BEFORE THE INDEPENDENT HEARING PANEL APPOINTED BY WAIKATO REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991 (the Act)
AND	
IN THE MATTER	Submissions made on Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments

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STATEMENT OF EVIDENCE OF GILLIAN MARGARET HOLMES FOR HORTICULTURE NEW ZEALAND (WATER QUALITY)

15 FEBRUARY 2019

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SUMMARY AND CONCLUSIONS

1. The scope of my evidence is to assist the Commissioners in understanding the technical work that has been undertaken to support the Horticulture New Zealand (**HortNZ**) submissions on Plan Change 1 (**PC1**), as outlined in Jacobs (2017) and (2018).

2. I acknowledge that some of the water quality analysis that was undertaken relates specifically to proposed changes in Policies, Methods and Rules, namely Rules 3.11.5.5 and 3.11.5.7, which will not be covered in the first block of hearings for PC1. However, I believe many of the general concepts supporting proposed rule changes in Jacobs (2017) and (2018) also require proposed changes to the overall direction of PC1 and Objectives. As such, this technical work is overviewed in this evidence.

3. The technical work drew on the existing published science and water quality models developed by NIWA during the PC1 process. I believe this was the correct approach as this has enabled the analysis to concentrate on the findings and conclusions, rather than preparing new data and modelling, which would then lead to a focus on the difference between input data.

4. The technical work assessed many different concepts and options for undertaking Commercial Vegetable Production in the Waikato under PC1. Overall, I believe that there are two main concepts that are required to be included within PC1, to allow for Commercial Vegetable Growers to continue to grow within the Waikato Region. These concepts are:

   (a) A multi-contaminant approach to managing effects of nutrients;

   (b) A catchment collective approach to allocation.

5. I believe the benefit of a multiple contaminant approach to assessing environmental effects, is that it is more likely to achieve water quality objectives outlined in PC1 than using a Nitrogen Referencing Point as a proxy for intensification.

6. In addition, I believe that a better approach to managing the multi contaminants in the Waikato catchment, is to assess loads of all four contaminants for each defined sub catchment.

7. Jacobs developed estimates of sub-catchment unattenuated loads for the short-term water quality targets (excluding point sources) in Jacobs (2017), and which have been since updated following the NIWA review (as discussed in paragraph 36). These loads would provide the compliance data required for the catchment collective approach proposed by HortNZ for managing contaminant discharges.

8. The management of the subcatchment loads would be undertaken under a catchment collective approach, which would allow the community to actively achieve water quality targets that provide flexibility to adopt tailored solutions. This includes allowing different landuses the flexibility to migrate around the sub catchment.

9. Jacobs completed additional technical work to demonstrate the benefits of the catchment collective approach. This work involved the retirement of land that has a land use capability (LUC) of class 6 or greater into forest and converting selected LUC 1 land to horticulture in the Port Waikato and Whakapipi catchments.

10. The results of this work demonstrated that the expansion of horticultural area in the Waikato region would not necessarily result in an increase on all nutrient losses, with only small increases in N calculated, as shown in Table 1.

11. However, it also highlighted that this approach can lead to a decrease in other contaminant losses, such as P and E. Coli if other landuses on LUC Class 6 or greater land is retired to forest.

12. I believe that these scenarios demonstrate that the catchment collective approach to managing contaminant discharges would allow greater flexibility to the community to develop land for specific landuses, such as Commercial Vegetable Production, without restrictions.

13. As such, I believe the inclusion of a catchment collective approach as requested by HortNZ should be included within PC1.

INTRODUCTION

Qualifications and experience

14. My full name is Gillian Margaret Holmes

15. I am employed by Jacobs New Zealand Ltd (Jacobs), an engineering and environmental consulting firm. I am contracted to provide water quality expertise on the Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments (PC1) to Horticulture New Zealand (HortNZ).

16. I hold a Bachelor of Science (BSc) in Geography (2001) and a Master of Science Degree in Physical Geography (2004) from Otago University.

