d) carbon neutrality

66. Farm plans and catchment community groups are crucial elements required to deliver on the four key areas listed above.

67. Farm Environment Management Plan (FEMP), Farm Environment Plan (FEP), Environmental Farm Plan (EFP), Land and Environment Plan (LEP), Whole Farm Plans (WFP) and Farm Plan are different terms for similar documentation that outlines how a farmer or landowner will manage their operations and activities in a way that takes into consideration environmental and business outcomes. For the purposes of this document I will refer to the above collectively as farm plans.

Farm planning background

68. In New Zealand farms plans have been used as a tool since around the 1950s in response to the Soil Conservation and Rivers Control Act 1941 (Stokes, Macintosh, & McDowell, 2021). They were first developed as soil conservation plans from ideas that were adopted from the United States. Initially many individual farm plans were prepared by Catchment Boards and were largely focussed on soil conservation and control of erosion prone

soils (Powell & Heath, 2018). This was the start of a more integrated approach to on-farm management (Stokes et al., 2021).

69. Soil conservation plans became a fundamental base unit of soil conservation in the 1960s and were nationally recognised. During the 1980s the national programme ceased, and the development of Resource Management Act 1991 saw the devolution of responsibility from central government to regional councils. Councils different interpretations of how to implement resource management obligations led to a fragmented and diverse range of farm plan programmes (Manderson, Mackay, & Palmer, 2007).

70. The New Zealand Land Resource Inventory (LRI) was used to define national Land Use Capability units (LUC) and helped to provide a consistent approach to land evaluation (Stokes et al., 2021).

71. During the 1980s and 1990s the national farm planning process extended beyond just soil conservation to include water bodies, biodiversity and greenhouse gases (Stokes et al., 2021).

72. In recent years farm plans have become increasingly recognised as an important way for farmers to improve their farming systems and practices. Importantly, farm plans are also a means of recording and demonstrating these improvements.

73. Accreditation schemes offered by processors often require farm plans to demonstrate that farming is being carried out in a sustainable way and robust information is needed to maintain or access to market premiums (Stokes et al., 2021).

Natural capital

74. Natural capital has been defined as the *"stocks of natural assets that yield a flow of valuable ecosystem good and services into the future"* (Dominati, Patterson, & Mackay, 2010), (Costanza & Daly, 1992). In terms of farm systems, they include the farm's soils and geology, climate and air, freshwater, and living things (biodiversity).

75. Matching the appropriate farm system and on-farm management is a key part of pastoral agriculture to optimise farms for long-term productive and environmental success through careful consideration of underlying

characteristics of the farm such as geology, soil, slope, topography, vegetative cover, erosion potential and climate.

Soil Conservation

76. Soil conservation principles have been a key part to the development of farm planning. The Soil Conservation and Rivers Control Act 1941 established catchment boards to assist with the construction of erosion and flood control measures (Cairns, Handyside, Harris, Lambreschtsen, & Ngapo, 2001).

77. Soil Conservation aims to reduce different types of erosion (particularly that from farmland) in order to reduce the impact of sediment that may reach waterways. Sediment can cause a number of issues such as increasing the likelihood of flood events, reducing production and changing or reducing the ecosystem health of waterways through habitat modification. Erosion can also reduce the productive potential of farms though soil loss and deposition of sediments onto pastures.

78. Erosion is a natural process but can be exacerbated by some types of landuse and some farming activities. Different geological substrate, climates, topographies, soil types and amount of vegetative cover may make different areas and regions more susceptible to certain types of erosional processes. These are therefore important factors to consider when determining appropriate land use.

79. Soil conservation principles for farmland may include measures such as ensuring stable soils though good soil structure, retaining vegetative cover, strategic use of planted trees to increase slope stability, reducing tillage and cultivation on vulnerable soils, controlling and minimising runoff and stock management.

Land Use Capability

80. The Land Use Capability system is an assessment tool that can help farm and catchment scale planning by using biophysical assessments to help determine the natural capital of the landscape, providing for opportunities as well as identifying limitations of certain land types. It has two key components the Land Resource Inventory (LRI) and the Land Use Capability (LUC) classification.

81. The LRI is compiled first and assesses physical factors considered to be critical for long-term land use management. They are:

(a) rock type;

(b) soil type;

(c) slope;

(d) erosion risk;

(e) vegetation cover.

82. The LUC classification uses the LRI to systematically categorise land parcels into eight classes and determines the capacity for sustained long-term production while taking into account the physical limitations of the land (Lynn et al., 2009).

83. The LRI is supplemented with information about possible limitations about climate, erodibility, wetness or soil that further refine the classification of the LUC.

84. LUC is a key part of advanced farm planning. It provides a system that assesses and categorises the natural capital of a farms land resources and limitations that may be present. LUC can also be further enhanced by identification of critical source areas, waterways and sensitive environments.

85. Having the correct scale for mapping LUC is important. Farm scale maps, around the 1:10,000 scale, can enable farms to understand their natural resources and identify opportunities and risks. This can help prioritise actions to maintain and enhance natural resources such as soil, water and biodiversity. LUC mapping has been carried out in the past at a district and regional scale and is available for most of New Zealand at the 1:50,000 scale.

86. New tools and technology that have been able to enhance the use of LUC mapping and interpretation include, global positioning systems (GPS), Lidar, geomagnetic surveys, digital elevation mapping (DEM) and geographic information systems (GIS) software.

Farm Planning

87. Beef + Lamb New Zealand's approach to farm planning is designed to help farmers:

(a) Ensure the sustainability and profitability of their farming business by adapting to climate change, understanding and managing greenhouse gas emissions, protecting the health of soil and freshwater and biodiversity.

(b) Meeting their own values and objectives as well as the wider communities or catchment values and objectives.

(c) Provide an evidence base to tell farming stories and meet the needs of consumers and regulatory bodies.

88. The B+LNZ environment module is the first part of a wider farm plan that will also include modules such as biosecurity, health and safety, human resources, and animal welfare

89. The B+LNZ farm plan environment module is broken into sections that include:

(a) Identification of resources (natural, physical, and human)

(b) Managing soil health

(c) Freshwater ecosystem health

(d) Integrating native biodiversity

(e) Responding to climate change

(f) Waste and chemical management

(g) Forage cropping (including winter grazing)

(h) Irrigation management

90. The process for developing each section in the B+LNZ farm plan environment module broadly includes:

(a) Setting values or objectives

(b) Assessment or stocktake

(c) Risk assessment (using a risk matrix)

(d) Action plan and implementation

(e) Monitoring and review

91. An important step included in the B+LNZ farm plan is identification and consideration of local catchment or community objectives and values when landowners are developing their own for their farm. Acknowledging wider community objectives in this process can lead to integration and alignment at the farm and catchment level. Individual landowners can see how they can contribute positivity to meeting the objectives of the wider community.

92. A risk matrix is provided to farmers to assess land use and management practices long-term. It also provides them with a way to prioritise on-farm management actions. By carrying out a risk assessment themselves, with support and guidance where necessary, farmers can make well informed and considered decisions.

93. It is important for farmers to be encouraged to recognise the environmental work they have already completed on the farm and be proud of their achievements. It is an important step to record this information in the farm plan. Recording, monitoring, and reviewing, are integral to the farm planning process.

