

**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 TIMOTHY MICHAEL BAKER FOR  
HORTICULTURE NEW ZEALAND (WATER QUALITY)**

**9 July 2019**

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## **SUMMARY AND CONCLUSIONS**

1. This evidence provides a technical assessment of the impact of several proposed new policy approaches for commercial vegetable production (CVP) on water quality.
2. A methodology for setting a nitrogen reference point (NRP) for land that had CVP during the reference period, but then loses the NRP when CVP moves off post the reference period is proposed. This is referred to as the post CVP NRP. The proposed approach would have no overall impact on sub-catchment nitrogen load.
3. Currently, Policy 3 (b) caps the maximum area of CVP in the region based on the production data from 2006-2016. HortNZ have sought for the inclusion of policy that allows for a future increase in land area used for CVP in the Waikato. This increase is to account for population growth and for the loss of land to urban expansion (within the Waikato).
4. A technical assessment completed by my colleague Mr Easton identifies that 716 ha is required to allow for this growth in CVP.
5. An assessment of the effects of this increased CVP land area on water quality indicates that the catchment scale effects would be negligible. The nitrogen increase would be only 0.23% of the total catchment load, sediment load would decrease, and *E. coli* load would decrease slightly.

## **INTRODUCTION**

### **Qualifications and experience**

6. My full name is Timothy Michael Baker.
7. 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).

8. I hold a Bachelor of Science (BSc) in Geography and Environmental Science (2000) and a Master of Science Degree with Honours in Physical Geography (2003) from Victoria University of Wellington.
9. I have 16 years' experience in the field of water resource science. I started my career at Wellington Regional Council and worked for them between 2002 and 2007, then Black & Veatch Limited and CH2M Hill (both Environmental Consultancies) in the UK between 2007 and 2012, and most recently joined Sinclair Knight Merz (now Jacobs) in 2013.
10. I have acted as an Expert Witness in water resource related consent hearings in New Zealand for the past five years. I have provided expertise in the fields of water allocation, hydrogeology, groundwater quality, and environmental monitoring plan design to Horticulture New Zealand (HortNZ), Fonterra, and a range of local government clients including Greater Wellington Regional Council, and Manawatu-Wanganui Regional Council.
11. Of particular relevance to this hearing, is my preparation of evidence for previous Horticulture New Zealand (HortNZ) submissions, including: the Board of Enquiry appointed to consider Plan Change 6 to the Hawkes Bay Regional Plan and a Resource consent application to enable the Ruataniwha Water Storage Scheme, and the Marlborough District Council Natural resources Plan change.
12. My evidence is prepared on behalf of HortNZ. I am familiar with the subject area, although I have not been involved in the Waikato plans changes until now.

### **Code of Conduct**

13. 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.

14. I confirm that the issues addressed in this brief of evidence are within my area of expertise.
15. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

### **Background and Role**

16. My colleague, Ms Gillian Holmes, has been previously engaged by HortNZ as their water quality expert and has presented evidence at both Block 1 and 2 hearings, as well as attending the Expert Conferencing on Table 3-11-1 and contributing to the Joint Witness Statement.
17. Ms Holmes is now on maternity leave and as such, I have been engaged by Hort NZ to prepare evidence based on my colleague's research, assessment and reporting for HortNZ in support of their key submission points on PC1 in Block 3.
18. 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.
19. I have read the Joint Witness Statement for the Expert Conferencing for Table 3-11-1 and concur with the recommendations made by Ms Holmes.

### **Purpose and Scope of Evidence**

20. This evidence provides a technical assessment of those provisions within the scope of Block 3 hearings on which HortNZ submitted and addresses the Section 42A Report for Block 3 prepared by WRC.

21. More specifically this evidence provides:
- (a) An outline of water quality aspects related to CVP covered in the S42A report for Block 3; supported by the technical assessment provided in the evidence of Mr Stuart Easton for HortNZ;
  - (b) A discussion and response to these water quality matters with relation to HortNZ's position.