17. I have 14 years' experience in the field of hydrogeology and water resources. I started my career at MWH New Zealand Limited and worked for them between 2004 and 2007 and joined Sinclair Knight Merz (now Jacobs) in 2007.

18. I have previously acted as an Expert Witness in groundwater related consent hearings in New Zealand. In addition, I have recently submitted expert evidence on the Proposed Water

Conservation Order for the Ngaruroro River and Clive River on behalf of HortNZ.

19. I regularly provide expertise in the fields of hydrogeology and groundwater quality to a range of local government clients including Bay of Plenty Regional Council and other organisations such as HortNZ, Wairakei Pastoral Limited and the New Zealand Transport Agency.

20. I am familiar with Plan Change processes through providing technical support for expert witnesses for Variation 6 of the Waikato Regional Plan, as well as supporting the expert witnesses for HortNZ on Hawkes Bay Regional Council's Tukituki River Catchment Plan Change 6. This support for Variation 6 of the Waikato Regional Plan has provided me with knowledge of the Waikato River catchment surface water flows and groundwater.

Code of Conduct

21. While this is not a hearing before the Environment Court, I can confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses produced by the Environment Court and have prepared my evidence in accordance with those rules. My qualifications as an expert are set out above.

22. I confirm that the issues addressed in this brief of evidence are within my area of expertise.

23. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Background and Role

24. I have been asked to prepare evidence based on my (and my colleagues) research, assessment and reporting for HortNZ in support of their key submission points on PC1.

25. HortNZ is concerned that PC1 does not give enough consideration to the fact that horticulture farming systems and operations are unique from other farming sectors. Due to this uniqueness, HortNZ believe that horticulture requires an additional separate consenting pathway to ensure the continued provision of vegetables to domestic communities.

26. HortNZ's key submission points covered by the technical reports are:

    (a) A multiple contaminant approach to assessing environmental effects is more likely to achieve water quality objectives than using a Nitrogen Referencing Point as a proxy for intensification for commercial vegetable growing);

    (b) Introducing the concept of managing the environmental effects of discharges on a sub-catchment basis through a catchment collective, i.e. a group of enterprises or

properties in multiple ownership, where the owners of those enterprises or properties undertake farming activities and operate as a collective for the purposes of contaminant management.

(c) New commercial vegetable production should be provided for as a restricted discretionary activity (or discretionary activity));

(d) A natural capital approach to allocation (as proposed by numerous submitters to PC1) is not appropriate for horticultural activities.

27. Two reports were completed to support these key submission points, namely:

(a) Jacobs (2017). Healthy River Plan Change Technical Support for Horticulture New Zealand's Submission, Values and Current Allocation of Responsibility for Contaminant Discharges.

(b) Jacobs (2018). Healthy Rivers Plan Change – Technical Support for Horticulture New Zealand, Additional Technical Report for Further Submission.

28. I did not contribute to the Jacobs (2017) report, however I was the main reviewer for the second technical report (2018). As both reports are interlinked, I have detailed knowledge of all the technical work completed by Jacobs and outlined in both technical reports.

29. I attended the Proposed Plan Change 1 – Waikato and Waipa Catchments Information Forum on 21 November 2018 as an expert for HortNZ.

Purpose and Scope of Evidence

30. The scope of my evidence is to assist the Commissioners in understanding the technical work that has been undertaken to support the HortNZ submissions on PC1. As such, my evidence will focus on the following:

(a) Overview of the technical work completed to date by Jacobs, as outlined in Jacobs (2017) and (2018), submitted with HortNZ original and further submission on PC1.

(b) A technical discussion on how a multi-contaminant approach to managing effects of nutrients would be more effective for all landuse than what is currently outlined in PC1 (to support HortNZ's proposed separate consenting pathway).

(c) Outlining the scientific reasoning behind the Catchment Collective approach to allocation proposed by HortNZ and the supporting contaminant loads proposed for Schedule

1C, as referenced in proposed changes to Objectives 3 and 4.

