



# **Ohura Water Supply Health Impact Assessment**



**Prepared by Population Health, Waikato District Health Board  
March 2014**

## **Acknowledgements**

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## Executive summary

Ruapehu District Council reports that the current Ohura Water Supply has become untenable and has proposed a number of options for consideration; one being a switch to rain water tanks and another being an alternative rating method such as an explicit subsidy or district-wide flat water rate.

The purpose of this health impact assessment is to explore the direct and indirect health impacts associated with the suggested options for the Ohura water supply and to inform decision making. HIA is a tool which can assist decision-makers in non-health areas consider the unintended health impacts of their decisions. The HIA process combines research evidence with community and stakeholder engagement and follows a four-phase process.

This HIA provides a health perspective and feeds into Council's decision making processes. Population Health recognises that Council must now balance the cost of supplying reticulated water to the Ohura community with limited community funds and ability to pay. Difficult decisions lie ahead.

### Water quality

Having reliable access to safe drinking water is vital for all, but even more so for more highly deprived communities because of their limited ability to provide independently for their needs. The isolation of some rural communities such as Ohura further compounds these difficulties.

There is a common perception that rainwater is pure and safe to drink. The risk of disease associated with the consumption of roof collected rainwater can be low, if the water is visibly clear, has little taste or smell, and regular maintenance of the storage tank and roof catchment system is carried out<sup>1</sup>. However there are a number of potential health risks associated with consumption of water from rainwater tanks, which can relate to microbiological or chemical contaminants in the water. Public reticulated water supplies are normally subject to regulation and monitoring to ensure the quality and safety of water delivered to the consumer. In contrast the operation and maintenance of rainwater tanks is generally the responsibility of the individual householder<sup>2</sup>. However, maintenance of storage tanks and roof catchment systems in NZ is generally poor.

Roof-collected rainwater carries risks that are difficult to manage at the household level. These risks can in general be managed reasonably effectively as part of a water treatment process.

Maintenance activities may be difficult for some groups in the community, such as the elderly. This increases the risk of either maintenance activities being avoided with an increased risk of contamination or having to pay somebody else to conduct the maintenance, thereby reducing affordability.

### Water supply

Ohura also faces issues of water supply. Ten-year rainfall data provided from NIWA suggests that Ohura has experienced drier summers during the previous five years when compared with previous 10 years' worth of data. Roof-collected rain water therefore poses a risk which is contrary to protecting and promoting the public health of the community. If tanks run out of water during a drought, tanker loads of water can be purchased from Taumarunui

at a little over \$400 for 9-10,000 litres. This is likely to be unaffordable for many in the Ohura community who may also be making repayments on loans for the water tank.

### **Water affordability**

Affordability is also an issue with the ongoing use of the current reticulated water supply. Annual water charges currently make up 10% of the median personal income within Ohura, a community with high levels of socio-economic deprivation. Alternative water charging systems may provide some financial relief for this community.

### **Community and stakeholder engagement**

There was general agreement that the current supply meets local needs, in terms of access to water. The current water supply provides water to local homes and gardens and also supports local services and amenities, such as the fire brigade, public toilets, clubrooms, B&B, school and swimming pool. Despite local droughts, the supply has remained operable, and has been of service to the local farming community during droughts. Drinking water assistance was provided by the Ministry of Health on the understanding Ohura's water supply would be maintained for the reasonable future.

A key concern of locals was the reliability of ongoing water supply in the township, both to the local population and local services, amenities and the Bed and Breakfast hostel if there was a switch to water tanks. At times of drought, the supply would be much less assured, would incur extra cost if water had to be trucked in, and would undermine people's ability to grow their own food and maintain gardens.

Some noted that the Ministry of Health had invested substantial amounts in maintaining the town supply. They were concerned about what would happen to that investment if the supply was changed; would it be sold or transferred to another area?

### **Recommendations**

Recommendations to inform Ruapehu District Council have arisen from the review of the evidence and community engagement on this issue.

#### **Recommendation 1**

Population Health, Waikato DHB **strongly recommends** Ruapehu District Council continue to supply treated reticulated water to the Ohura community.

#### **Recommendation 2**

Population Health, Waikato DHB **strongly recommends** Ruapehu District Council explore and utilise an alternative water rating system, such as a district-wide flat water rate or targeted subsidies, to increase affordability of water for the Ohura community.

The evidence review and consultation discussed above, together with recommendations, will provide the basis of the Medical Officer of Health's consideration, if and when a formal approach is made following Council decisions on this issue.