### **BLOCK 3 SECTION 42A REPORT**

22. The Section 42A report covers many aspects specific to the HortNZ submission on PC1, specifically:
- (a) Section C1: commercial vegetable growing, which covers such aspects as the use of Overseer for CVP; the proposed 10% reduction in Nitrogen (N) loss for CVP; the Nitrogen Reference Point (NRP) for CVP; Maximum area cap; transferring nitrogen losses between properties; and
  - (b) Section C2: discussion on the concept of subcatchment planning.
23. All of these topics have been touched on within the two Jacobs technical reports completed to support HortNZ's key submission points (Jacobs 2017 and 2018). I have outlined areas of agreement and disagreement from the conclusions of the s42A report related to these topics in the sections below.

### **10% REDUCTION IN NITROGEN LOESS FOR CVP**

24. Section 4.1 of Jacobs (2017) provided a technical assessment of the proposed 10% reduction in diffuse discharge of N and a tailored reduction in the diffuse discharge of P, sediment and microbial pathogens by CVP under Policy 3(d).
25. This assessment concluded that the proposed 10% in nitrogen leaching from CVP is likely to have a negligible benefit, given

the small contribution of horticulture to the N load in the Waikato River. However, achieving the 10% reduction in nitrogen leaching would have a substantial financial effect on growers.

26. The Officers have stated that although all landowners need to play a part in achieving the water quality attributes in PC1, the specification of a 10% reduction in N has many issues. As such, they have stated in paragraph 74 of the S42A report that they prefer the removal of the numeric 10% decrease in Policy 3, in favour of strengthened reliance on faster uptake of Good Management Practice (GMP) for all CVP.
27. I am fully supportive of this approach.

#### **NITROGEN REFERENCE POINT FOR LAND POST CVP**

28. The s42a report acknowledges the challenges of setting a nitrogen reference point (NRP) for CVP due to the highly veritable nature of CVP. Practices such as crop rotations, fallow seasons and land leasing making the calculation of the NRP over the 2006 – 2016 reference period difficult.
29. WRC has submitted on Schedule B (f) to seek an amendment to specify that where land is used for CVP during only part of the reference period, it is only when land is used for CVP that it is included when calculating the NRP.
30. I am supportive of this change.
31. An additional challenge is setting a NRP for land where CVP has operated during the reference period, but then moves off the land (most likely leased land) after the reference period. Currently it is unclear what NRP would be given to the land once vacated by CVP (it can't have no, or a zero NRP). This is herein referred to as the post CVP NRP.
32. My colleague Mr Easton has developed a methodology to calculate NRP for land requiring a post CVP NRP. This methodology is outlined below.

33. The post CVP NRP can be estimated as the area weighted average sub-catchment yield for suitable CVP land, for non-CVP land uses, for example:
- (a) The total area of land in a sub-catchment suitable for CVP (but excluding current CVP) is determined (this is defined as LUC 1 or 2 AND existing land use is not urban or horticulture AND is zoned rural);
  - (b) The nitrogen loss for this suitable CVP land is summed (kg/ha/yr) and converted into a load (kg);
  - (c) The CVP suitable sub-catchment load is divided by the CVP suitable land area to determine a post CVP NRP that would be applied to land where CVP has moved off the land after the reference period.
34. A post CVP NRP calculated in this way means that the total catchment NRP derived load will not increase when CVP rotates to new land, assuming that post-CVP land use proportionality is equivalent to the current configuration of CVP suitable land. Therefore, there should be no net change in water quality as a result of this post CVP NRP methodology.
35. I am supportive of this methodology being incorporated into PC1 policy to provide land owners in this situation with some clarity around their future NRPs.

#### **MAXIMUM AREA CAP FOR CVP**

36. Policy 3 (b) caps the maximum area of CVP in the region based on the production data from 2006-2016. As such, any consent for additional areas above this maximum area required for CVP would fall under Rule 3.11.5.7 – Non-Complying Activity Rule.
37. Through submissions, HortNZ have sought for the inclusion of policy that allows for a future increase in land area used for CVP in the Waikato. This increase is to account for population growth and for the loss of land to urban expansion (within the Waikato).