94. By using LUC and land resource mapping at the appropriate scale and allowing for a range of management actions, tailored farm plans that are developed by farmers provide an approach that is relevant at both the farm and catchment level. Farmers being involved in the building and development of farm plans, with required assistance and adequate support, will lead to greater engagement from farmers long term as they will have deeper understanding of the values, opportunities and issues on their farms which can extend to those within their communities.

95. Tailored farm plans that are developed by farmers can help inform wider catchment plans. They do this by supplying information on the broader scale issues that may be present in certain areas of a catchment. Conversely, tailored farm plans can also use catchment plans to help identify where collective actions on a number of farms may contribute to greater overall environmental gains on individual farms and also within the catchment.

96. Individual farm plans should be active and flexible to change and evolve over time. This ensures they remain relevant to the individual farm and landowner as well as communities and catchments by supplying up to date information. Flexibility to develop and modify farm plans ensures an evolving understanding and awareness of issues, as well as an ability to capitalise on opportunities that are presented that may contribute to better personal, social, economic, or business outcomes.

97. Farm planning needs to take a broader approach to sustainability than acting solely as a regulatory compliance tool. Farm planning should consider the economic, environmental, and social wellbeing of a farming business. It can work at different temporal scales and act to provide long-term strategic direction as well as inform day-to-day decision making.

98. Powell and Heath (2018) recognised the need to develop suitable and diverse pathways for farmers to develop a plan; included in which is being involved in their development to both gain a deeper understanding and to reduce excessive costs.

99. Farmers need to retain control of their farm plan and the information it contains. They need to able to decide what information to share, who to share it with and when it is shared. Some of the information held in farms plans may be very personal and sometimes may have sensitive information such as financial data.

100. Farm plans are an important tool that can be used as proof of compliance with market assurance programmes such as the New Zealand Farm Assurance Programme (NZFAP) New Zealand Farm Assurance Programme Plus (NZFAP Plus) which provides evidence to environmentally discerning markets and consumers of environmentally sustainable farming practices.

101. Farm plans provide flexibility and a tailored approach to understanding and categorising a farm's natural capital assets such as geology, topography, soils, climate, biodiversity and water. It also a provides a mechanism to assess environmental risks and strengths, and a way to review these over time. Farm plans developed in this way also take into account wider business, social and cultural goals.

102. Farm plans when developed by farmers, with the appropriate support and guidance, ensure that farmers have a greater understanding of the relevant issues that they are faced with on their property. Providing a less prescriptive approach to farming allows the necessary flexibility that leads to greater resilience, innovation, and adaptability within the primary sector.

103. In the Hawkes Bay region between 2014 and 2020, B+LNZ provided 38 farm planning workshops that were attended by a total of over 560 people. Over the same period, over 4,500 people attended a B+LNZ farm planning workshop in New Zealand. This represents a significant industry-good investment in farm planning. This has helped farmers build and develop their own individual farm plans.

104. In the Aparima catchment (six individual sub-catchment groups) in Southland a farmer survey was conducted in 2019 and 2020. The surveys have shown that farms with farm plans were significantly more likely to have water resource management practices (such as stock exclusion, buffer zones and riparian planting) and nutrient management practices (such as targeted fertiliser use and nutrient budgeting) implemented. Also farms with farm plans were more likely to report sound winter grazing practices (ResearchFirst, 2020).

105. The results from the Aparima catchment show that farm plans can make a difference to implementing on-farm actions and result in change. Freshwater health is directly affected by landuse and on-farm actions. The uptake of farm plans and subsequent improvement in uptake of established good farming practices that directly affect freshwater health and water quality would suggest that implementation of farm plans leads to better overall freshwater health outcomes. A direct link of changes in land-use to changes in freshwater health is difficult to measure in waterways in the short-term due to the high variability and variables that are present.

106. Farm plans will be an integral delivery mechanism for the He Waka Eke Noa primary sector partnership. They will be used to measure and manage greenhouse gas emission. There is an expectation for all farms to have this in place by 2025. While primarily aimed at greenhouse gas emissions in this context, farm plans will become an essential part of all farmers management tools.

TANKS Schedule 30

107. Access to and control of the content of a farm plan is an issue that needs to be further considered in HBRC's PPC9. In Schedule 30 section C 2.1 the Farm Environment Plan will be submitted to HBRC. How will this information be secured and who will have access to it? Some farmers may have sensitive information in their farm plans that they may not want made available to others. If the information is not perceived to be "safe", farmers will be less inclined to provide it.

108. Schedule 30 Section C 1.1.a "A farm plan must be prepared by a person with the professional qualifications necessary to prepare a farm plan". Having farmers involved in the farm planning process is essential for long term success. They need to be given the opportunity to choose how, and by whom they would like it prepared. Some farmers may choose to have assistance with farm plan preparation, while others will prefer to prepare the plan themselves.

109. Schedule 30 section B 4.2. Information will be required where appropriate about (amongst others) c) "the results of any environmental monitoring carried out by the catchment collective or industry programme". While monitoring and review are important to measuring progress, the extent of monitoring expected, by who and how it is funded are important considerations. If professional monitoring is expected above and beyond the Councils state of environment monitoring, a funding mechanism is likely required. Alternatively, tools such as the Stream Health Check (detailed in para 116) can be carried out by farmers and their families at no cost are effective tools for measuring improvement. Farmers and catchment collectives may be less inclined to submit results if they think it could lead to ramifications for individuals or the group. Data collected by a catchment group is most powerful when it is retained and managed by the group so that they can assess the implications, make informed decisions and act accordingly. This will enable trust to be built rather than potentially being a process that causes stress and distrust about how that information will be used by the council.

Catchment groups

110. Catchment community groups are an effective way to achieve larger scale environmental outcomes. Collective responsibility and actions over a larger area can result in long-term gains in freshwater ecosystem health. Holmes et al. (2016) found that habitat quality improved in stream areas where there was a collective effort by farmers in a community led catchment group to put in riparian stock exclusion and management. Sediment reductions showed the strongest response.

111. B+LNZ catchment community programme aims to support farmers taking a leadership role to establish or run catchment community groups. An important part of catchment groups is defining why the group is coming together and what is a shared vision for the future.

Figure 3: Catchment Action Cycle.

112. At a catchment scale and driven though farm plans and catchment groups, farmer practice change can be linked to changes in water quality outcomes (Scarsbrook, 2011).

113. A community-based approach to catchment groups and farm planning is essential to build trust and relationships. With the appropriate support and guidance, farmers and communities will be able to effectively manage the natural resources in their area.

114. Freshwater ecosystem health is an important component that catchment groups should consider. Freshwater ecosystem health is a measure of the overall state of a waterway. It takes in account chemical, physical and

biological parameters assessing parameters such as habitat quality, surrounding vegetative cover, what the stream bed is composed of and what aquatic life there is, such as macroinvertebrates and fish, and aquatic plant life (O'Brien et al. 2016). Traditionally there has been a large emphasis on the water quality part of freshwater ecosystem health. This usually focuses of a range of chemical measurements but often includes a selection of nitrogen, phosphorus, sediment and *E.coli*. These variables are often used and have set limits in particular waterways. They don't necessarily give an accurate indication of ecosystem health.