OVERVIEW OF TECHNICAL WORK COMPLETED

31. As outlined above, my colleagues and I completed water quality analysis to provide technical support for HortNZ's proposed amendments to PC1. The two technical reports (Jacobs (2017) and (2018)) were submitted with HortNZ's original and further submissions.

32. I acknowledge that some of the water quality analysis that was undertaken relates specifically to proposed changes in Policies, Methods and Rules, namely Rules 3.11.5.5 and 3.11.5.7, which will not be covered in the first block of hearings for PC1. However, I believe many of the general concepts supporting proposed rule changes in Jacobs (2017) and (2018) also require proposed changes to the overall direction of PC1 and Objectives As such, this technical work is overviewed in this evidence.

33. The technical work drew on the existing published science and water quality models developed by NIWA during the PC1 process. I acknowledge that these water quality models have numerous limitations including in the underlying contaminant yield and landuse datasets, however Jacobs did not seek to review the validity of the modelling undertaken for the PC1 process.

34. I believe this was the correct approach as this has enabled the analysis to concentrate on the findings and conclusions, rather than preparing new data and modelling, which would then lead to a focus on the difference between input data.

35. HortNZ engaged NIWA to provide a review of the calculations completed within Jacobs (2017) and (2018); i.e. load calculations by land use and sub-catchment and unattenuated loads; to determine if Jacobs had interpreted the input data provided by NIWA correctly, as well as completed the calculations accurately.

36. This review was completed by Annette Davies from NIWA on 18 January 2019, with clarifications obtained around some data sources, in particular around the NIWA calculations for *E. Coli.* Following this review, minor corrections have been made to subcatchment load table proposed in Schedule 1C by HortNZ. As this block of hearings does not include methods, policies and rules, I have not presented the updated table at this time. I will present the updated table in my evidence for Block 2 hearings.

37. NIWA completed a review on the updated data, with the following comments received in a memo dated 31 January 2019, and attached to this evidence as **Appendix 1**:

    (a) "I can confirm that the calculations of baseline unattenuated nutrient loads generated by each sub-catchment undertaken by Jacobs are correct and match

the unattenuated subcatchment loads calculated by NIWA.

(b) I can also confirm that the calculated cumulative loads with attenuation and point sources for both TP and TN match the cumulative loads calculated by NIWA."

38. Based on the technical review comments provided by NIWA, I am satisfied that the water quality analysis undertaken in Jacobs (2017) and (2018), and subsequently updated following the review is accurate and can be used to provide technical input into HortNZ's submission.

39. To aid in the understanding of the main points of my evidence discussed in the subsequent sections, I have provided a high-level overview of the main conclusions from Jacobs (2017) and (2018) below.

40. The conclusions were as follows:

(a) In total, horticultural land occupies 0.6% of the total area of the Waikato River catchment and is estimated to account for 2.5% of the diffuse Total Nitrogen (TN) load and 0.9% of the diffuse Total Phosphorous (TP) load in the overall catchment. The contribution of horticulture land to sediment loads predicted from each sub-catchment is also very low, while horticultural practices contribute very little to negligible amounts of *E. coli* in waterways (Jacobs, 2017).

(b) The 10% nitrogen reduction by the horticultural sector proposed in Policy 3(d) and Rule 3.11.5.5 would result in a reduction of 0.2% in nitrogen load to the Waikato catchment and would likely have negligible benefits over the 5-10% reduction modelled for the dairy sector (Doole et al., 2016).

(c) In the same way that an offset policy is likely to be useful for mitigating the effects of point source discharges (as proposed under Policy 11 of PC1), it could also be useful in reducing the effects from horticultural land, which due to the intensity and small footprint, has fewer on-farm mitigation options compared with pastoral farming.

(d) Landuse and bare soil analysis indicated that horticultural land, while having a higher proportion of bare earth compared with other land uses, is likely to make up only a small fraction of the bare earth on farm land within the Waikato Region, due to its small footprint. This analysis supports HortNZ's proposed changes to the requirements of Farm Management Plans in Schedule 1, which includes recognition of cultivated land outside of the horticultural sector.