38. The S42A report outlines the issues raised by HortNZ and other submitters regarding this area cap for CVP. The S42A identifies the view of WRC officers that to better enable the expansion of existing CVP operations, or allow for new growers, greater policy support is required to ensure the policy outcomes of PC1 are still met.
39. I believe the calculations provided in the evidence of Mr Easton provide useful policy support. Mr Easton has completed a technical assessment that identifies a maximum area cap for CVP that allows for both population growth and compensates for land lost to urban expansion.
40. In the following paragraphs I will summarise this work and provide my opinion on the likelihood of this approach being able to meet the objectives of PC1.
41. Two land area scenarios are outlined in Mr Easton's assessment, the first being for an increase in CVP land area capped at 716 ha, and the second and increase capped at 1,473 ha. These are increase on the existing footprint of CVP.
42. I will focus on the N load and other water quality effects of the 716 ha cap as I believe that 716 ha has negligible effect on water quality at a catchment scale and would be easy to adopt as policy.

#### **Derivation of Growth Area (ha)**

43. The 716 ha (rounded) represents an increase of CVP land to account for population growth and CVP land lost to urban expansion in the Waikato region only. These data are derived from:
  - (a) Population Statistics - the total CVP area in the Waikato is approximately 6,250 ha<sup>1</sup>. Stats NZ<sup>2</sup> predicts a 9.9% increase in population to 2030 under a medium

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<sup>1</sup> NIWA Healthy Rivers modelling GIS data

<sup>2</sup> Statistics New Zealand, Subnational Population Projections

growth scenario. An equivalent increase in CVP land is 619 ha.

- (b) Waikato District Plan Change - a desktop GIS exercise was conducted to estimate the current CVP land in the Pukekohe hub and surrounds that has been zoned for future urban growth in Waikato District proposed plan. Property parcels within future development zones were classified as CVP land based on visual assessment of aerial imagery. A total of 565 ha of current CVP land zoned for urban development was identified. Of the 565 ha, 96.5 ha is within the Waikato Region

44. A total of 82,379 ha of land in the Waikato has been identified as suitable for the expansion of CVP, based on the following criteria (subzone subtotals are in Table 1 of Attachment A):

- (a) LUC 1 or 2;
- (b) Existing land use is Dairy, Forestry, Miscellaneous, or Sheep & Beef (i.e. not Urban or Horticulture); and
- (c) Is zoned as 'Rural' in the proposed Waikato District Plan.

#### **N Loss from CVP Growth Area**

45. Data for the following calculations was provided to Jacobs by NIWA and was used for the earlier Jacobs reporting<sup>3</sup>. The calculation in this reporting were checked and reviewed by NIWA.

46. Mr Easton has calculated the additional N loss expected from this provisional CVP increase as the difference between the existing land use loss and CVP loss. Using the NIWA modelled Healthy Rivers data at the sub-catchment scale, the additional N loss associated with new 716 ha CVP (distributed across the

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<sup>3</sup> Values and Current Allocation of Responsibility for Contaminant Discharges. Technical report prepared by Jacobs NZ Ltd for Horticulture NZ. 2017.

82,379 ha discussed above) averages 50 kg/N/ha (i.e. the average N loss of non-horticultural land use is 50 kg/ha less than horticultural land for these sub-catchments). This is summarised in Table 1 below.

**Table 1: Calculated N load of provisional CVP growth area**

Region	Provisional CVP growth area (ha)	Additional N load into Waikato River associated with provisional CVP growth (kg)	Additional N load as percentage of total Healthy Rivers N load
Waikato	716	35,775	0.23%

47. The above data shows that as a percentage of the total N load into the Waikato, the proposed increase from new CVP is minor, equating to only 0.23% of the total catchment load.
48. Furthermore, the 716 ha of provisional CVP growth area required for the Waikato could be provided for with a less than 0.5% increase in N load from the Lower Waikato, Waipa, and Central Waikato FMUs (these FMUs contain all the current CVP land).
49. Looking at this increase in N load in the context of the reductions gained from other PC1 provisions (outlined below), the increase in load appears negligible. These expected reductions are:
- (a) CVP Good Management Practice (BMP) is estimated to reduce N load by an average of 5% across the sector (HortNZ Submission). This is equivalent to 19,847 kg/N/year across the current CVP area, or 418 ha of additional CVP.
  - (b) Additionally, Dairy Farming is required to reduce the N-loss from the highest yielding Dairy land to meet the 75<sup>th</sup> percentile yield (36.8 kg/ha<sup>4</sup>). This is estimated to reduce N load to the River by 397,770 kg, equivalent to

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<sup>4</sup> Jacobs 2017, Values and Current Allocation of Responsibility for Contaminant Discharges.

