BEFORE THE HEARINGS PANEL

IN THE MATTER of hearings on submissions concerning the Proposed One Plan notified by the Manawatu-Wanganui Regional Council

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SECTION 42A REPORT OF MR GORDON WILLIAM STEWART ON BEHALF OF HORIZONS REGIONAL COUNCIL

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1. INTRODUCTION

My qualifications/experience

1. My full name is Gordon William Stewart. I am the director of AQUAS Consultants Ltd, an independent consultancy based in Tauranga. AQUAS is involved in research, planning and communications relating to sustainability issues, with a special emphasis on projects in water demand management.

2. My academic background includes a B.A. (Economics) and M.Sc. (Kinesiology), both from Simon Fraser University in British Columbia, Canada. I also have an MSc (with Distinction) in Environmental Management from Imperial College, University of London. My environmental management studies focused on water resource management and included research on educational and financial incentives to promote water-use efficiency. I am a professional member of the Environment Institute of Australia and New Zealand and a member of Water New Zealand.

3. My work in water demand management ranges from research and planning through to implementation. Projects have addressed water-use issues in the municipal, industrial, and agricultural settings.

4. In 2005, I authored *Promoting Customer Water-Use Efficiency: A Planning Guide for Local Authorities*, a publication supported by Environment Waikato and provided to all territorial authorities in the Waikato region. In May this year, I completed *The Case for Demand Management in Council Water Supplies*, a joint publication of Water New Zealand, Local Government New Zealand and Ministry for the Environment.

5. For Environment Waikato, I have developed a series of Water-Use Efficiency Checklists, which are now available to water users in the region to assist them preparing resource consent applications.

6. On the planning side, I have prepared Water Demand Management Action Plans for a number of councils around the North Island, spanning from Palmerston North to Rodney.

7. Implementation projects have ranged from auditing water use in Hamilton City Council buildings and facilities to a region-wide Smart Water Use campaign in the Waikato, working on a coordinated effort involving Environment Waikato, Hamilton City Council and the nine district councils in the region.

8. In the area of rural water use, I did a study with dairy farmers on 12 farms in the Waikato region to document simple and inexpensive ways to use water more efficiently and to reduce water loss in farming operations. We used the findings of this study as the basis of a Smart Water Use in Dairy Farming campaign targeting farms in the Hauraki and Thames Coromandel area in the summer of 2006/07. I am currently working with Dairy*NZ* to roll this out to the broader Waikato region.

9. I have read the Environment Court's practice note *Expert Witnesses – Code of Conduct* and agree to comply with it.

My role in regard to the One Plan

10. I have prepared two technical reports to assist Horizons Regional Council in developing the One Plan.

11. One report relates to municipal water use and is entitled *Assessment of the Proposed Water-Use Guidelines for Public Water Supplies* (November 2006). Preparation of this report included examination of water allocation approaches in other regions for comparison purposes. It also involved working with four district councils in the Manawatu-Wanganui Region to document current water use in representative water supply schemes. A further important outcome of the work was to provide each of the councils with a short report identifying water-use efficiency options and opportunities based on what was learned in the study.

12. The other report focused on water use in the rural setting and is entitled *Reasonable Stock Water Requirements: Guidelines for Resource Consent Applications* (December 2007). This report was co-authored with Dr. Robert Rout of Aqualinc Research Limited.

13. Details of my work in these two areas are provided in the full evidence statement following. I understand the Hearings Panel has been provided with copies of all the reports on which this information is based.

Scope of evidence

14. My evidence relates to water demand management, which addresses the efficient use of water and minimising water losses. I will specifically consider municipal water use and stock water requirements.

15. Information on municipal water use is based on reported best practice overseas, known strategies and practices throughout New Zealand, and my own professional experience as noted above.

16. Information on stock water is based on research done to prepare the *Reasonable Stock Water Requirements* report cited above. Significant earlier work in this area done by Dr Rout for Horizons Regional Council was used as a basis and starting point for the 2007 report that we co-authored.

2. EXECUTIVE SUMMARY OF EVIDENCE

17. This evidence statement focuses on demand management and the role it can play in sustainable management of the Region's water resources.

18. To this end, I was asked by Horizons Regional Council to prepare two technical reports to assist it in developing the One Plan. The two areas considered were:
- municipal water supplies, and
- stock water requirements.

19. In terms of municipal water supplies, demand management can help councils meet local needs in a variety of ways. It can help to:
- address seasonal water shortages
- slow the growth in operating costs
- possibly reduce, defer or avoid capital costs
- assist in stormwater management
- control rates increases and manage assets in a cost-effective manner, and
- increase resilience of the water supply in the face of climate change uncertainties.

20. The study and report done for Horizons compared the proposed efficiency criteria (water-use guidelines) to water allocation approaches in other regions and to current typical water use in municipal water supplies in the Region.

21. Information was gathered on water allocation initiatives in seven other regions, including a number of areas where per capita water use was a basis for planning and management.

22. To consider current use in the region, Horizons identified five water supply schemes to examine, ranging from small/rural systems (Eketahuna being one of them) to moderate

size urban schemes (Levin and Feilding). These were deemed to provide a representative picture of water use in community schemes around the Region.

23. Strong, positive support was provided by the four district councils involved in compiling and providing information and with answers to queries as the report was being prepared. Along with the technical report for Horizons, each of the participating councils was provided with a short report outlining demand management options and opportunities relevant to them and geared to their local situation.

24. Based on the study of the municipal water supply schemes, it can be said that:

- The proposed efficiency criteria/water-use guidelines appear suitable when compared to approaches in other regions.
- The guidelines seem reasonable and fair when assessed against typical water use around the Region.
- Any gaps between high-season/peak-day use and the restricted-flow guidelines can be addressed via appropriate demand management initiatives.

25. Demand management options and opportunities are discussed in detail in this evidence statement and in the Water New Zealand publication entitled *The Case for Demand Management in Council Water Supplies* (a copy of which has been provided to the hearings panel).

26. Suffice it to say, there are local, national, and international examples of demand management initiatives that are both practical and cost-effective. The wide range of options available means that councils can examine their own issues and concerns and develop solutions that are locally appropriate.

27. The examination of stock water requirements took the form of a literature review and gathering of information from related professional and industry organisations. The report prepared for Horizons was co-authored with Dr. Robert Rout of Aqualinc Research Limited, and built on earlier work he had done for Horizons in this area.

28. Based on the data and studies available:

- The proposed 70 litres/hour/day (l/h/d) for average drinking water needs for dairy cows can be considered a fair (even generous) standard.

29. The volume-based water-use guidelines proposed in the One Plan – for municipal water supplies and for stock water use – provide clarity for resource consent holders and can serve as a basis for developing simple water-use efficiency steps or more detailed water

demand management plans, with the latter being a logical approach for council water supply schemes.

30. Appropriate guidelines will help to create a positive and supportive setting in which demand management efforts can occur. Demand management contributes to sustainable water use in the Region and this, in turn, brings economic, social, cultural and environmental benefits that are shared by all.

3. EVIDENCE

Introduction to demand management

31. Others providing evidence to the Hearings Panel have indicated that use of both surface water and groundwater in the Region has increased dramatically during the last decade. It has been noted that the demand for surface water in some catchments in the Region already exceeds supply, and other catchments are experiencing marked increases.