(e) The development of estimated sub-catchment unattenuated loads for the short-term water quality targets (excluding point sources) would provide the compliance data for the catchment collective approach proposed by HortNZ for managing contaminant discharges. Jacobs have calculated unattenuated loads to correspond with short term water quality targets in the amended Table 3.11-1 in Jacobs (2017). These unattenuated loads were incorporated into HortNZ's proposed changes to Schedule 1 of PC1.

(f) Many sub-catchments in the Waikato have poor water quality due to *E. coli*. *E. coli* is a direct measure of two of the core values within PC1 (Human Health for Recreation and Mahinga kai), while N is a direct measure of only one of those core values (Ecosystem Health). Therefore, a focus on N, as proposed in PC1, is unlikely to achieve the fulfilment of these core values.

(g) Assessing new land use (e.g. new commercial vegetable production area) based on the comparison of the N reference point is unlikely to achieve the fulfilment of the water quality objectives and core values outlined in PC1. Horticultural land has a range of mitigations that can reduce the effects of the four contaminants used within PC1 (TN, TP, *E. coli* and sediment), however the severity of the effects really depends on the vulnerability of the receiving environment (which is different between each sub-catchment).

(h) An increase in horticultural area will not result in an increase in all four contaminant loads to receiving waters as indicated by WRC in the Section 32 Report (WRC, 2016). While N, P and sediment loss may increase slightly, *E. coli* will decrease in catchments.

(i) It is more effective to assess contaminant loads to achieve water quality outcomes, rather than yields and concentrations.

(j) Cropping on dairy farms can have greater impacts on nutrient loads into rivers than commercial vegetable cropping for human consumption, given the effect of direct animal foraging, and the fact that dairy farms are not required to complete a sediment management plan as part of the overall management of the farm.

(k) Under a natural capital approach to allocation, it would not be possible to undertake more intensive land uses such as vegetable cropping and may not result in a decrease in N across the Waikato catchment.

41. Based on these conclusions, I believe that there are two main concepts that are required to be included within PC1, to allow for

Commercial Vegetable Growers to continue to grow within the Waikato Region. These concepts are:

(a) A multi-contaminant approach to managing effects of nutrients;

(b) A catchment collective approach to allocation

MULTI-CONTAMINANT APPROACH TO MANAGING EFFECTS

42. As concluded above (with the key supporting conclusions found in paragraphs 26 (f), (g) and (h)), I believe a multiple contaminant approach to assessing environmental effects is more likely to achieve water quality objectives outlined in PC1 than using a Nitrogen Referencing Point as a proxy for water quality effects .

43. I am not alone in this belief as the Council received thousands of submission points related to this topic, including opposition to the proposed Nitrogen Reference Point (NRP), the focus on N, and matters that explicitly identify N in a manner that submitters consider is out of context with the other three contaminants (paragraph 129, WRC (2019)).

44. It is difficult to fully assess the Officers thoughts on this matter, given that many of the detailed points will be covered in Section C1 of the Report, which is yet to be produced. I understand that this will be discussed in the Block 2 hearing process.

45. However, it is my interpretation of the 42A Report that the Officers tend to disagree with many of the high-level points raised around using N as a proxy for water quality effects how with statements such as:

(a) Paragraph 128 – "*In the rule framework, N is subject to particular scrutiny, by way of a NRP. Farm Environment Plans (FEPs) are the intended mechanism for managing all four contaminants, with particular emphasis on farming activities staying within their NRP…*"

(b) Paragraph 131 – "*At the outset, Officers wish to make it clear that N is not considered to be any more important than the other three contaminants. N, and in particular increased N losses, can be a good indicator of farm intensity*".

(c) Although I acknowledge that Method 3.11.4.3 states that an "*FEP will be prepared by a certified person as per the requirements outlined in Schedule 1 and will assess the risk of diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens and specify actions to reduce the risks in order to bring about reductions in the discharges of those contaminants.* ….." I do not agree that this is the best approach for managing the multiple contaminants in the Waikato River catchment.