2.5% of the total Healthy Rivers catchment N load (and equivalent 8,792 ha additional CVP).

50. In summary, if the additional N load is considered in the context of both the CVP GMP and Dairy Clawback, even with the 0.09 % increase on overall N load, there is still a -2.45 % change in catchment N load. This is presented in detail in Table 5 of Mr Easton's evidence.

#### **Sediment Change from CVP Growth Area**

51. Using the BMP sediment modelling produced by Agrilink (refer to the evidence of Mr Barber), Mr Easton has calculated the change in sediment load likely to occur as a result of increasing the CVP area cap by 716 ha.
52. The estimates presented in Section 5 of Mr Easton's memo indicate that sediment load would decrease if there is an increase in CVP.
53. Mr Easton's calculations are based on an average slope of 0.9° and assume the replacement of pasture with BMP CVP. The results show that an increase in CVP of 716 ha has a net benefit on sediment load between 143 and 501 tonnes, depending on slope class assignment. This is largely because BMP CVP adopts sediment retention ponds for all cultivated areas, which on low slope land has negligible (zero) sediment loss.

#### **E.coli change from CVP Growth Area**

54. Using the NIWA modelled Healthy Rivers data Mr Easton has calculated the change in *E. coli* load expected to occur because of increasing the CVP area cap by 716 ha.
55. Based on the NIWA data, the total catchment load is estimated to decrease by 0.06%. This is because the average *E. coli* yield from CVP land is slightly less than from non-CVP land.
56. It is my understanding that the methodology used by NIWA to calculate *E. coli* loads is based on their CLUES model. It is also

my understanding that in the CLUES model used for the Healthy Rivers calculations, CVP land is grouped with other miscellaneous land i.e. it is assigned an *E. coli* load the same as other non-ruminant farmed land.

#### **SUB-CATCHMENTS SUITABLE FOR PROVISIONAL CVP GROWTH**

57. Assuming an additional 716 ha of CVP land is required to account for population growth and urban encroachment, the catchment scale change in loads of N, sediment and *E.coli* (as described above) appear to be negligible, and in the case of sediment, there is an improvement. Additionally, when measured in the context of GMP improvements, and the catchment wide Dairy Clawback, the overall change in N load is a reduction on present load.
58. The sub-catchment allocation of the 716 ha of new CVP land needs some consideration as the existing water quality state of some sub-catchments would suggest that they are not suitable for additional CVP growth.
59. I recommend that any new policy excludes sub-catchments that are assessed as not suitable for additional CVP. Not suitable could be defined as:
  - (a) Any sub-catchment currently in, or below the National Objectives Framework (NOF) C band for nitrate are excluded. This would exclude: Mangaone (Central Waikato), Whakapipi (Lower Waikato), Komakorau (Lower Waikato), Mangamingi (Upper Waikato), and Kawanui (Upper Waikato).
  - (b) Sub-catchments containing sensitive lake environments should be excluded. These are Waikare, Whangamarino at Island Block Rd, Whangamarino at Jefferies Rd Br and Whangape).
60. These catchments are listed in Appendix A.