32. For all resource consent holders, an active demand management programme can help to maintain takes within allocated volumes.

33. For municipal water suppliers, customer demand management initiatives are a way to respond to requirements of the Local Government Act (2002), specifically Sections 126 (1) (e) and 128 (2) (a). Section 128 calls for demand-reduction strategies, such as public education, promotion of appropriate technologies, pricing and regulation.

34. On a practical basis, demand management can help councils meet local needs and concerns in a variety of ways. It can help to:

- address seasonal water shortages
- slow the growth in operating costs (eg. water/wastewater treatment)
- possibly reduce, defer or avoid capital costs
- assist in stormwater management
- reduce the need for rates increases and manage assets in a cost-effective manner
- demonstrate a commitment to sustainability, and
- increase resiliency of water supply systems in the face of climate change uncertainties.

35. All these benefits won't necessarily accrue in each situation, but every council should find at least a few on the list that will pay off for them. More details are included in the

Water New Zealand publication *The Case for Demand Management in Council Water Supplies*. I understand the Hearings Panel has received a copy of this document.

36. For agricultural and industrial water users, demand management offers both tangible and intangible benefits. Wherever water is paid for on a volume basis, reducing water use and its loss leads to lower operating costs. Even where there is a fixed cost for water, if energy is required for pumping or heating it, reducing water use will reduce costs. Beyond this, efforts to use water efficiently demonstrate a concern for the environment. This is a good business practice in a world where more and more international markets are examining the sustainability credentials of their suppliers.

37. Demand management can help protect the natural environment as well. This is particularly important under surface water low-flow conditions, where altering water levels and flow patterns can have an impact on life-supporting conditions. In extreme conditions, small watercourses can run dry. The temperature of water can rise and adversely affect fish, plants, and other aquatic life. Care must also be taken not to unduly draw down groundwater (to protect the aquifer itself and to avoid reducing the flow to springs, streams and rivers). In essence, demand management is a form of environmental stewardship encompassed in the Māori philosophy and approach of kaitiakitanga.

38. As noted above, my evidence addresses demand management in two specific areas, considered in turn:
    - municipal water supplies; and
    - stock water requirements.

Municipal water supplies

39. The information pertaining to municipal water supplies is divided into five sections as follows:
    - One Plan proposed efficiency criteria
    - approaches in other regions in New Zealand (for comparison purposes)
    - analysis of sample municipal water use in the Region against the proposed efficiency criteria
    - conclusions based on regional comparisons and sample water use within the Region, and
    - ways to bridge any gaps between current use and the proposed efficiency criteria (ie. demand management options and opportunities).

One Plan proposed efficiency criteria

40. The efficiency criteria for Policies 6-12 and 6-19 noted below use One Plan 2006 draft wording, which was operative when the AQUAS study was done for Horizons. These criteria (called 'guidelines' at the time and referred to as such in this statement, as it reports on the original work) were used for comparison purposes with actual water use. There are a few changes to the wording and application, but not the intent, of the criteria in the current Proposed One Plan.

41. Policy 6-12 deals with reasonable and justifiable need for water (applied under normal flow conditions). For public water supplies, the following shall be considered to be reasonable:

    i. An allocation of 300 litres per person per day for domestic needs; plus
    ii. An allocation for commercial use equal to 20% of the total allocation for domestic needs; plus
    iii. An allocation for industrial use calculated where possible in accordance with best management practices for water efficiency; plus
    iv. Any allocation necessary to cater for the reasonable needs of livestock or agricultural practices that are within the boundary of the public water supply system; plus
    v. An allocation necessary to cater for growth, where growth of the municipality is reasonably forecast; plus
    vi. An allocation for leakage equal to 15% of the total of (i) to (v) above.

42. In applying the guidelines, the One Plan notes that where the existing allocation for a public water supply exceeds the allocation calculated in accordance with subsections (i) to (v) above, the Regional Council would establish, in consultation with the relevant territorial authority, a timeframe by which the existing allocation shall be reduced to the calculated amount.

43. Policy 6-19 addresses the apportioning, restricting and suspending of takes in times of low flow. In this case, public water supply takes shall be restricted to a total public water consumption calculated as follows:

    i. An allocation of 250 litres per person per day for domestic needs, plus
    ii. An allocation for commercial use equal to 20% of the total allocation for domestic needs, plus
    iii. An allocation which meets the reasonable needs of hospitals, other facilities

iv. providing medical treatment, schools, other educational facilities, and abattoirs, plus

v. Any allocation necessary to cater for the reasonable needs of livestock that are within the boundary of the public water supply system, plus

vi. An allowance for leakage equal to that in (vi) for normal-flow conditions noted above.

44. Municipal water use in the Region – using a few water supply schemes as examples – was compared to the proposed efficiency criteria/guidelines noted above. This analysis is covered in the second section below.

Water allocation/efficiency approaches in other regions

45. Regional councils throughout New Zealand are taking a variety of approaches to water-use efficiency for public water supplies. These were examined in the 2006 AQUAS study as a point of comparison for Horizons' proposed guidelines.

46. **Study methodology.** Details on the strategies and approaches in other regions were obtained by (1) checking the websites of the reference councils for related information, (2) reviewing and assessing relevant information, and (3) personal contact with appropriate council staff to seek clarifications and gather additional information.

47. **Results.** A summary of the results appears in Section 2 of the Horizons report, with details in Appendix B. Things have progressed since the report was completed, with strategies in a number of regions showing different approaches. For example:

- The Greater Auckland region is committed to meeting the goals and objectives for sustainable water management set out in the *Auckland Water Management Plan*. The plan has established a target of five percent reduction in per capita consumption across the region by 2024.
- Environment Waikato's Proposed Waikato Regional Plan: Proposed Variation No.6 – Water Allocation is calling for the region's territorial authorities to present water management plans as a part of resource consent applications and to demonstrate efficiencies over time through demand management initiatives.
- Greater Wellington Regional Council has prepared a *Wellington Water Management Plan* covering its four constituent city councils and drawing on a range of demand management options.

48. **Guidelines and targets.** Kapiti Coast District Council and Environment Canterbury have indicated domestic per-person consumption targets or guidelines for public water supply schemes as follows:

- Kapiti Coast District Council is aiming to reduce peak residential use to 400 l/p/d (made up of 250 litres for essential use and 150 litres non-essential).
- For the Waitaki catchment (Canterbury region), the guideline is 300 l/p/d above minimum flow and 250 l/p/d below minimum flow based on the population to be served.
- For the remainder of the Canterbury region, the guideline is 250 l/p/d during times of low water availability based on the current census population.

49. In the Waitaki catchment for above minimum flow, daily stock water requirements are also taken into account as is "a reasonable quantity for other water uses supplied from the water supply system". Below minimum flow, in addition to domestic use, there are allowances for actual stock drinking-water requirements, the minimum necessary for fire-fighting and processing/ storage of perishable produce, and for reasonable leaks and losses from the system.