115. The Macroinvertebrate Community Index (MCI) is a tool that has been developed for use by freshwater ecologists to assess the biological health of a waterway. Macroinvertebrates are sensitive to a range of chemical, physical and biological conditions in stream and are a useful indicator of overall ecosystem health as set out in the evidence of Dr Greer.

116. There are a range of tools that can make very basic assessments of ecosystem health and are often suitable for people to carry out with minimal training such as community members, landowners or farmers. Examples are, the Stream Health Monitoring and Assessment Kits (SHMAK), Rapid health Assessment and the Stream Health Check. The latter of these is used as a tool developed for use by farmers and landowners in the B+LNZ Farm Plan. It is a relatively quick method that requires only a basic understanding and asks a range of questions designed to assess the habitat, stream life, surrounding land use and makes has a weighted index that are summed to give an overall score. The scores given directs users to look at a range of risk factors and drivers that may be contributing to reduced ecosystem health and landowners can consider how they can be managed. It is not intended to replace sound expert advice, but outcomes of the assessment will be an indicator if further action or assistance is necessary. It is worth getting expert advice before carrying out large scale and expensive mitigations.

117. The basic assessment tools are very useful tools for building engagement in freshwater health. They are hands-on and practical and highly visual which suits a range of personalities. They are great tools for use with community and catchment groups and training days can inspire farmers and community members to undertake assessments in their local streams and

waterways. Used on a regular basis, the results can inform farm plans and monitor long term trends in a waterways. If desired, the results can also be compared between farmers in a catchment group setting and can help build social capital and develop the overall understanding of waterways within the group.

118. Taking into account the natural capital of the land and using the LUC sytem within the context of a catchment group can help bring about catchment scale change and target appropriate land use change and on-farm management as noted by Mr Kessels in his evidence in paragraph 33. New technologies and systems allow for catchment scale mapping of specific parameters to model future gains that may be made from implementing mitigation strategies or land use changes.

IRRIGATION AS A PROXY FOR RISK

119. Irrigation can cause nutrient losses to water in two main ways:

(a) By inducing soil drainage

(b) By causing surface runoff

120. The level of risk associated with irrigation is related to the farming practices that are deployed because of the irrigation. Irrigating previously non-irrigated dryland increases the productivity of that land. This can result in increased pasture production, increased stocking rates, higher rates of fertiliser application, higher crop yields, and the ability to grow different crop types. These all have the potential to increase the nutrients present in the farm system.

121. However, there are management practices that can reduce the risk of water (and thus nutrient) loss from farming systems.

122. An increase in irrigated area does not automatically lead to a high contaminant loss system. The range and degree of impact of irrigation on N leaching losses (and P losses via surface runoff) is varied and depends on a number of factors including:

(a) Irrigation type;

(b) Irrigation management;

(i) irrigation management tools such as soil moisture monitoring, irrigation scheduling (using a soil water balance) are used; and

(ii) irrigators are well maintained.

(c) Soil type;

(d) Climate;

(e) Farm system; and

(f) Mitigations adopted by farmers/land managers.

123. Due to the diverse and complex nature of sheep and beef farms having a 10 ha threashold for irrigation before triggering a consent is flawed. I believe that it should be more nuanced than this taking into consideration:

(a) The percentage of the farm area under irrigation;

(b) The farming system employed on the irrigated area; and

(c) The irrigation system (design and management/monitoring systems)

124. Irrigation can be conducted without significant, farm-level, negative impacts on N leaching. It is important that irrigation systems/consents are considered on a case-by-case basis or at least consider the individual situation and farmsystem -specific characteristics.

STOCK DRINKING WATER

125. Breeding ewes need approximately 3 L of water per day. Beef cattle need up to 45 L of water per day (Fleming, 1996). These requirements are based on a pasture-based diet where some of the water requirements are met by the feed that they are eating. In a situation where stock are eating more dry supplements such as hay or straw, their requirements for water will increase.

126. During dry, hot weather stock will need to have increased allowance for water as they use more to stay cool. Stock water consumption may increase to 5 L per day for ewes and up to 11 L per day for lactating ewes on dry feed. Beef cattle water demand may go up to 60 L per day during hot, dry weather (Stewart & Rout, 2007). Therefore, more allowance needs to be

made for stock to have access to this increased demand for drinking water. Having access to sufficient drinking water is an animal welfare requirement.

127. Hawke's Bay region reaches dry to extremely dry conditions on an annual basis and drought conditions approximately 1 year in 10 (Figure 4). This needs to be taken into consideration when allowing for adequate stock water supply.

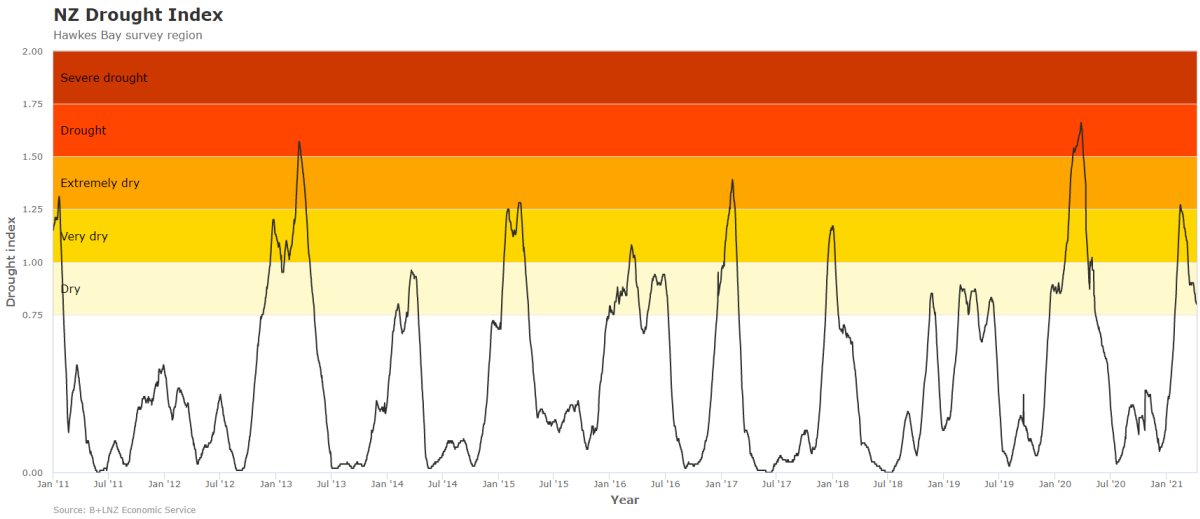

Figure 4: Drought Index Hawke's Bay region (January 2011 to January 2021). Source B+LNZ, NIWA.

128. Reticulated water systems deliver clean fresh water to stock though a piped system that is delivered from a source to troughs that are placed in paddocks. Troughs are usually kept topped up by a gravity fed or pumped system.

129. In some areas, reticulated water systems can be a way to reduce environmental losses caused by stock directly accessing waterways to drink from. This can then reduce direct faecal deposition to waterways and may also reduce sediment loss directly to waterways by stock causing disturbance of the waterway beds and banks.