46. I have reviewed the specified requirements of FEP's outlined in Schedule 1 of PC1, and found that the only monitoring and reporting required for these plans relates to N. Although there are mitigations for the other contaminants to be specified under the FEP, there is no requirement to report on the amount leaving the property.

47. As such, it is not clear how compliance will be measured against the other three contaminants, which in some subcatchments of the Waikato River, need improvement as well as N (e.g. the Mangaonua subcatchment where the *E. coli* concentration is much higher than all other 74 sub catchments (Jacobs, 2018)).

48. It is my opinion that the NRP being used as a tool to indicate water quality effects of contaminant discharges, and hence potential effects of contaminants, does not work for all landuses within the Waikato River catchment.

49. For example, in general for dairy farms, as N losses increase, so do sediment, phosphorus and *E. coli*. This is not the case for sheep and beef, with relatively low N losses but high sediment and *E. coli*, or horticulture, with relatively high N and very low *E. coli* losses.

50. In addition, there is an issue around the scale of enterprises using land parcels. Larger enterprises can incorporate a mixture of high intensity and less intensive activities (such as pasture and forestry blocks), which allows the ability to average nutrient losses. This is not the case of smaller scale enterprises such as horticulture,

51. I also believe that additional uncertainty regarding compliance of consent applications is further introduced through Table 3.11-1. The explanation of Table 3.11-1 (page 56 of PC1) states:

> *"these targets are used in decision-making processes guided by the Objectives in 3.11 and for future monitoring of changes in the state of water quality within the catchments. With regards to consent applications for diffuse discharges or point source discharges of nitrogen, phosphorus, sediment and microbial pathogens, it is not intended, nor is it the nature of water quality targets, that they be used directly as receiving water compliance limits/standards."*

52. I agree that monitoring targets should be set to reach the Objectives of improving water quality within the catchment. However, this information does not aid consent applicants in assessing potential effects of discharges from their property. Essentially, any new consent application will only have to provide a NRP and a FEP outlining the ways in which they aim to reduce TP, sediment and *E. coli*. However, they will not have to consider the amount of these contaminants that they are contributing to the river system and the vulnerability of the receiving environment with regards to the four contaminants.

53. I believe that a better approach to managing the multi contaminants in the Waikato catchment, is to assess loads of all four contaminants for each defined sub catchment.

54. Jacobs developed estimates of sub-catchment unattenuated loads for the short-term water quality targets (excluding point sources) in Jacobs (2017), and which have been since updated following the NIWA review (as discussed in paragraph 23). These loads would provide the compliance data required for the catchment collective approach proposed by HortNZ for managing contaminant discharges.

55. In addition, this approach will also allow the community to actively achieve water quality targets that provide flexibility to adopt tailored solutions. This includes allowing different landuses the flexibility to migrate around the sub catchment.

56. I acknowledge that a similar concept was investigated in the Section 32 report for PC1. However, this approach involved setting property limits or standards for phosphorus, sediment or microbial pathogen discharges. It was proposed to either set a property-level limit on the amount of diffuse discharge leaving a property or setting a standard in the water.

57. This option was rejected by WRC over the current approach of a NRP and FEP, because property level data is not available in many cases, or the models required to provide the information are based on sub-catchment scale.

58. I believe the sub catchment loads calculated by Jacobs overcome the reasons for rejecting this approach to managing contaminants and as such the proposed changes to Schedule 1 outlined in HortNZ's submission should be adopted in PC1.

59. While acknowledging methods are not addressed in this hearing block, to assist understanding of how the sub catchment loads would work, I provide further information on implementation through a catchment collective approach in the next section of my evidence.