50. For the rest of the Canterbury region, water-use efficiency is generally covered in the proposed variations to Environment Canterbury's Natural Resources Regional Plan. In this case, there are the same add-ons to domestic use – ie. actual stock water drinking requirements, the minimum necessary to maintain fire-fighting capability, plus allowance for reasonable losses. Alternatively, if the city or district council has a water supply asset management strategy that restricts (in an alternative manner) the use of water supplied by a scheme during periods of low water availability, it can use this as the operative guide. This strategy must ensure that all practicable methods of water-use conservation will be applied at the time of restrictions. Reporting on the implementation of this water supply asset management strategy during periods of low water availability will be required. This alternative may be secured as a condition of consent.

51. A further benchmark is provided by the Ministry of Health (2004) publication *Household Water Supplies: The selection, operation and maintenance of individual household water supplies*. While this resource focuses on on-site water systems, the household requirements noted are relevant for our purposes. The total is set at 300 l/p/d, consisting of:

- 5 litres for drinking, cooking and food preparation;
- 100 litres for bathing, showering and cleaning;
- 145 litres for toilet flushing and clothes washing; and

- 50 litres for general use (presumed to cover some outdoor/garden use).

52. The proposed Horizons' guidelines certainly fall within the range noted here (see more on this in the conclusion to the Municipal Water Supplies section).

Analysis of sample municipal water use in the Region

53. A focus of the work done by AQUAS was to look at water consumption levels and practices within the Region to assess typical use against Horizons' expectations as set out in the guidelines.

54. **Study methodology.** Information on current water consumption and practices within the Region was obtained directly from councils. Horizons identified five public water supply systems to be examined – Bulls, Hunterville, Eketahuna, Levin and Feilding. These ranged from small/rural systems to moderate size urban schemes and were deemed to provide a representative picture of water use in community schemes around the Region.

55. AQUAS Consultants had positive support from the district council staff in providing data and meeting to discuss matters. They were helpful and efficient in reviewing information and offering feedback, especially given their many responsibilities and busy schedules. The work could not have been completed without this level of support.

56. Council contacts for the work were as follows (with their position at the time noted in brackets):
    - Rangitikei – Claire Scrimgeour (Engineering Services Manager);
    - Tararua – Dave Watson (Utilities Manager) and Eric Bonny (Services Engineer);
    - Horowhenua – Ken Hale (Utilities Manager); and
    - Manawatu – Wayne Spencer (Water Manager).

57. The following activities were carried out by AQUAS to gather information for analysis:
    - Provide councils with a 'Water Supply Services Worksheet' as a first step in capturing and organising helpful information.
    - Receive completed worksheets from councils, review them, and respond by e-mail for clarifications.
    - Prepare a data summary sheet for each system based on the information in the worksheet.

- Spend time in the Region to visit the area served by each water system and meet with council representatives (noted above) to gather information more easily obtained via face-to-face discussion.
- Revise and add to the worksheet and data summary and prepare an additional information list for each system; return this to councils for final review.
- Make the necessary changes to the data and information based on each council's review and feedback; obtain sign-off/approval from each council.

58. The data and information gathered on each scheme (summarised in Section 3.3, starting on page 12 of the report to Horizons) was used to estimate any gaps between current water consumption and the proposed water-use guidelines. This analysis is covered in Section 4.3 (page 27) of the report.

59. *Reports provided.* As noted earlier, in addition to the full technical report provided to Horizons, separate, shorter reports were prepared for each of the participating councils to assist them in their own demand management efforts. The titles of these reports are as follows:
- *Water Demand Management: Options & Opportunities for Horowhenua District Council*
- *Water Demand Management: Options & Opportunities for Manawatu District Council*
- *Water Demand Management: Options & Opportunities for Rangitikei District Council*
- *Water Demand Management: Options & Opportunities for Tararua District Council.*

60. **Results.** The following is provided in Horizons' reports for each of the water supply schemes studied:
- a data summary in table format
- additional information gathered in discussion with council staff
- a summary of current and planned demand management activities
- observations/comments on the data and information.

61. The data summary sheets include both raw data provided by councils and some calculations and estimates based on that data. These included determining current use per capita, approximate use by category (eg. residential, commercial, non-revenue water) and net residential per capita use.

62. The data and information provided by the councils show that the schemes vary widely, confirming the need for water-use guidelines that have broad application. While Levin and Feilding are fairly typical urban schemes, Bulls, for example, is a smaller scheme with nearly half the water supply taken by one industrial customer. Eketahuna, on the other hand, is a rural scheme serving a number of dairy farms along with its residential population.

63. Details on the schemes are provided in Sections 3.3.1 to 3.3.5 (pages 13-22) of the report to Horizons. The completed worksheet for each scheme appears in Appendix C (starting on page 49).

64. *Potential for schemes to achieve Proposed One Plan policies.* Tables comparing current use with the proposed 'reasonable use' and 'restricted use' guidelines were prepared for Bulls, Hunterville (urban), Levin, Eketahuna and Feilding (see Section 4.3 of the Horizons report). These comparisons provided an opportunity to see what sorts of gaps might exist and, in turn, explore how difficult it would be to close them via demand management efforts.

65. Table 1 on the next page provides the information for Levin as an example for easy reference. All water-use and guideline figures are in cubic metres per day. Information following the table notes how the tables were devised.

Table 1. Comparison of Current Use to Proposed Guidelines - Levin Example

Current Use

Item	Data	Calculations/Comments
Consent conditions	24,000	= Peak daily extraction allowed (10,000 average)
Current use (system)	ADD 8,509 PDD 12,656	ADD (average day demand) = 35% of 24,000 consent PDD (peak day demand) = 53% of 24,000 (PDD = 1.49 ADD)
Current population	19,706	Estimate at 2006

Guideline ~ Reasonable Use at Regular Flow

Guideline for Total System Use	Use by Category ~ Estimates ~ Calculations
9,699	(i) Domestic: 19,706 X .300 = 5,912 (ii) Commercial: 5,912 x .20 = 1,182 (iii) Industrial: Levin Meats and others peak daily use 1200, 5% efficiency = 1140 (iv) Stock/agriculture: restricted flow 1 m^3/day x number of connections, estimate 200 connections like this = 200 (note: this includes human use on property as well) (v) Growth – guidelines recalculated (yearly) based on population/industry changes (vi) Leakage: 15% of 8,073 [ie. total of (i) to (iv) above] = 1,265 Total all above = 9,699

Guideline ~ Restricted Use at Low Flow

Guideline for Total System Use	Use by Category ~ Estimates ~ Calculations
8,800	(A) Domestic: 19,706 X .250 = 4,927 (B) Commercial: 4,927 x .20 = 985 (C) Industrial: Levin Meats, etc. as in (iii) plus say another 400 estimate for other uses in this category = 1,540 (D) Stock/agriculture: restricted flow 1 m^3/day x 200 as in (iv) = 200 (E) Leakage: same allowance as (vi) above = 1237 Total all above = 8,800

Comparisons

Flow Level	Guideline-Use Comparisons
At Regular Flow	Guideline (9,699) is 114% of ADD and 40% of 24,000 consent
At Low Flow	Guideline (8,800) is 70% of PDD and 37% of 24,000 peak extraction allowed

System total	Current ADD	Current PDD	At reasonable use	At restricted use
l/p/d	432	642	492	446

- **Current use** – This information was taken directly from the corresponding tables in Section 3 of the report.