NOTES TO THE HEARING PANEL REGARDING S42A RECOMMENDATIONS

130. I support the officers recommendations that submission points seeking greater levels of regulation and resource consent requirements <u>be rejected</u> (s42A para 931) for reasons outlined in my evidence, namely that the diversity and complexity of farm systems requires a flexible management approach.

131. I support that where possible and appropriate, national, and regional regulation is aligned because this provides clarity and certainty to farmers and communities (s42A para 934 & 935).

Tom Orchiston

7 May 2021

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APPENDICES

APPENDIX 1: B+LNZ SHEEP AND BEEF FARM SURVEY AND FARM CLASSES

1. The data in this section largely comes from the B+LNZ Sheep and Beef Farm Survey ("Survey"), which is conducted by B+LNZ's Economic Service. The sample is randomly selected from the business frame used in the country's census of agricultural producers to reflect New Zealand's livestock base.

2. A core part of this is the Sheep and Beef Farm Survey, which was initiated after a 1949 Royal Commission, which was instructed by the government of the day to "Inquire into and Report Upon the Sheep-Farming Industry", concluded "there is no consistency of facts on which we can rely".

3. The Survey has been running continuously since 1950, which means it has reached its 70th year and makes it the longest running primary sector survey on.

4. It has not remained static but has evolved and changed to meet needs of the industry and issues of the time.

5. The Survey framework and the operational structure of B+LNZ's Economic Service supports making credible forecasts of production and farm outcomes.

Data Limitations and Constraints

6. The Sheep and Beef Farm Survey is a sample survey in which the sample is randomly selected from the business frame used in the country's census of agricultural producers to reflect New Zealand's livestock base. Statistical methods can be used to reliably represent the real world, albeit with some measure of variability/uncertainty. Generally, the discipline of statistics reduces such uncertainty, but absolute knowledge cannot be assured until the population of farms across a region and timeframes envisaged by policy measures is surveyed. That is not practicable for such policy development.

7. Hawke's Bay region aggregation is used in this document to provide perspective and where necessary ensure the confidentiality of individual

farmers. The Hawke's Bay region is indicative of and encompasses the Hastings district and TANK catchments.

8. Sheep and beef farms are complex and diverse. Sheep and beef farms are located on a variety of landscapes and operated under a variety of climates. B+LNZ characterises farms into eight Farm Classes, which combine both physical and financial characteristics. The Farm Classes that are relevant in the Hastings District/ Hawke's Bay region are:

Farm Class 3 – North Island Hard Hill Country - Steep hill country or low fertility soils with most farms carrying six to 10 stock units per hectare. While some stock are finished a significant proportion are sold in store condition.

Farm Class 4 – North Island Hill Country - Easier hill country or higher fertility soils than Class 3. Mostly carrying between seven and 13 stock units per hectare. A high proportion of sale stock sold is in forward store or prime condition.

Farm Class 5 – North Island Finishing - Easy contour farmland with the potential for high production. Mostly carrying between eight and 15 stock units per hectare. A high proportion of stock is sent to slaughter and replacements are often bought in.

APPENDIX 2: STOCKING RATES BY FARM CLASS

Stocking Rates by Farm Class

9. Stocking rates averaged 8.1, 8.6 and 9.1 SU/ha for Farm Classes 3, 4 and 5, respectively in 2018-19. These comprise 62%, 55% and 52% sheep for the three Farm Classes (Table 2).

10. Over the 30-year period from 1990-91 to 2020-21, the average stocking rate on Farm Class 3 farms has remained much the same, increasing by <1 SU/ha. Sheep as a percentage of cattle have declined from 74% to 62%. On Farm Classes 4 and 5 farms the average stocking rates has declined slightly over the past 30 years, and sheep as a percentage of cattle have declined on both Farm Classes (**Figure *5***).

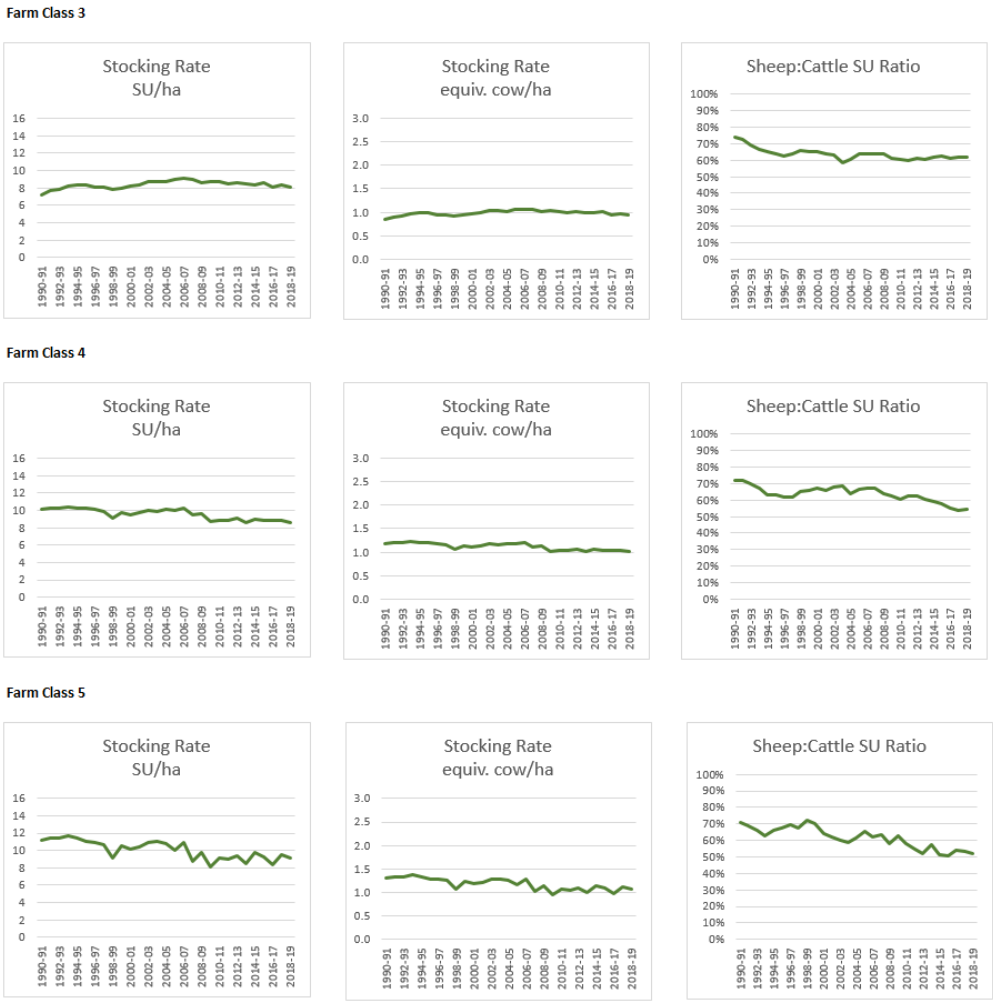
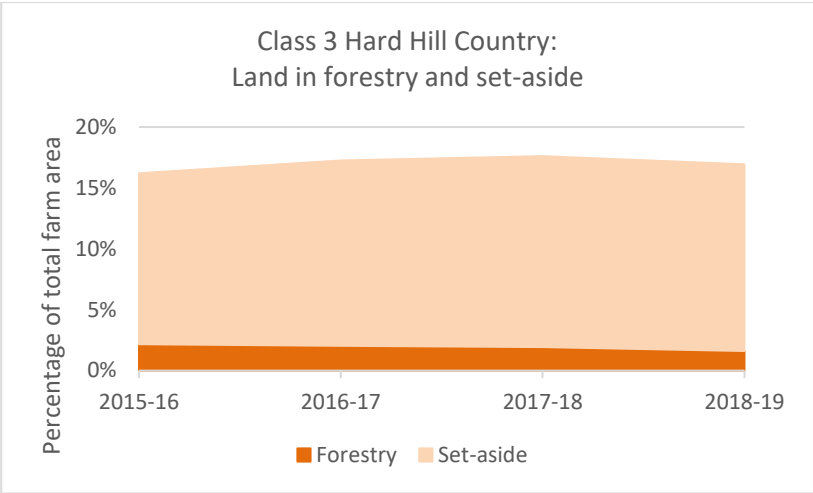