CATCHMENT COLLECTIVE APPROACH TO ALLOCATION

60. Based on the technical work completed by Jacobs (2017 and 2018), which highlighted issues for commercial vegetable production under the proposed PC1, HortNZ have proposed an alternative approach to managing contaminants, which involves a catchment collective approach. This approach was detailed in a memo to WRC dated 24 January 2018, and the evidence of Mr Chris Keenan and Miss Lucy Deverall for HortNZ.

61. The main components of this approach are:

    (a) Using subcatchment loads, as discussed in the previous section of my evidence, to manage the responsibility for

contaminants at the subcatchment scale as opposed to individual farms; and

(b) Allowing the community to manage effects collectively and take advantage of shared responsibility to increase flexibility of land use activity, while still achieving the short-term targets proposed in Table 3.11.1.

62. To demonstrate how the catchment collective approach would work for Commercial Vegetable Production, my colleagues at Jacobs have completed additional technical work to demonstrate two potential horticulture expansion scenarios. This work focussed on subcatchments in the Lower Waikato were horticulture is currently concentrated, specifically Waikato River at Tuakau Bridge, Whakapipi, Ohaeroa, and Waikato River at Port Waikato.

63. The scenarios involved the retirement of land, which involved the retirement of all land that has a land use capability (LUC) of class 6 or greater into forest and converting selected LUC 1 land to horticulture in the Port Waikato and Whakapipi catchments. This scenario was undertaken to illustrate an example of a subcatchment collective consent in which a group might agree to develop high value land (LUC Class 1) and retire other land (LUC Class 6-8), or where a grower might lease some high value and low value land and then mitigate for the development of high value land with the retirement of the low value land.

64. Specific details on the scenarios were as follows:

(a) Scenario 1a – Waikato River at Port Waikato subcatchment. The retirement of dairy/sheep and beef land in LUC class 7 and 8 to forest, and the conversion of selected LUC class 1 land to horticulture (an increase in horticultural area by 177 ha).

(b) Scenario 1b – Whakapipi subcatchment. The retirement of dairy/sheep and beef land in LUC class 6, 7 and 8, and the conversion of selected LUC class 1 land to horticulture (an increase in horticultural area by 94 ha).

65. The results of these scenarios are shown in **Table 1** below.

66. These findings demonstrated that the expansion of horticultural area in the Waikato region would not necessarily result in an increase on all nutrient losses, with only small increases in N calculated.

67. However, it also highlighted that this approach can lead to a decrease in other contaminant losses, such as P and *E. Coli* if other landuses on LUC Class 6 or greater land is retired to forest.

68. I believe that these scenarios demonstrate that the catchment collective approach to managing contaminant discharges would allow greater flexibility to the community to develop land for

specific landuses, such as Commercial Vegetable Production, while operating within sub-catchment load limits.

69. As such, I believe the inclusion of a catchment collective approach as requested by HortNZ should be included within PC1.

Gillian Holmes for Horticulture New Zealand
15 February 2019

Table 1: Results for scenarios 1a and 1b. *Negative number means a reduction in nutrient and *E.coli* losses from the subcatchment, and a positive number means an increase in nutrient and *E.coli* losses from the subcatchment.

Scenario	Description	Area (ha)	N load change (kg N/yr)*	P load change (kg P/yr)*	E.coli load change (10^{15} org/yr)*
1a – Port Waikato	Retired LUC 7+8 land to forest	721	-8,409	-453	-0.28
	Converted LUC 1 land to horticulture	177	+8,534	+39	-0.079
	Total load change	N/A	+125	-414	-0.359
1b – Whakapipi	Retired LUC 6-8 land to forest	756	-5,006	-382	-0.084
	Converted LUC 1 land to horticulture	94	+5,197	+38	-0.011
	Total load change	N/A	+191	-344	-0.095

REFERENCES

Doole, G. J.; Quinn, J. M.; Wilcock, B. J. and Hudson, N. (2016). Simulation of the Proposed Policy Mix for the Healthy Rivers Wai Ora Process. Report commissioned by the Technical Leaders Group for the Healthy Rivers Wai Ora Project; Report No. HR/TLG/2016-2017-4.5, 13 July 2016.