- **Reasonable use guideline** – This was calculated using the formula provided by Horizons (as per page 3 above). Components (i) and (ii) were straightforward, using population figures provided by the councils. Estimates were required for both (iii) and (iv). For (iii), information provided by the councils allowed placement of some customers in this category. Where a peak daily figure was provided, this was used as a basis for the calculation. (This makes the guideline more liberal as in many cases peak use is significantly above typical daily use.) Slight reductions were applied to the base amount as a way of addressing the "best practices" clause in the guideline. For (iv), a simple estimate of the number of properties to which this might apply and apportioning each with a cubic metre per day of water was used for the calculation. Determining (vi) was a simple calculation – a percentage of the total of (i) to (iv). The overall total is the guideline for daily water use for the system as a whole.
- **Restricted use guideline** – The same process was followed as in developing the reasonable use guideline, with estimates for (C) and (D) required. The resulting total is the guideline for daily water use at low flow. Some customers in (ii) shifted into (C), making the required reductions less onerous in practice.
- **Comparisons** – Based on the three components of the charts outlined above, a number of comparisons are noted, including current use vs the guidelines and vs consent levels. The chart also notes the per capita targets (in l/p/d) at 'reasonable use' and 'restricted use'.

66. Given the assumptions and estimates noted above that were used to do the calculations, the numbers provided should be used as a general guide. Detailed calculations by councils during implementation would determine the exact guidelines under 'reasonable use' and 'restricted use' conditions.

67. Table 2 below extracts key information from the four charts in Section 4.3 of the report and provides some further calculations to compare actual use to the proposed guidelines.

68. PDD (peak day demand) is the highest recorded water use on any single day over the whole year. ADD (average day demand) is the average daily use throughout the year. The PDD/ADD ratio is shown for the four systems. Feilding is the highest (at 1.58), followed by Levin. Both of these councils indicate summer garden watering as an issue driving this seasonal demand. Bulls, on the other hand, is affected by high production at Riverlands beef processing plant. Garden watering is not considered a significant part of

demand for Bulls. Hunterville's high summer use can likely be attributed to stock watering and other agriculture requirements more than domestic garden upkeep.

Table 2. Summary Comparison ~ Current Use & Proposed Guidelines (l/p/d)

Water Use Variable	Bulls	Hunterville*	Levin	Feilding
Current ADD	662	432	432	418
Current PDD	883	595	642	661
PDD/ADD ratio	1.33	1.38	1.49	1.58
High season use/ADD ratio	1.25	1.20	1.30	1.35
High season use (actual amount)	828	518	562	564
Reasonable use guideline	902	458	492	466
ADD as % of reasonable use guideline	***72%***	***94%***	***88%***	***90%***
PDD as % of reasonable use guideline	98%	130%	130%	142%
Restricted use guideline	856	399	446	431
ADD as % of restricted use guideline	77%	108%	97%	97%
High season use as a % of restricted use guideline	***97%***	***130%***	***126%***	***131%***

***** urban system only

69. While there may be a few other days close to the PDD figure, it would be helpful to consider more typical or average higher use throughout the peak/summer season. This is termed 'high season use' in Table 2. For discussion purposes, an estimated 'high season use'/ADD ratio is provided for each system. These estimates are based on the circumstances in the system and the opportunities to reduce this higher summer use.

70. For Bulls the difference between the 'high season use'/ADD and PDD/ADD ratios is minor based on little variation due to garden watering, and the range in Riverlands use

by season is 42%-50% of the system total. A larger difference is given for Hunterville, but still recognising the contribution of stock watering and agriculture to overall use. The biggest differences are given to Levin and Feilding, since a sizeable portion of their summer water use is reportedly non-essential (outdoor/garden).

71. The high season use (actual amount) is ADD (in l/p/d) x 'high season use'/ADD ratio. It is this figure that is compared to the restricted use guideline in the following discussion.

72. For analysis, it makes sense to compare ADD with the reasonable use guideline, as the average daily use will tend to occur under normal river flow conditions. Similarly, high season actual use is compared to the restricted use guideline as this higher use will typically coincide with low-flow conditions. (These comparisons are noted in bold/italics so they stand out in the table.)

- **ADD – reasonable use guideline comparison** – As shown in Table 2, in all four cases the average daily use is below the reasonable use guideline, ranging from 72% of the guideline for Bulls up to 94% for Hunterville.
- **High season use – restricted use guideline comparison** – This second, and more important, comparison shows a significant contrast to the ADD usage above. Three of four systems show high season actual use above the restricted use guideline, ranging from 126% of the guideline for Levin up to 131% for Feilding.

73. Based on these comparisons, water use under regular flow conditions does not look to be a problem. There are, however, some fairly significant gaps to close under restricted-use conditions if councils are to comply with the guidelines.

74. **Opportunities for improved water-use efficiency in the schemes studied.** Section 3.3 of the Horizons report documents the current situation in each of the schemes examined. In addition to the water-use data and calculations/estimates, it includes additional information (gained in discussion with the relevant council contact), details of current and planned demand management initiatives, and consultant comments based on all the details gathered. Together, this information identifies opportunities for improved water-use efficiency. This is further discussed and summarised in Section 4.4 of the report.

75. Some of the planned initiatives at the time of the study in 2006 may now have been implemented. Areas identified where good gains were possible are as follows:

- **Bulls** – Water use at Riverlands beef processing plant. A 2003 Detection Services analysis indicated possible significant losses at the plant. Riverlands was reportedly not proactive in managing water use for efficiency.
- **Hunterville** – Water use in commercial and community facilities. Night-flow measurements in 2003 found approximately 8% of total use for the day was in cyclical-flushing urinals at the school. (Horowhenua's work noted in the 'Methods to bridge any gaps …' section below is evidence of the significant gains possible from attention to this problem.)
- **Eketahuna** – Leaks and losses in the system generally and efforts to manage water use and loss on dairy farms connected to the town supply.
- **Levin** – Complete metering for all commercial customers, water efficiency efforts at Levin Meats (which takes about 10% of total supply), and attention to residential summer outdoor water use.
- **Feilding** – Similar to Levin, including full metering of commercial customers, water-use efficiency in 'wet' industries and summer outdoor use.

76. A Region-wide effort – similar to the Smart Water Use campaign in the Waikato – could be a logical way to strive for desired water-use reductions at a modest cost to participating councils. Shared resources and activities could include:
    - a radio 'awareness' campaign and printed educational materials
    - a common water restriction policy throughout the Region (with councils still retaining control as to when different restriction levels are implemented)
    - a customer water advisory service (industrial/commercial and residential)
    - a targeted effort to retrofit/upgrade water fixtures in public toilets and other community facilities
    - a summer water conservation campaign.

77. With involvement and participation of Palmerston North City Council and Horizons, Region-wide initiatives such as those noted above would be possible. Individual councils could build on this collaborative campaign, making sure they address their own particular needs and issues. Together, these efforts have the potential to make a real contribution to sustainable management of the Region's freshwater resources.

Conclusions based on regional comparisons and sample water use within the Region

78. The overall purpose of the work was to assess Horizons' proposed water-use guidelines for municipal water supplies. This was done by examining the guidelines from two angles, essentially asking the questions:

- Are the guidelines suitable or fitting based on what is being done in other regions?
- Are the guidelines realistic given current water consumption levels and practices within the Region?