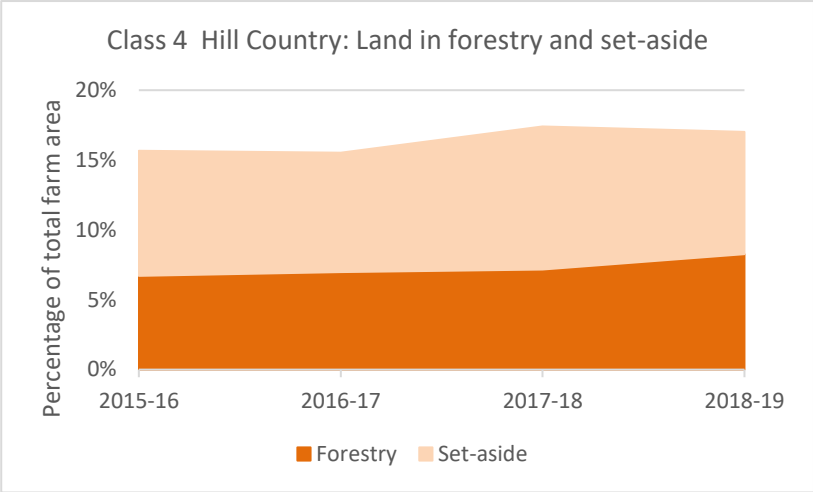
Figure 5: Stocking rate on Farm Classes 3, 4, 5 for commercial Sheep and Beef farms in Hawke's Bay. Source B+LNZ

APPENDIX 3: FORESTRY AND SET-ASIDE AREAS

11. **Figure *6*** on the following page shows the average percentage of total farm area that is forestry or set-aside for the Hawke's Bay Survey farms. These graphs also show that the proportion on the set-aside areas to forestry areas increases as the stocking rate decreases. On average, Farm Class 3 and Farm Class 4 farms have a similar total proportion of their farm in non-grazed areas (forestry plus set-aside) but Farm Class 3 have a higher set-side:forestry ratio than the other farm classes.

12. Set-aside areas include areas of manuka, scrub, lakes, riparian areas and wetlands. These areas provide ecosystem services such as habitat for native fauna. Forestry is defined (for the purpose of the Survey) as tended forestry and does not include agro-forestry, which are areas of land that are grazed underneath forestry trees.





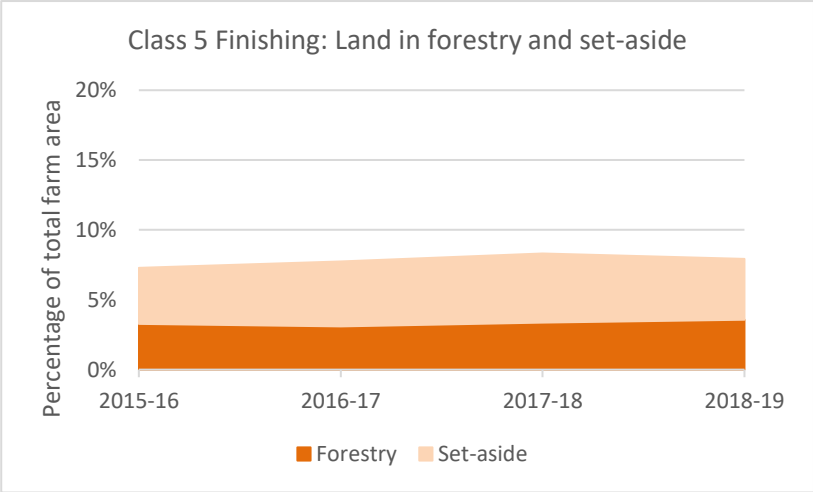


Figure 6: Average Percentage of area in forestry and set-aside, East Coast North Island. Source B+LNZ

APPENDIX 4: AGGREGATE FARM REVENUE

13. Gross Revenue Output from pastoral farming is significant for the Hastings District, Hawke's Bay and greater East Coast regions. Gross Revenue is spent within the district or region on farm inputs and for farm family living. Total Gross Revenue Output from the pastoral sector in Hastings District for 2018-19 was $260 million, of which almost $214 million is from sheep and beef farms (**Figure *7***).

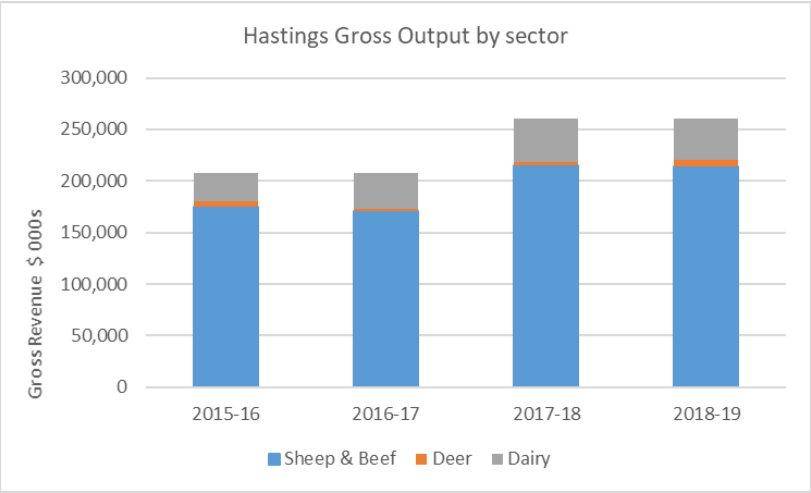


Figure 7: Estimated Aggregate Gross Revenue Output from Pastoral Farming, Hastings District. Source B+LNZ Economic Service, DairyNZ Economics Group.

14. Total Gross Revenue Output from the pastoral farming sector in 2018-19 for Hawke's Bay was estimated at $704 million, of which $547 million (78%) was from sheep and beef farms (**Figure *8***). Across the wider East Coast region, pastoral farming sector Gross Revenue Output in 2018-19 was an estimated $1.9 billion of which sheep and beef contributed 70% ($1.3 billion; Figure *9*).