## **TRANSFERRING N LOSSES BETWEEN PROPERTIES**

61. The S42A report states that Rule 3.11.5.5 (f) and (g) were intended to enable the movement of CVP land uses to new areas of land.
62. However, one of the main issues with the current rule framework (and as acknowledged by the S42A report in paragraph 110) is that it is based around per-property land use consents with associated discharges. As such, these are unable to be transferred between sites during the rotation of crops, that is a key requirement for CVP.
63. Paragraph 111 of the S42A report outlines some options for CVP transfers as discussed through the CVP forum. These are covered in the evidence of Mr Keenan.
64. I believe that the local and cumulative effects of landuse in subcatchments can be managed and assessed through the area cap approach, discussed earlier in my evidence (paragraphs 32 to 51). One additional requirement for the management of contaminants under this approach is the inclusion of load limits within PC1. This approach was outlined in Jacobs (2017 and 2018), and Block 1 evidence of my colleague Ms Holmes.
65. In addition, this approach was discussed in the Expert Conferencing for Table 3-11-1 and is outlined in the Nutrient paper included in Appendix 2 as Approach 3. There was general agreement from the experts that this approach (calculating TN and TP loads for subcatchments) was a good approach to managing effects in sub-catchments, while also managing the cumulative effects in the main stem of the Waikato River.
66. It is my understanding that the finer detail of this approach was not discussed during the Expert Conferencing, with my general opinions on how loads would be incorporated into PC1 outlined below.

67. Currently, the concentrations incorporated into Table 3-11-1 are freshwater objectives as specified in the National Policy Statement for Freshwater Management 2014 (as amended 2017) (NPS-FM), i.e. they describe the intended environmental outcome in a freshwater management unit.
68. In order to achieve the freshwater objective outlined in Table 3-11-1, a limit is required to be specified which is “the maximum amount of “resource use” that is possible, which allows a freshwater objective to be met”.
69. I believe that loads, in particular unattenuated loads, are the most reflective of the definition of a limit as defined in the NPS-FM. This is because unattenuated loads reflect the load that is occurring to the land due to current landuse, rather than attenuated loads which are measured instream once various attenuation has occurred.
70. The unattenuated loads allow land owners to directly manage their loads to land, rather than relying on managing via instream values which may vary over time and may be difficult to pinpoint the direct connection between landuse and increasing or decreasing loads.
71. As such, I believe unattenuated loads should be included within PC1 for the main contaminants (TN, TP, E. Coli and sediment) to add the management of water quality in subcatchments.

**Tim Baker for Horticulture New Zealand**

**9 July 2019**

## ATTACHMENT A

Sub-Catchment Name	FMU	Total Catchment Area (ha)	Existing CVP area (ha)	Potential CVP growth (ha)	Potential CVP growth area (% of total sub-catchment area)
Firewood	Waipa	3372	0	5	0%
Waerenga	Lower Waikato	1959	0	67	3%
Mangatawhiri	Lower Waikato	6795	0	78	1%
Opuatia	Lower Waikato	7319	94	202	3%
Kirikiroa	Central Waikato	1233	0	214	17%
Awaroa (Rotowaro) at Harris/Te Ohaki Br	Lower Waikato	4730	0	335	7%
Awaroa (Waiuku)	Lower Waikato	2506	27	372	15%
Waikato at Horotiu Br	Central Waikato	5405	2	447	8%
Ohaeroa	Lower Waikato	2033	123	499	25%
Waikato at Narrows	Central Waikato	12987	124	778	6%
Waipa at SH23 Br Whatawhata	Waipa	31506	122	1127	4%
Waikato at Rangiriri	Lower Waikato	6853	0	1240	18%
Ohote	Waipa	4041	12	1704	42%
Waikare	Lower Waikato	10418	72	1722	17%
Waikato at Tuakau Br	Lower Waikato	15135	684	1815	12%
Matahuru	Lower Waikato	10637	0	2146	20%
Waikato at Bridge St Br	Central Waikato	5072	200	2237	44%
Mangaonua	Central Waikato	8096	90	2382	29%
Waikato at Port Waikato	Lower Waikato	28185	950	3072	11%
Mangatangi	Lower Waikato	19452	6	3229	17%
Waipa at Wainaro Rd Br	Waipa	15484	106	3706	24%