79. **On the suitability of the guidelines** … Compared to per capita water-use targets in other regions studied, Horizons' proposed guidelines are in the middle of the range for domestic needs – more demanding than one guideline but less so than two others. Horizons' guidelines of 300 l/p/d during normal times and 250 l/p/d during times of low flow are also consistent with the Ministry of Health's household requirements (ie. 250 l/p/d as essential use and 50 litres in addition for general use). Finally, Horizons' guidelines for non-domestic use vary from the compared approach in Canterbury, but there are similarities.

80. Overall, Horizons' guidelines can be considered suitable or fitting for their intended use.

81. **On how realistic the guidelines are** … Compared to other regions, water consumption in the schemes studied fall in the middle of the ranking – considerably higher than for rural systems in Rodney District, for example, but generally lower than comparable systems in the Waikato region as summarised in the tables on pages 26 and 27 of the full Horizons report. (Interestingly, in comparable Rodney schemes where there is a significant volumetric charge, residential water use is markedly lower than for unmetered schemes in the Waikato and in the Manawatu-Wanganui Region.) Other water supply schemes in the Region, documented in an earlier report by Aqualinc Research Ltd, show greater water use than the schemes included in this study. Water use in the Region could, thus, be considered in the middle to higher range overall, so efficiencies are certainly possible.

82. As noted earlier, certain assumptions and estimates were necessary to compare actual use with the proposed guidelines. Given this, for the four water schemes assessed, the average daily demand was below the reasonable-use guideline – ranging from 72% to 94% of the guideline figure.

83. However, for ‘high season’ water consumption relative to the restricted-use guideline, three of the four schemes registered above the guideline (as noted earlier). This results from the restricted-use guideline obviously being lower than the reasonable-use guideline and the typically higher water use during this period due to residential outdoor/garden watering and higher production levels in a number of processing industries.

84. Overall, Horizons’ water-use guidelines can be considered realistic and fair. The reasonable-use guideline (for normal river flow conditions) is generally achievable. The restricted-use guideline (for low-flow conditions) is more difficult to achieve. The brief discussion above, which is specific to the water supply schemes studied, and demand management details in the next section, provide some insights as to how the guidelines can be achieved.

Ways to bridge the gap: demand management options and opportunities

85. The Water New Zealand publication, *The Case for Demand Management in Council Water Supplies*, highlights the many opportunities councils have to improve water-use efficiency and reduce water loss in operations. These include both system-level and customer-level options, discussed below.

System-level options

86. Pressure management, controlling leaks and losses, and using water efficiently in operations are all part of demand management. Engineering specialists at councils around the Region address these issues, with the approach and emphasis determined by a variety of local factors.

87. High pressure causes stress to the pipe network and variability in this stress can lead to infrastructure fatigue and leakage. Lowering pressure throughout the system can reduce the leakage rate, and fixing leaks quickly minimises the extent of water loss.

88. Depending on current leakage, bringing water loss down to a reasonable level may be the single biggest opportunity for reducing overall demand for water. It is recognised, however, that renewal work for upgrading pipes is expensive and something that councils have to tackle over an extended period of time.

89. Leak detection work on mains also helps to identify possible losses from laterals on private property. This is particularly important for unmetered properties as there could be long-term leaks going unnoticed. Where leaks are identified, councils can follow up to ensure repairs are completed.

90. Councils also use water to backwash the filters used in water and wastewater treatment. Additional uses include cleaning mains and pressure testing fire hydrants. All these activities can be examined to see if the desired ends can be achieved with lower water use.

Table 3. Sample System-Level Demand Management Options

Pressure Management	**Leaks and Losses**	**Water Use in Operations**
Review/assess pressure zone boundaries Establish/expand district/zone metering programme Evaluate pressures in district metered areas (DMAs) Pressure test all new reticulation Trial and monitor residential response to lowering minimum pressure Implement permanent pressure controls where possible	Acoustic testing of mains and laterals Inspection of valves and hydrants Night flow testing in DMAs Reservoir night flow testing Reduce response time for leaks and burst pipes Mitigate illegal hydrant use Water balancing/auditing – modeling and benchmarking	Assess/reduce water use in … … treatment – filter backwashing … water main cleaning … sewer main cleaning … fire hydrant pressure testing … yard and vehicle wash down … tanker refilling, sweeper trucks, dust suppression … buildings and other facilities … irrigation of gardens, reserves, sport fields

Customer-level options

91. Customer demand management options can be categorised in a variety of ways. One approach is to divide them into measures and instruments as shown in the table below.

92. **Measures** involve the use of specific devices or actions that result in reduced water use. These include indoor and outdoor technologies and practices along with water capture, reuse and recycling.

93. **Instruments** are supportive elements that encourage adoption of a technology or a change in habits or practices. These include communication and education, policies and regulations, and economic incentives.

94. In each of the six areas shown in Table 4, options can be subdivided further as in the examples provided. Details of these options and opportunities – and some examples of their use and benefits – are provided following the table.

Table 4. Customer Water-Use Efficiency Options

Measures

Technologies & Practices Indoor	**Technologies & Practices Outdoor**	**Water Capture, Reuse & Recycling**
Residential *Fixtures and devices* *Efficient appliances* *Retrofits* Industrial/Commercial/Institutional *Fixtures and devices* *Production processes and practices*	Residential *Moisture gauges, timers and shut-off devices* *Irrigation systems* *Water-saving landscapes* *Other applications and activities* *Leak detection and repair* Commercial *Best practice irrigation systems* *Broader management practices*	Rainwater harvesting Greywater reuse Wastewater recycling

Instruments

Communication & Education	Policies & Regulations	Metering, Pricing & Other Financial Incentives
General Communication *Information/educational material* *Media/advertising* Personalised Information *Water tax invoice information* *Interactive tools and calculators* *Water-use audits* Personal Contact *Displays and events* *Presentations and workshops* *Interaction in the community* Promotional efforts *Demonstration gardens* *Cooperation with retail plumbing* *Water conservation awards*	Bylaws, regulations and restrictions Planning control/building code Support for legislative reform	Meter Installation Pricing Strategies *Uniform volume rate* *Increasing Block Rate (IBR)* *Peak load pricing* *Wastewater charging* Financial Incentives *Rebates and subsidies* *Loans and savings schemes* *Giveaways* *Direct Installation* *Subsidised/free water audits*

Technologies and practices indoors

95. Indoor water use includes 'service' water (for taps, showers, toilets/urinals and appliances) and water use in industrial operations.

96. 'Service' water use can be reduced by ensuring the best available technology is installed during new construction and renovations. This is something council building inspectors can encourage with local contractors and developers.

97. Retrofitting older, less-efficient fixtures is another effective way to reduce water use. A good example of this is Tauranga City Council's Waterline programme where the domestic water advisor installs a cistern weight in older single-flush toilets during home visits, with the owner's permission. For the cost of the weight ($5) and a couple of minutes to install it and explain its use, the payoff is an immediate reduction of up to 60% water use in toilet flushing. This can be as much as 60,000 litres a year for a family of four.

98. Further savings can come from installing a faucet aerator on taps with high flow rates under mains pressure. These, too, are inexpensive (about $8) and easily installed, reducing water use by as much as 50%.