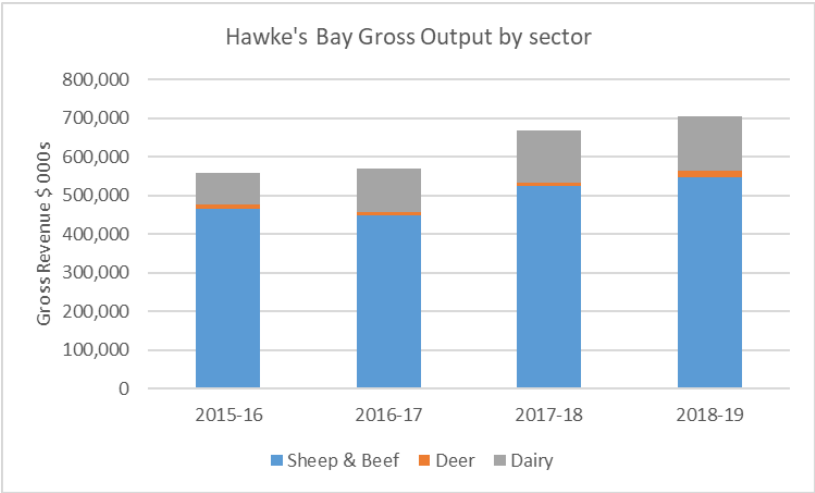


Figure 8: Estimated Aggregate Gross Revenue Output from Pastoral Farming, Hawke's Bay region. Source B+LNZ Economic Service, DairyNZ Economics Group.

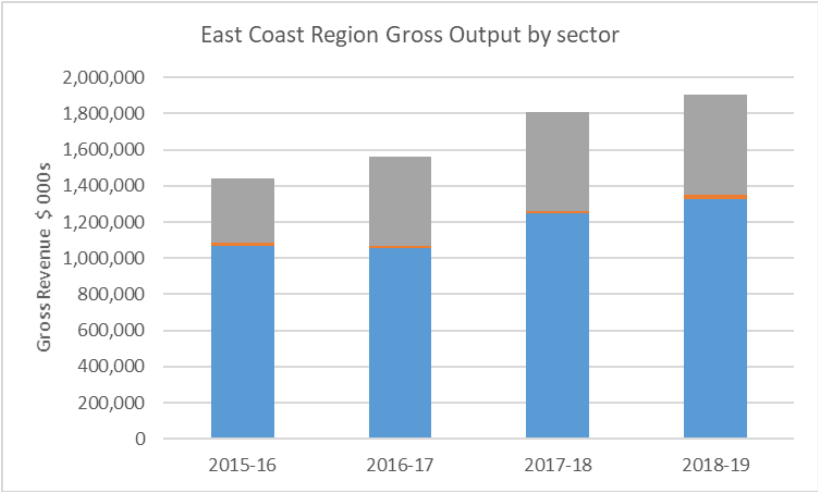


Figure 9: Estimated Aggregate Gross Revenue Output from Pastoral Farming, East Coast North Island. Source B+LNZ Economic Service, DairyNZ Economics Group.

Schedule 30: ~~Landowner~~ Catchment Collective, Industry Programme and Freshwater Farm ~~Environment~~ Plan 8.25, 50.1, 85.8, 216.20, 231.2 , 180.70, 210.140 and 216.22 et al

The TANK Plan provides for an **Industry Programme ~~Group~~** or a **Catchment Collective** to work ~~collectively~~ on behalf of their members to meet local water quality and environmental objectives.

Alternatively, landowners may also prepare an individual **Freshwater Farm ~~Environment~~ Plan.**

This schedule sets out the requirements for:

- Tthe establishment of a ~~TANK Industry Group or~~ TANK Catchment Collective, their operation and the preparation of their environment plan in order for them to be approved by the Hawke's Bay Regional Council.
- ~~It also sets out the requirements for~~ Freshwater Farm ~~Environment~~ Plans.
- Industry Programmes.

~~**Heretaunga Plains Water Management Unit**~~

~~In the Heretaunga Plains Water Management Unit, requirements for stream flow enhancement will be imposed through conditions of a water permit. Management of a stream flow enhancement scheme is not required to be done by water permit holders acting collectively, however, an Environmental Management Plan can address collective management of any flow enhancement scheme and also address water quality issues according to Sections A and B at the same time.~~

~~**Industry Groups and Catchment Collectives**~~

~~A TANK Industry Group or a TANK Catchment Collective must meet the requirements set out in Section A below.~~

~~**Industry Programme or Catchment Collective Programme**~~

~~Each TANK Industry or TANK Catchment Collective must prepare an **Industry Programme** or **Catchment Collective Programme** that meets the requirements set out in Section B below. This programme~~ The Freshwater Plans and Industry Programmes must identify the key water quality and water quantity management issues identified in this Plan that are relevant to;

- ~~The catchment(s)~~

1. the modelled or measured water quality as indicated in Schedule 26, 28 or the Council's SOE reports, or local water quality measured using comparable water quality monitoring methods in the applicable catchment(s)
2. other water quality monitoring may be used as a guide to measure progress towards water quality targets.
3. the nature of the land and water use activities carried out within that catchment
4. the scale of the effects on water quality or water quantity from the land and water use activities in that catchment.

~~The Programme will describe an environmental management strategy relevant to the freshwater water management objectives where the member properties are located. An Industry Programme can be based on existing good agricultural practice industry [52] programmes, and will in addition need to address local water quality and quantity issues.~~

~~A summary of the Programme objectives and outputs will be made publicly available through the Council website.~~

Any TANK Freshwater Plan ~~Programme~~ prepared in accordance with Schedule 30 may include or contribute to other initiatives or objectives (such as in relation to farm production, pest control, biodiversity or other land management issue) as desired by the Catchment Collective or Industry Programme. These aspects are not subject to the Council's approval, but may be a means of enabling integrated land and water management for a wider range of management objectives.

~~[52] This refers to existing industry programmes such as Hort NZ GAP, Sustainable Winegrowing, Fonterra Clean Stream etc.~~

Catchment Collectives

A TANK Catchment Collective must meet the requirements set out below.

~~**Farm Environment Plan**~~

~~The requirements of the Farm Environment Plan are set out in Section C below.~~

~~**Programme Requirements**~~

Section A: Industry Groups and Catchment Collectives Governance and Management

1. Governance and Management

1.1 Each Catchment Collective ~~or Industry Group must undertake to carry out the requirements of Sections A and B and must specify in writing the manner in which it will carry this out. This~~ must address the following ~~: Details relating to the~~ governance and management arrangements of the ~~Programme~~ Catchment Collective including:

a) How decisions are to be made and how the requirements of Section B will be carried out including obligations by members to carry out the property specific requirements

b) Conditions of membership of the ~~Programme~~ Catchment Collective by individual land managers (the 'Members' who commit to the Catchment Collective ~~Programme~~), including the circumstances and terms of membership, the conflict resolution process that will be used in the event that Members do not undertake their activity in accordance with the approved plan, and the circumstances under which sanctions or removal from the Collective ~~or Industry Programme including~~ in relation to unreasonable non-performance of actions identified in clause 2 below will be considered.

c) The process for assessing performance at an individual property level compared to agreed actions at the catchment scale.