# 1 Introduction

This health impact assessment (HIA) was undertaken by Population Health Waikato District Health Board (DHB) between December 2013 and March 2014. This HIA is intended to identify some of the impacts (direct and indirect) the proposed changes to the Ohura Water Supply may have on the health and wellbeing of Ohura residents. The HIA was led by Population Health and assisted by an external advisor from Synergia Ltd, specialising in health impact assessments.

Population Health's involvement comes after considerable work had already been carried out by Ruapehu District Council (Ruapehu DC) as evidenced in their document Ohura Water: Consultation and Questionnaire, August 2013<sup>3</sup>.

Population Health's core business is disease prevention, health promotion and reduction in inequalities in the health outcomes of all New Zealanders.

## 1.1 Aim

This HIA is intended to inform Ruapehu DC and the Ohura community of the health impacts associated with the suggested options for the Ohura Water Supply.

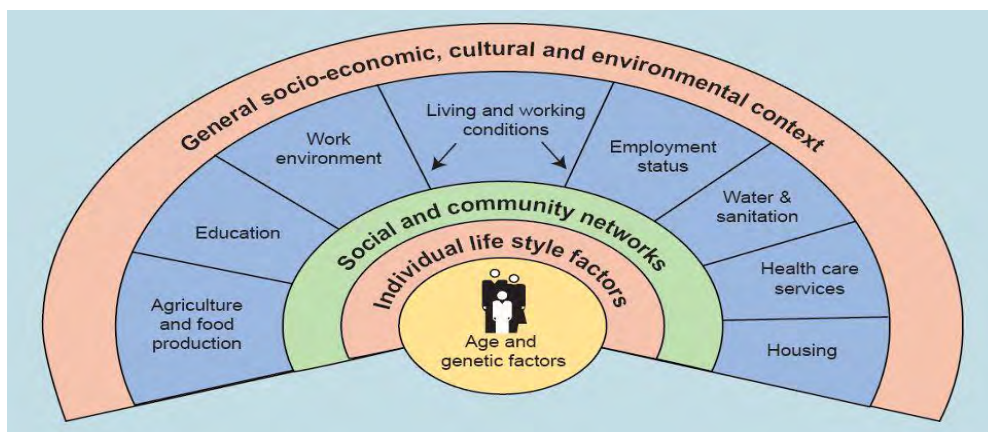
## 1.2 Determinants of health

Health is influenced by many factors, at the level of the individual, their community and wider society. Peoples' lifestyles strongly influence their health, as do the conditions in which they live and work. Poor social and economic circumstances affect health throughout life. Families and individuals who struggle financially and can't afford the basics in life have poorer health outcomes than those who have greater opportunities or access to lifestyle choices.

The longer people live in stressful economic and social circumstances, the greater wear and tear they suffer and the less likely they are to enjoy a healthy old age. These effects are not defined just to the poor. They occur right across society<sup>4</sup>.

People's health can be affected by the quality of their neighbourhoods, their level of education, the type of house they live in, how much money they earn, and whether or not they have a job or access to healthy food, transport, health services or recreation. These are known as the social determinants of health and have both a direct and indirect impact on health (Figure 1). Other key determinants include good sanitation, potable water and clean air.

Figure 1: Social Determinants of Health



Source: Dahlgren & Whitehead 1991

The activities of local government are vital to public health and in many respects are key determinants of health including provision of facilities and amenities, access to water supply, public sanitation, and licensing/inspection services. As a broad overview, councils draw from an extensive range of legislation and make decisions about the types of services they will provide and the level of rates and fees they will charge to fund these services. These decisions shape the environment and context in which people live, work and play, and influence the overall health and wellbeing of individuals and communities.

The determinants of health related to the Ohura Water Supply underpinning this HIA include water quality, water security and water affordability.

Local government has a mandate; direct and indirect, to protect and promote health under two key pieces of legislation. Both the Health Act 1956 s23 "*it shall be the duty of every local authority to improve, promote and protect public health within its district*", and the Resource Management Act 1991 section 5 "*people and communities to provide for their social economic and cultural wellbeing for their health and safety*", provide a protective function for population health and wellbeing.

## 2 Background

Ruapehu DC is currently investigating options for the continued supply of drinking water to the Ohura community. Despite funding assistance from the Drinking Water Assistance Programme, Council reports that the on-going maintenance costs have become untenable and it is no longer feasible or sustainable to continue to pass the high cost related to the water supply onto the Ohura community. Current proposed options include rainwater tanks and an alternative rating method such as an explicit subsidy or a district-wide flat water rate<sup>3</sup>.

Ohura is a small remote rural community with a declining population base. Statistics NZ 2013 census data shows the usual resident population count for Ohura is 129, down from 162 in 2006. More than half the residents are aged 25-64 years (Table 1) and more than a third of residents are one person households (Table 2). The occupied dwelling count has dropped from 72 in 2006 to 69 in 2013.