Sub-Catchment Name	FMU	Total Catchment Area (ha)	Existing CVP area (ha)	Potential CVP growth (ha)	Potential CVP growth area (% of total sub-catchment area)
Waikato at Huntly-Tainui Br	Lower Waikato	17322	77	6678	39%
Waikato at Mercer Br	Lower Waikato	44917	977	7367	16%
Mangawara	Lower Waikato	35884	0	15305	43%
<b>Sub-Catchments with suitable CVP land but excluded from additional CVP expansion due to water quality limitations (CVP capped at current area)</b>					
Kawaunui	Upper Waikato	2134	0	0	0%
Komakorau	Lower Waikato	16399	23	14264	87%
Mangamingi	Upper Waikato	5175	0	0	0%
Mangaone	Central Waikato	6760	113	2837	42%
Whakapipi	Lower Waikato	4663	1000	820	18%
Whangamarino at Island Block Rd	Lower Waikato	14364	204	2638	18%
Whangamarino at Jefferies Rd Br	Lower Waikato	9701	30	2946	30%
Whangape	Lower Waikato	31767	0	2144	7%
<b>Sub-Catchments without suitable CVP land</b>					
Awaroa (Rotowaro) at Sansons Br	Lower Waikato	4561	0	0	0%
Kaniwhaniwha	Waipa	10260	0	0	0%
Karapiro	Central Waikato	6741	36	0	0%
Little Waipa	Upper Waikato	10649	0	0	0%
Mangaharakeke	Upper Waikato	5415	0	0	0%
Mangakara	Upper Waikato	2235	0	0	0%
Mangakino	Upper Waikato	22182	0	0	0%
Mangakotukutuku	Central Waikato	2708	1	0	0%
Mangaohoi	Waipa	431	0	0	0%
Mangaokewa	Waipa	17416	0	0	0%

Sub-Catchment Name	FMU	Total Catchment Area (ha)	Existing CVP area (ha)	Potential CVP growth (ha)	Potential CVP growth area (% of total sub-catchment area)
Mangapiko	Waipa	28069	34	0	0%
Mangapu	Waipa	16104	0	0	0%
Mangarama	Waipa	5528	0	0	0%
Mangarapa	Waipa	5443	0	0	0%
Mangatutu	Waipa	12269	0	0	0%
Mangauika	Waipa	978	0	0	0%
Mangawhero	Central Waikato	5347	46	0	0%
Moakurua	Waipa	20630	0	0	0%
Otamakokore	Upper Waikato	4645	0	0	0%
Pokaiwhenua	Upper Waikato	32701	0	0	0%
Pueto	Upper Waikato	20027	11	0	0%
Puniu at Wharepapa	Waipa	16853	0	0	0%
Puniu at Bartons Corner Rd Br	Waipa	22786	304	0	0%
Tahunaatara	Upper Waikato	20815	0	0	0%
Torepatutahi	Upper Waikato	21715	0	0	0%
Waikato at Karapiro	Upper Waikato	53969	323	0	0%
Waikato at Ohaaki	Upper Waikato	29008	130	0	0%
Waikato at Ohakuri	Upper Waikato	53140	0	0	0%
Waikato at Waipapa	Upper Waikato	69373	0	0	0%
Waikato at Whakamaru	Upper Waikato	44665	0	0	0%
Waiotapu at Campbell	Upper Waikato	6006	0	0	0%
Waiotapu at Homestead	Upper Waikato	20477	0	0	0%
Waipa at Pirongia-Ngutunui Rd Br	Waipa	43607	156	0	0%
Waipa at Mangaokewa Rd	Waipa	3217	0	0	0%
Waipa at Otewa	Waipa	28666	0	0	0%

Sub-Catchment Name	FMU	Total Catchment Area (ha)	Existing CVP area (ha)	Potential CVP growth (ha)	Potential CVP growth area (% of total sub-catchment area)
Waipa at Otorohanga	Waipa	13955	0	0	0%
Waipapa	Upper Waikato	10049	25	0	0%
Waitawhiriwhiri	Central Waikato	2223	0	0	0%
Waitomo at SH31 Otorohanga	Waipa	4393	0	0	0%
Waitomo at Tumutumu Rd	Waipa	4318	0	0	0%
Whakauru	Upper Waikato	5302	0	0	0%
Whirinaki	Upper Waikato	1080	0	0	0%