99. Similar reductions can be achieved by installing flow restrictors on showerheads or replacing them with low-flow (LF) models. Sydney Water, for example, ran a year-long Smart Showerhead programme offering customers a $10 voucher towards the purchase of a LF showerhead. A follow-up study of 775 customers who took up the offer showed average water savings of 16,000 litres per household per year. An added bonus was an estimated $100 annual saving per household in energy costs related to water heating.

Figure 1. Retrofit Devices for Water Fixtures

100. Retrofit devices are inexpensive, easily installed and a great interim measure until upgrading is done. The payback period is short – even if only energy cost savings are taken into account.

101. As for appliances, newer, high-efficiency washing machines can reduce water use by 50% over conventional models. Similarly, high-efficiency dishwashers can save 45-65% water volume per load.

102. The installation of water-saving fixtures and appliances leads to an immediate reduction in water use with no need for a change in customer behaviour. Water-conserving practices can add to the savings. In either case, education will be necessary to motivate individuals to install the water-saving devices *or* change habits and sustain the change.

103. Water use in urinals is a further consideration in community and commercial facilities. Water savings are possible in manual, cyclical and sensor systems – with significant reductions possible through changes to cyclical units that normally flush day and night, year round. Horowhenua District Council has shown real leadership here by converting cyclical-flushing urinals to manual flush and fitting dual-flush toilet cisterns in some public facilities, in the process reducing water use to 15% of previous levels.

104. Beyond 'service' water, use in industrial operations varies widely. This can include in processing (product preparation, materials transfer and dust control), cleaning and sanitation (plant and equipment, work areas, yards and vehicles) and in heating and cooling.

105. Careful assessment of water use in operations is a good starting point for achieving efficiencies. Assessment can also confirm potential for water reuse, as many industrial applications do not require water of potable quality. Real savings can be achieved through analysis of commercial water use in water supply schemes where one or more large customers account for a significant portion of overall demand.

Technologies and practices outdoors

106. Savings are also possible in residential outdoor water use through inexpensive water-saving devices, appropriate landscaping and installation/proper use of efficient irrigation systems.

107. Tap timers on sprinklers and trigger guns on hoses used for outdoor chores such as washing cars and boats, for example, are practical ways to prevent water running to waste.

108. Amy Vickers, a US-based engineer specialising in water conservation, provides some estimates of possible water savings in landscape irrigation in her *Handbook of Water Use and Conservation* as follows:

- 5-10% of outdoor water use can be saved by installing a rain sensor/shut-off device on automatic irrigation systems
- 20-50% can be saved with 'water wise' landscaping (eg. native plantings, ground covers, etc)
- up to 75% can be saved by switching from sprinklers to drip irrigation for non-turf areas.

109. Sydney Water recommends watering gardens in the early morning or evening to reduce the amount of water wasted through evaporation. It also recommends the use of mulch as it will help soil retain moisture and reduce evaporation by up to 70%.

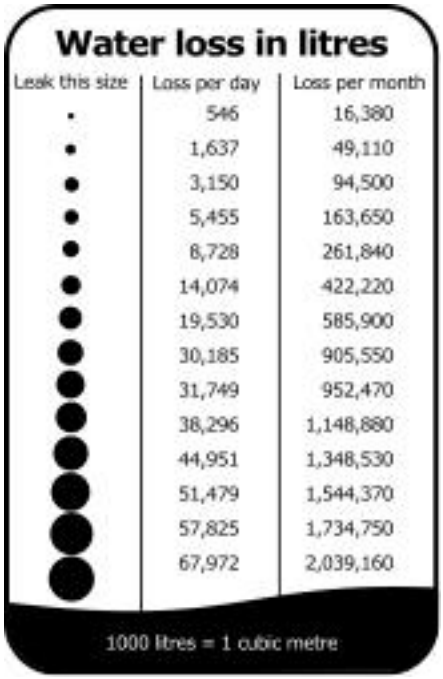
110. Residents in Victoria, British Columbia, have taken advantage of free audits and training workshops provided by the local water utility. Audits advise residents about soil structure and water needs, irrigation system efficiencies and watering practices. Residents are left with a checklist of suggested changes and improvements. Workshops guide residents in the purchase and proper use of automatic irrigation systems.

111. Outdoor water audits can play a part in educating residents and businesses; they lead to improved landscape watering practices wherever they are done. A real benefit is that this addresses discretionary water use during times of peak requirements by other customers (eg. agriculture and some industries).

112. Council watering practices for public gardens, reserves and sport fields can set an example for residents and businesses. Helpful practices include appropriate plant and turf selection, taking advantage of shading and use of alternative sources of water where possible. Commercial buildings with landscape irrigation could follow similar water-use practices.

113. Water supply schemes that serve rural areas require special attention. Property owners with stock crop watering requirements need to use water efficiently and minimise water loss. Ways to do this – promoted in Hauraki and Thames Coromandel district councils' Smart Water Use in Dairy Farming campaign – include 'mapping' farm water systems, finding and fixing leak-prone spots, and installing an alert system for early detection of leaks and losses.

Figure 2.



The 'Water Loss …' figure confirms the value of early detection and repair of leaking pipes.

Water capture, reuse and recycling

114. Localised rainwater harvesting in urban areas has the potential to reduce demand on reticulated supply if the collected water is used for flushing toilets, washing clothes and for hot water supplies. There are additional benefits if it is used for outdoor irrigation, in particular when rain tanks can be topped up with water from council supply.

115. It is possible to significantly reduce peak demand from new homes, if rainwater tanks are required to serve outdoor use and the amount of potable top-up to tanks is restricted. Kapiti Coast District Council has done this in its Waterstone subdivision and it is intended policy in its District Plan Change 75.

116. Greywater reuse for garden irrigation provides further benefits by reducing both the draw on mains water supply and the volume of wastewater requiring treatment. The Waterlillee™ garden irrigation system (employing patented New Zealand technology) diverts used water from the bath, shower and laundry to sub-surface irrigation in the garden. These systems serve 99 of 102 homes in the Waterstone subdivision at Kapiti, providing a reliable year-round source of water for gardens.

117. Rainwater harvesting in commercial settings is also practical where there are large roof areas for collection. The New Zealand Green Building Council GreenStar-rated buildings include rainwater harvesting as a standard procedure. This provides an alternative supply of water and reduces the flow of water to the storm drain.

118. Several buildings at Rangitoto College on Auckland's North Shore, for example, reticulate roof rainwater to a cluster of tanks set in a bank beside the school. The collected water is used to irrigate school grounds and fields, and results in a significant reduction in stormwater flowing off site.

119. FIL New Zealand, a company specialising in animal and hygiene products for the dairy industry, is realising similar benefits in its new office and manufacturing facility in Mount Maunganui. Two 30,000-litre tanks capture rainwater from the factory roof; the water is filtered and used for process water. Condensate from the heating/ventilation system irrigates the atrium gardens. FIL has reduced its draw on city water supply by 95% compared to the quantities used at its previous site. The company has examined NIWA historical rainfall records and is confident the system will provide more than its full requirements year round. The system, in turn, reduces stormwater leaving the site by almost 50%.

120. In terms of broader (residential) developments, community systems can also be designed. For example, Figtree Place, a 27-unit development on 0.6 ha in Newcastle, NSW, includes rainwater harvesting, stormwater soak-aways for groundwater recharge and indoor water-saving devices and technologies in each residence. These combined initiatives have led to a 60% savings on mains water requirements.