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Jacobs (2018). Healthy Rivers Plan Change – Technical Support for Horticulture New Zealand, Additional Technical Report for Further Submission. IZ081700-RP-0005, 17 September 2018.

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Waikato Regional Council (2018). Section 42A Report, Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments. Part A: Overview and Context; Part B: Overall Direction, Values and Uses, Science and Economics, Objectives, Limits and Targets. ISBN 2230-4347, 21 December 2018.

APPENDIX 1 – NIWA MEMORANDUM

(see next page)

Memo

From	**Annette Semadeni-Davies**
To	Catherine Sturgeon
CC	Michelle Sands
Date	31 January 2019
Subject	Peer review of Hort NZ reports for Healthy Rivers
File path ***(right click to update)***	*Document2*

Hi Catherine

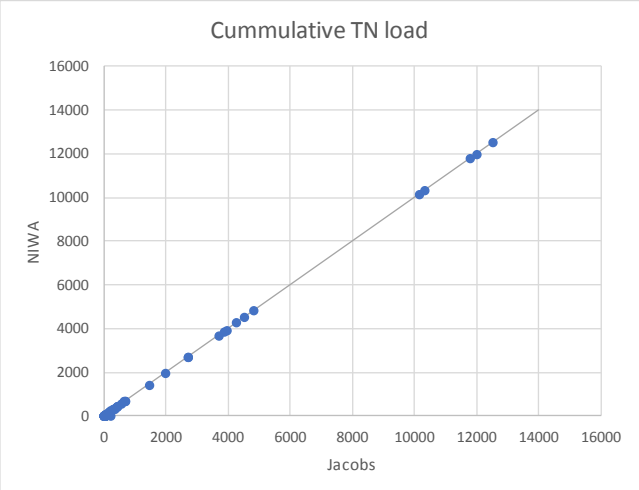
This memo is in response to the email you sent to me on 29th January 2019.

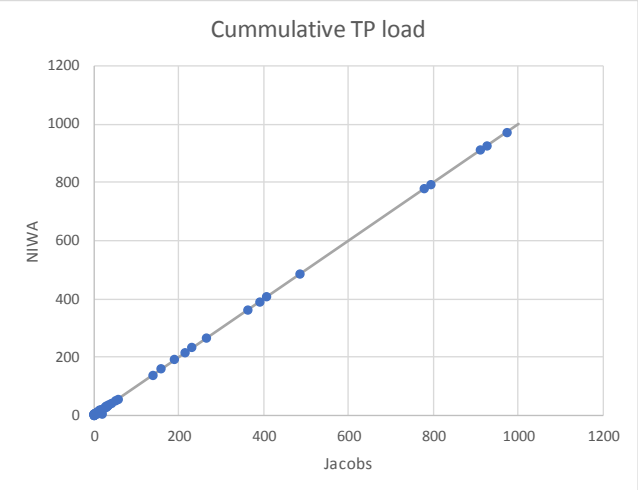
1. I can confirm that the yields for nutrients (TP and TN) that were used by NIWA for nutrient load modelling were supplied to Michelle Sands, then at Jacobs in December 2016, and the E. coli yield were sent in April 2017. The nutrient yields were supplied to us by Graeme Doole and were derived from Overseer Modelling undertaken by him while he was working at the University of Waikato. The E. coli yields were derived from our own modelling.

   Please note that NIWA did not undertake the sediment load modelling – this was undertaken by Landcare Research using NZEEM. NIWA did however review the model results.

2. I can confirm the calculations of baseline unattenuated nutrient loads generated by each sub-catchment undertaken by Jacobs are correct and match the unattenuated subcatchment loads calculated by NIWA.

3. I can also confirm that the calculated cumulative loads with attenuation and point sources for both TP and TN match the cumulative loads calculated by NIWA. Please refer to the scatter charts below; the line is the 1:1 line.





4. I can confirm that the inputs and estimated outputs, with and without attenuation, are the same as the NIWA calculated loads for E. coli. Please refer to scatter plot below.