Note 1: the Catchment Collective ~~or Industry Programme~~ may prepare its own terms of reference as well as manage their own decision making processes and administration. This may include appointing a spokesperson or secretary to ensure recording and reporting work is completed as necessary. ~~Note 2:~~ If a membership is lapsed, refused or discontinued, the Council will require the landowner to comply with ~~r~~Rule TANK 1.

1.2 Information and management systems and processes to ensure:

a) Competent and consistent performance in meeting the requirements of this sSchedule

b) Robust data management, including up-to-date registers of ~~Programme~~ Catchment Collective Members

c) Timely provision of suitable quality data and information required under the following clauses to Hawke's Bay Regional Council

d) Conditions of membership of the Programme by individual land managers (the 'Members') who commit to the Programme including provision of information to enable reporting requirements to be met.

1.3 A description of the Programme area including:

a) locations and maps,

b) land uses,

c) locations of ;

(i) drains (including subsurface drains), streams, rivers, wetlands and other water bodies,

(ii) any Source Protection Zone or Extent for any Registered Drinking Water Supply that any properties in the programme area are located in, plus the contact details of the water supply manager (Note – Maps included with this plan show the locations of the SPZs and Extent for any Registered Drinking Water Supplies. Contact information for the supply manager is available on the Council website),

d) activities at particular risk of nutrient loss,

e) property boundaries,

f) up-to-date details about ownership and property managers,

g) up-to-date contact details of individual land managers and landowners within the Programme (the 'Members').

~~Section B:~~ Catchment Collective Freshwater Plan Requirements

This section sets out the requirements for the Freshwater ~~environment p~~Plan for each Catchment Collective ~~or Industry Programme~~

The Programme summary report will be made publicly available through the Council website.

2. Environmental Outcomes

2.1 The Plan must include statements about the;

a) specified water quality outcomes in Schedule 26 of this Plan relevant to the location of Members'

properties

b) measures or practices needed to minimise and mitigating the cumulative environmental effects of land use that will enable the specified water quality objectives to be met.

c) timeframes for when each of the actions or mitigations at a property or catchment scale are to be implemented and which are consistent with ~~meeting the timeframes specified for relevant water quality objectives and~~ milestones specified in ~~the~~ TANK Pol 27. ~~Plan~~

2.2 The Plan must address where appropriate;

a) managing contaminant losses (especially sediment, nutrients and bacteria) to waterways including efficient use of nutrients and good management practice including when carrying out land disturbance activities and ~~especially~~ in relation to management of critical contaminant source areas.

b) where water quality does not meet standards in Schedule 26, identifying how there will be reductions in losses that contribute to meeting the specified water quality including, where appropriate, reference to;

(i) in relation to industry specified benchmarks or good practice for nitrogen and phosphorus management ~~loss;~~

(ii) LUC (Land Use Capability) and soil type;

(iii) Olsen P levels in soil;

(iv) Stock management including rates and densities of different classes of stock;

(v) Application of fertilisers;

(vi) Application of collected animal effluent;

(vii) Cultivation, soil disturbance or vegetation clearance activities

c) Management of riparian margins, including to meet the outcomes specified in TANK Pol 11 and maintaining or improving the physical and biological condition of soils in a manner consistent with TANK Pol 20 and RRMP Rule 7 in order to avoid, remedy or mitigate problems arising from;

(i) Loss of topsoil by wind or water erosion;

(ii) Movement of soils and contaminants into waterways;

(iii) Damage to soil structure and health;

(iv) Mass movements of soil;

d) wetland management including to meet the outcomes specified in TANK Pol 14 and 15;

e) management of animal effluent to avoid contamination of ground and surface waters;

f) measures required to reduce risk of contamination of the source water for any Registered Drinking Water Supply;

g) management of stock, including in relation to river or stream crossings and exclusion from waterways in a manner that complies with the Resource Management (Stock Exclusion) Regulations (2020)~~is consistent with Policy 22 and Rules TANK 1 or 3;~~

h) **in the Karamū and ~~Lake~~ Poukawa Catchments ;** the identification of opportunities to provide shading of the adjacent waterway or improvements to riparian margin values as specified in TANK Pol 2 and 11.

2.3 The Plan must include measures to address **Nutrient Management** in any catchment or programme area where water quality objectives for nitrogen concentrations as detailed in Schedule 26 are not being met, including;

a) development of an inventory of the current nitrogen loss rate (kg/ha/year) for every property as determined by application of Overseer (or an alternative nutrient budget model approved by the Hawke's Bay Regional Council) and a target nitrogen loss rate that demonstrates industry good practice ~~by a suitably qualified independent practitioner~~;

b) a description of any mitigation measures identified as necessary to meet water quality objectives on those properties or within the relevant catchment;

c) annual recording and reporting of nutrient input and export data, including annual nitrogen loss rates.

2.4 A Catchment Collective member may adopt or integrate a plan or documentation developed as part of an Industry Good Agricultural Practice programme, provided that the Plan or documentation is consistent with the requirements of the Catchment Collective Programme

3. Approval

3.1 The Catchment Collective Freshwater Pplan ~~or Industry Programme~~ will be submitted for approval by the HBRC no later than by the end of the relevant year specified for that catchment in Schedule 28. In making decisions to approve the Plan ~~rogramme~~ the Council will take into account;

a) whether the requirements of this Schedule are met;
b) whether the programme is consistent with the policies, water quality objectives and milestones that are relevant for that Catchment Collective ~~or Industry Programme~~
c) whether the Plan ~~rogramme~~ was appropriately informed by person(s) with the necessary ~~professional qualifications~~ knowledge to make assessments about the contaminant loss risk and mitigation measures
d) whether the governance and management systems are in place to enable the implementation of the Plan ~~programme~~

3.2 Where approval is not given, it means the requirements of Rule TANK 1 are not able to be met and land use is therefore subject to either Rule TANK 1 (b)2 or Rule TANK 2.

4. Information Requirements

4.1 The Catchment Collective ~~or Industry programme~~ must prepare a statement of the data and information that will be collected in order to monitor implementation and report to Council.

4.2 Information will be required where appropriate about:

a) changes to programme area and membership;
b) nature and significance of any land use change in accordance with TANK Pol 22 and Rule TANK 5 or 6 and based on land uses at 2 May 2020.
c) the results of any environmental monitoring carried out by the Catchment Collective or Industry Programme;
d) the mitigation measures or practices carried out to reduce contaminant loss (consistent with what is industry ~~agreed~~ good management practice) that will be adopted by the property owners or managers and as detailed in clause 2.1;
e) data, which may be aggregated across a catchment, about nitrogen loss and any changes in losses in respect of clause 2.3.

5. Reporting and Review

5.1 A summary report on the implementation of the Freshwater Plan ~~Programme~~ shall be submitted annually to the Hawke's Bay Regional Council or less frequently as determined by Council if all agreed mitigations have been completed, water quality objectives are being met and there is no proposed land use change exceeding 10ha of the programme area.

5.2 The report will be supplied in the format specified by Council.

5.3 The report will include;

a) information collected under section 4;
b) any amendments to the programmed mitigation measures in response to any areas where the Catchment Collective Freshwater Plan is not achieving the outcomes sought as determined under the process described in 2.1 and 2.2 of this Schedule, and the timeframes for implementation, plus any changes made to them and reasons for them (including any adverse events such as severe weather, earthquakes etc);
c) issues or matters that require input or direction from the Council, including the management of activities outside the Catchment Collective which may be adversely affecting the achievement of the of programme objectives, including identification of additional information/support from HBRC that would assist in the achievement of the objectives of the programme.