121. Considering the three waters – water supply, stormwater and wastewater – as an integrated whole can lead to solutions and economies not possible when they are managed separately.

Communication and education

122. Providing accurate and helpful information and effective promotion are key components of a successful demand management programme. Examples of the opportunities available are noted in Table 4 on page 15.

123. Pamphlets, fact sheets and booklets are low-cost ways of communicating important messages. All information available in printed form can be duplicated on council

websites. Booklets such as Water New Zealand's *The Story of Drinking Water* are available to help educate the public, so councils don't necessarily have to produce all their own materials.

124. While mass communication plays an important part in conservation efforts, personal contact is crucial to success. This can come in the form of booths or displays at various events, through presentations and workshops, and in one-on-one discussions.

125. Waitakere City Council uses a Water-wise Gardening display to promote conservation, especially during the peak summer season. Kapiti Coast District Council's annual Sustainable Home and Garden Show is a great public education event, allowing attendees to interact with specialists. Tauranga City Council's domestic water advisor presents the Every Drop Counts message to a wide variety of community groups each year.

126. Feedback is a powerful motivator for change, too. Personalised information on water use can be provided in a variety of ways including on the water bill (for metered customers), via a (web-based) water-use calculator, such as the one used in the Waikato region's Smart Water Use campaign, or through a customer water advisory service. Once individuals are aware of their own water use, they are more likely to heed advice on how to reduce it.

127. Water audits provide just this sort of feedback and are a great way to spur water-saving action. EcoMatters Environment Trust, for example, does free, comprehensive water audits in schools and businesses on behalf of Waitakere City Council. Since water is metered and charged on a volume basis, it is also straightforward to create a business case for using less. After a detailed audit, each business is presented with five- and 10-Year Net Present Value assessments so they can accurately compare investing in saving water to other more traditional investments.

128. Water conservation awards and a demonstration low-water-use public garden are two more ways to help raise awareness about water conservation and bring about positive change.

Policies and regulations

129. The Resource Management Act (1991) and the Local Government Act (2002) both address efficient use of water resources. The Proposed National Environmental

Standard for Measurement of Water Takes will provide further direction and requirements.

130. Local water bylaws also give support to councils striving for sustainable management of water resources. Water restrictions are a common way to target summer outdoor water use.

131. Councils deal with this in a variety of ways. For example, when Dunedin City Council's water restrictions are put into effect at Level 1, residents are allowed to operate sprinklers and irrigation systems only between 8 pm and 8 am. This has two important benefits: it limits the likely amount of time people will apply water and it reduces water loss through evaporation. Dunedin's five-level restriction system ramps up to a total sprinkler and hose pipe ban and applies to unmetered domestic and metered commercial customers alike.

132. Beyond restrictions, councils have other means to encourage demand management solutions. These include engineering Codes of Practice and design guidelines for specific water-saving technologies. Local circumstances may also dictate the need for more stringent planning controls.

133. Kapiti Coast District Council's Plan Change 75 is a good example of this. It proposes mandatory rainwater storage and/or greywater reuse as a demand-reduction measure. Under the plan, all new houses would be required to have either a 10,000-litre tank for outdoor use and toilet flushing or a 4,500 litre tank for the same uses, plus a greywater reuse system for garden irrigation.

134. Overseas, authorities have used a variety of other methods to assist in demand management. These include: a surcharge for irrigating large turf areas (Los Angeles); requirements for water-efficient landscaping (Albuquerque, New Mexico); requirements for drip irrigation (various cities and states in the US); and stiff fines and penalties for disregarding regulations (South East Water in Melbourne and Sydney Water).

135. The Water Efficiency Labelling Scheme (WELS), scheduled to be operational in New Zealand by mid-2009, takes a softer, encouraging approach. It covers taps, dishwashers, washing machines, showers, toilets and urinals. Following the same approach as energy efficiency labelling, the scheme will help consumers make informed decisions and should lead to a greater uptake of water-efficient fixtures and appliances.

Metering, pricing and other financial incentives

136. Metering, pricing, and other financial incentives complete the list of customer demand management options shown in Table 4.

137. While metering commercial customers is common in the Manawatu-Wanganui Region, residential metering is not. However, residential metering and volume pricing offer a number of important benefits. Without meters, households have no idea how much water they use and hence have no incentive to conserve. With a price in place, residents are more likely to install water-saving devices, for example, and heed educational messages about water use. Volume pricing is also more equitable, ensuring that moderate water users are not subsidising those who are less careful.

138. A water charging options study done for Christchurch City Council reports that demand reduction with metering and volume pricing varied from 9% in parts of Australia and the United Kingdom to as high as 60% in Canada.

139. Here in New Zealand, Tauranga offers an excellent example of the benefits of metering (combined with other demand management initiatives). The city metered all residential and commercial properties and instituted volume charging in 2002. Average per capita water consumption is now 25% below levels prior to metering. Per capita peak use is 30% lower. For a capital cost of under $10 million to install 39,000 meters, the city has delayed an estimated capital expenditure of $70 million on water supply investments for more than 10 years. For an approximate $250,000 annual cost (for meter reading and conservation activities), Tauranga is saving a net amount of approximately $1 million in depreciation costs for every year new infrastructure is delayed. (This excludes any savings arising from the cost of committing the capital.)

140. Volume charging by Nelson City Council has shown similar water-efficiency benefits – reducing peak water demand over summer by at least 37%. Auckland region residents have long been metered and are consistently among the lowest water users in the country. (By contrast, in areas with a high portion of seasonal residents and lots of holiday visitors, universal metering is not likely to be as effective. In these situations, other options and incentives would be wisely considered first.)

141. More recently, Carterton District Council has reduced water use by a third in one year through water metering, an active leak detection programme, and charging for excess water. Inspectors now visit properties where meter readings indicate higher than normal

use (following work that found leaks on 63 properties). To discourage wasteful use, customers are charged $1.50 per cubic metre for water above an annual 300 cubic metre allocation.

142. Wastewater charging is a further option to promote efficient water use and is encouraged in recommendations from the 2007 Local Government Rates Inquiry.

143. A logical step en route to universal metering would be charging for discretionary uses such as irrigation on large residential sections and filling swimming and spa pools. It simply doesn't make sense to incur the economic and environmental costs (eg. chemical and energy use) associated with treating water to a high standard for these kinds of non-potable uses.

144. Beyond pricing, a range of financial incentives can be used to encourage customers to adopt water-saving technologies. These include subsidies (via discounts or rebates), giveaways and free direct installation.

145. Several councils in New Zealand have offered residents rebates for the purchase and installation of rainwater tanks. Waitakere has also provided residents with water-efficient shower heads at no cost. A state-wide programme in Victoria, Australia, provides rebates on a range of water-saving technologies – from showerheads ($10-$20) and dual-flush toilets ($50) to rainwater tank toilet connections ($300) and greywater systems ($500). In Victoria, British Columbia, the rebate scheme covers a rain sensor/shut-off device for residential irrigation systems.

146. Councils can easily manage and budget for an incentives programme by controlling the range and number of devices available in any given time period. They could also make arrangements for retailers to provide discounts directly on water-saving devices, as was done in the Waikato region's Smart Water Use campaign this past summer.