5.4 Every 5 years the annual report shall provide information about;

a) adoption of any new mitigation or good practice measures identified by industry;
b) identification of opportunities for improvements to the programme including, where necessary, amending performance standards, and in relation to nutrient management in clause 2.3, where the Catchment Collective Freshwater Plan is not achieving the outcomes sought as determined under the

process described in 2.1 and 2.2 of this Schedule.

6. Auditing

6.1 Auditing will be carried out as described in Section D.

Section B: Freshwater Farm Plans

If a property is not subject to a TANK Catchment Collective prepared under Section A~~B~~ or a TANK Industry Programme prepared under Schedule ~~D~~C of this Schedule a Farm Environment Plan must be prepared in accordance with Section B~~C~~.

~~Section C:~~ Freshwater Farm Plan Requirements

1. Requirements for Freshwater Farm Plans

1.1 A Farm Environment Plan must;

a) be submitted to the Council to ensure it complies with the requirements of this Schedule and Schedule 28.

b) contain the following information;

(i) physical address;

(ii) details about ownership and property managers including contact details for the person responsible for the implementation of the Plan.

c) be accompanied by maps or aerial photograph at a scale to clearly show;

(i) property boundaries;

(ii) locations or activities likely to result in contaminant loss or at risk from contaminant loss including;

i. areas at risk of sediment loss;

ii. the location of drains (including subsurface drains), streams, rivers, wetlands and other water bodies;

iii. the location of any Source Protection Zone or Extent for any Registered Drinking Water Supply that any properties in the programme area are located in, plus the contact details of the water supply manager (*Note Maps included with this plan show the locations of the SPZs and Extents for any Registered Drinking Water Supplies. Contact information for the supply manager is available on the Council website.*

iv. activities at particular risk of nutrient loss;

v. contaminant discharge activities.

d) meet the requirements of Clauses 2 and 4 in Section A~~B~~ of this Schedule as applicable for the property, its location and the land use activities being carried out.

2. Approval

2.1 The Freshwater Farm Plan will be submitted for approval to HBRC no later than by the end of the year specified for the catchment in which the farm operation is located in Schedule 28. In making decisions to approve the plan, Council will take into account:

a) Whether the requirements of this Schedule are met;

b) Whether the programme described in the plan is consistent with the policies, water quality objectives and milestones that are relevant for the catchment in which the farm operation is located;

c) Whether the plan was appropriately informed by person(s) with the necessary knowledge to make assessments about the contaminant loss risk and mitigation measures.

2.2 Where approval is not given, it means the requirements of Rule TANK 1 are not able to be met and land use is therefore subject to either Rule TANK 1(b)(ii) or Rule TANK 2.

3. Reporting and Review

3.1 The Freshwater Farm ~~Environment~~ Plan will be submitted to the HBRC no later than by the end of the relevant year specified in Schedule 28 for the catchment(s) the property is located in.

3.2 The report will be in the format specified by Council.

3.3 The report will include:

a) information collected under Clause 4 of Section A~~B~~

b) any amendments to the programmed mitigation measures in response to any areas where the Freshwater Farm Plan is not achieving the outcomes sought as determined under the process described in 2.1 and 2.2 of this Schedule, and the timeframe for implementation, plus any changes made to them

and reasons for them (including any adverse events such as severe weather, earthquakes etc)

3.4 Every 5 years the annual report shall provide information about;

a) adoption of any new mitigation or good practice measures identified by industry,

b) identification of opportunities for improvements to the programme including, where necessary, amending performance standards, and in relation to nutrient management in clause 2.3 of Section A~~B~~ where the Freshwater Farm Plan is not achieving the outcomes sought as determined under the process described in 2.1 and 2.2 of this Schedule.

4. Auditing

4.1 Auditing will be carried out as described in Section D.

Section C: Industry Programmes

The purpose of this schedule is to set out the minimum standards for Industry Programmes.

Applications for approval of an Industry Programme shall be lodged with the Hawke's Bay Regional Council, and shall include information that demonstrates how the following requirements are met. The Hawke's Bay Regional Council may request further information or clarification on the application as it sees fit.

Approval will be at the discretion of the Chief Executive of the Hawke's Bay Regional Council subject to the Chief Executive being satisfied that the scheme will meet the standards set out below.

1. Governance and management

1.1 Industry Programmes must include:

a) A description of the governance arrangements of the programme

b) The contractual arrangements between the programme and its members;

c) A description of the process for gaining and ceasing membership;

d) A description of the programme area, including

(i) land uses,

(ii) key environmental issues and measures to address them,

(iii) property boundaries and

(iv) ownership details of members' properties;

e) A procedure for keeping records including up-to-date registers of programme members and provision of data to the HBRC

f) Details including procedures agreed with the HBRC about how requirements of this Section are to be met.

2. Preparation of Freshwater Farm Plans

2.1 Industry Programmes must include:

a) A statement of the programme's capability and capacity for preparing and certifying that Freshwater Farm Plans meet the requirements of this Schedule, including;

(i) The requirements of Section A2 of this Schedule

(ii) The qualifications and experience of any personnel employed by or otherwise contracted to the programme to prepare or certify Freshwater Farm Plans;

3. Implementation of Freshwater Farm Plans

3.1 Industry Programmes must include:

a) A statement of the programme's capability and capacity for monitoring and assessing the implementation of Freshwater Farm Plans, including the qualifications and experience of any personnel employed by or otherwise contracted to the programme to monitor or assess implementation of Freshwater Farm Plans;

b) A description of the expectations and agreements around landowner and property record-keeping;

c) A strategy for identifying and managing poor performance in implementing Freshwater Farm Plans.

4. Audit

4.1 :Industry Programmes must include a description of an annual audit process to be conducted by an independent body, including:

a) A process for assessing the performance of the programme and any personnel employed by or otherwise contracted to the scheme to prepare, certify, and audit the implementation of Farm Environment Plans;

b) A statement of how audit results will be shared with the programme's members and the wider community;

c) A summary audit report must be submitted to the Hawke's Bay Regional Council annually.

SSection D Auditing

1. The HBRC will;
   a) Publicly report on the implementation of requirements for TANK Freshwater Farm Plans and Catchment Collective Plans ;
   b) Undertake audits of TANK ~~Industry or~~ Catchment Collective Programmes including on member properties in relation to individual and programme implementation of programmed works, adoption of identified good management practices, including nutrient management budgets where required.

~~*Note 2: that if the conditions of any applicable RRMP Rule 7 for specified activities are not being complied with by a landowner or manager, there must be information as outlined in section B2 above of the Catchment Collective or Industry Programme to show how the relevant contaminant loss risks are to be managed to a similar level of performance.*~~

~~2. The HBRC will;~~
   a) ~~Publicly report on the implementation of TANK Freshwater Farm Environment Plan requirements~~
   b) Undertake audits of properties in relation the Freshwater Farm ~~Environment~~ Plan implementation of programmed works, adoption of identified good management practices, including nutrient management budgets where required.