147. The options noted in Table 4 and the examples provided in the six sections above demonstrate the range of demand management opportunities available to councils. Each council can choose its desired options, based on budget, preferred approach and local needs and issues.

Stock water requirements

148. The purpose of the work done by AQUAS Consultants was to gather and assess information on reasonable water requirements in a variety of farming operations. This information appears in the report entitled *Reasonable Stock Water Requirements: Guidelines for Resource Consent Applications*.

149. Specifically, the purposes of the study were to:

- review the scientific literature to establish standard estimates of the drinking-water needs of a range of farm animals (plus for related-farm activities)
- gather additional information on water requirements and use as needed from related industry associations (Codes of Practice, etc.)
- recommend reasonable levels of water use that Horizons could apply as a standard for resource consent applications, and
- devise a simple procedure which Horizons could use when processing applications.

150. The study examined stock drinking water needs and related water use for eight farm animals/fowl: dairy cattle, beef cattle, sheep, deer, horses, goats, pigs and poultry. Particular attention was paid to gathering information on water use in dairy farming, based on its economic importance in the Region and the recent growth in the number of dairy operations.

151. **Study methodology.** A 2004 report prepared for Horizons by Dr Bob Rout of Aqualinc Research Limited (*Water Allocation Project – Stage 1*) served as a starting point for the current work. Appendix B of that report included details on livestock water demand.

152. The Lincoln Environmental report, *Water Requirements on Dairy Farms*, also provided a base for the study reported here. This 2003 report addressed both stock water requirements and use of water in the dairy shed, and was based on:

- a literature search of scientific journals at the Ruakura Research Centre, Hamilton
- review of national and regional guidelines on water use in the dairy industry
- consultation with consultants and professionals with Auckland Regional Council, Fonterra, Dexcel, Quality Consultants New Zealand Ltd and Massey University, plus with two milking plant suppliers.

153. The 2007 review (report to Horizons entitled *Reasonable Stock Water Requirements: Guidelines for Resource Consent Applications*, co-authored by Dr Rout and myself) was carried out to:

- locate any relevant research/information subsequent to 2004
- look for greater detail on the other farm stock areas (similar to the information on dairying), and
- identify any other resources and information that might be helpful.

154. A number of steps were taken to identify relevant data and information.

155. Searches of the National Library of New Zealand and USDA Agricola databases elicited a number of relevant articles. The SciQuest (Online Science Journals – Veterinary, Animal and Agricultural Sciences) database of 17 journals/sources was also searched. A Google search identified a number of other potential sources.

156. Ministry of Environment, Biosecurity New Zealand, Ministry of Agriculture and Forestry (including MAF Technical Papers), Livestock Improvement Corporation (LIC) and Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) websites were scanned for pertinent information. Key contacts at AgResearch, Fonterra and Dexcel were informed of the work and provided helpful information. Nine industry organisations were contacted with a request for any relevant information (the list appears on page 3 of the report to Horizons).

157. All of the information was reviewed and assessed in the process of summarising the data and discussion points set out in Part 2 of the Horizons report. All the sources considered in the review appear in the References list starting on page 26 of the report.

158. **Results: Comments on the proposed drinking water standard for dairy cows.** Horizons has proposed a guideline of 70 litres per head per day (l/h/d) drinking water for dairy milking cows. This volume is consistent with the research, and certainly reasonable as it would be at the top end of the range of data available.

159. The dairy cattle Drinking Water Estimates table, on page 6 of the Horizons report, notes a variety of sources and estimated average day demand (ADD) and peak day demand (PDD) in l/h/d. A 1980 report by Harrington notes figures from earlier studies of water consumption. These range from milking Friesians at 22 l/h/d ADD and 60 l/h/d PDD, to milking Jerseys at 27 and 52 (ADD and PDD respectively) and 70 (PDD) for 'milking cows', citing Tauranga Council (1964).

160. Lincoln Environmental (2003) suggests that current estimates of 70 l/h/d and 45 l/h/d for milking and dry cows respectively should be retained as the basis for peak daily water requirements. For average water requirements, it suggests volumes of 40 l/h/d and 20 l/h/d should be adopted for lactating and dry cows respectively.

161. Industry planning appears to have adopted the 70 l/h/d as a guideline figure. ANZECC (2000), Fleming (2003) and Dexcell (2007c) all cite this volume. Fleming puts this figure forward "as a reasonable basis for design". Dexcel proposes it "for water supply planning purposes".

162. The proposed 70 l/h/d for average drinking water needs is considerably higher than ADD in the research sources cited in the table, and higher than PDD, in all but two cases. This would make it a very fair standard. It easily encompasses water use throughout the year and recognises that milking cows are dried off for a portion of the year.

163. **Comments on water use in dairy shed wash down.** Less information is available quantifying water use in dairy shed wash down. The Water Use in the Dairy Shed table on page 7 of the Horizons report captures the information found.

164. Lincoln Environmental (2003) notes that 50 l/h/d was adopted by Auckland Regional Council based on a 1999 study of wastewater on 20 farms in Franklin District. Fleming (2003), Aqualinc (2004) and NZFSA (2007) all cite a figure of 70 l/h/d. One Dexcel source suggests an average of 50 l/h/d, but notes that it could range from 30 to 100. Another Dexcel source suggests 70 l/h/d.

165. This recurring 70 l/h/d figure is the amount generally accepted for water-use planning. This is the same as peak milk cooling requirements suggested by Lincoln Environmental (2003). Reuse of milk cooling water for plant and yard wash down is common, so absolute water use (ie. draw on supply) in the dairy shed is driven by milk cooling volumes, given that wash down volumes generally do not exceed milk cooling water use (as noted in the Water Use in the Dairy Shed table in the report).

Evidence statement concluding remarks

166. Demand management should be an integral part of the solution to the problem of increasing – and competing – draw on the water resources of the Region.

167. Demand management initiatives have proven economic, social, and environmental benefits.

168. The study of municipal water supplies carried out for Horizons indicates that:

- The proposed efficiency criteria/water-use guidelines appear suitable when compared to approaches in other regions.
- The guidelines seem reasonable and fair when assessed against typical water use around the Manawatu-Wanganui Region. (Guidelines based on specific volumes of use provide clarity for councils and can serve as a good basis for developing a demand management plan.)
- Any gaps between high-season/PDD use and the restricted-flow guidelines can be addressed via appropriate demand management initiatives.

169. The review of stock water requirements suggests:

- The proposed 70 l/h/d for average drinking water needs for dairy cows is a fair (even generous) standard based on the data and studies available.

170. With the wide variety of demand management options available, there are practical and inexpensive steps that all resource consent holders can take to use water more efficiently and reduce water loss.

171. Appropriate guidelines should help to create a positive and encouraging environment in which these demand-reduction efforts can occur. Thus, guidelines should contribute to sustainable management of freshwater resources in the Region. Patience will be important, however. This means looking for change and improvement over a period of time.

172. Peter Gleick, a world-leading water resource specialist and editor of *The World's Water: The Biennial Report on Freshwater Resources*, summarised the challenge nicely when he said, "Long-term sustainable use of water does not require drastic advances in technology or heroic or extraordinary actions. Instead, it requires an ethic of sustainability and the will to continue expanding positive trends that are already under way".

Gordon Stewart
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