The Ohura Prison located in the town provided sizeable employment opportunities until its closure in 2005. The impact of this closure on the usual resident population has been substantial. The local high school closed as did a number of businesses. However, the Ohura Valley Primary School is still operating and this resilient community has discernible economic ability such as the Ohura Bed and Breakfast facility, Forgotten World Adventures and an active Cosmopolitan Club.

**Table 1: Age Groups (percent)**

	0-14 years	15-24 years	25-64 years	65 years and over
<b>Ohura</b>	<b>27.8</b>	<b>5.7</b>	<b>53.9</b>	<b>11.2</b>
<b>Ruapehu</b>	23.3	12.6	50.7	13.2
<b>New Zealand</b>	20.4	13.9	51.4	14.3

Source: Statistics NZ Census 2013 data

Raw data has been randomly rounded to protect confidentiality. Percentages may therefore not equal 100.

**Table 2: Household/family composition (percent), Ohura 2006**

<b>Couple without children</b>	<b>Couple with children</b>	<b>Single parent with children</b>	<b>One person household</b>
<b>26.1</b>	<b>21.7</b>	<b>13.0</b>	<b>34.8</b>

Source: Statistics NZ Census 2006 data

Raw data has been randomly rounded to protect confidentiality. Percentages may therefore not equal 100.



Ohura is not a wealthy community and has a deprivation rating of 10; where 1 indicates least deprived and 10 indicates most deprived<sup>3</sup>. The median income for households is \$18,500 compared with the NZ median of \$51,000<sup>6</sup>. Personal income is also considerably lower than the national median; \$11,500 compared with \$24,000<sup>3</sup>.

Hospitalisation data between October 1, 2010 and December 21, 2013 shows there were 156 total admissions to Waikato DHB hospitals. Within this same time period, 49 residents had at least one overnight admission to a hospital in the Waikato DHB region. Reasons for the admissions included congestive heart failure, unspecified chest pain, unspecified abdominal pain, asthma and pneumonia<sup>7</sup>.

Ruapehu DC has held a number of meetings with Ohura residents to discuss the sustainability and affordability issues of the current water supply. Council sought an independent assessment of five residential properties and one business in Ohura to provide the community with estimates of the cost involved in installing rain water tanks. These findings were communicated to the community in early 2014 with mixed response.

Concern about possible health risks associated with changes to the water supply led Population Health to offer to apply a health impact assessment process (HIA) to better understand the health impacts of the proposed options.

HIA is a tool which can assist decision-makers in non-health areas consider the unintended health impacts of their decisions. HIA had its origins in environmental impact assessments and later the scope was broadened to include public health. HIA is now applied to a range of plans, policies and strategies that have the potential to impact on health. HIA is a forward looking approach that is best applied in the early stages of policy or planning (Appendix 1).

In December 2013 it was decided HIA was required and appropriate for the Ohura Water Supply because:

- The future of the community water supply to the Ohura residents was uncertain.
- There were potential long-term health implications for the affected residents and the Ohura community.
- Ohura is a vulnerable community in terms of income, employment, levels of education, geographic and social isolation and deprivation.
- Under the Local Government Act 2002, Ruapehu DC is required to consult with and obtain the view of the Medical Officer of Health prior to any closure or transfer of a small water supply. The results of HIA would inform the view of the Medical Officer of Health.
- There was an opportunity to explore other health issues in the community that the Waikato DHB should be aware of.
- Decisions affecting the Ohura Water Supply have implications for other remote and vulnerable rural communities throughout New Zealand.

Central to this HIA was enabling the voices of affected parties to inform this process. It was important to provide the residents of Ohura with an opportunity to voice any concerns they had about the potential health impacts of the proposed options affecting the continued supply of water to their community. This was complemented by a literature review exploring water issues, in terms of how they relate to health and wellbeing.

## **2.1 Ohura Water Supply Options**

Ruapehu District Council proposed a number of options for the Ohura community.

- Utilising roof-collected water tanks as a water supply,
- Community operation,
- Utilising an alternative rating method for payment of the water supply such as an explicit subsidy or flat water rate.

### **2.1.1 Rainwater tanks**

The Ohura community were provided with an opportunity to consider a roof-collected rain water system. Each property, including the Ohura Primary School, and businesses such as the Ohura Cosmopolitan Club and Ohura Bed & Breakfast, would be required to invest in the necessary infrastructure for a roof collected rain water system which included a rainwater tank, soak hole, pump and a UV Filter set. An independent assessment showed that some homes would need roof repairs such as re-painting or a new roof in addition to spouting, downpipes, storm water lines, a ceiling tank, and earth works. Estimates ranged from \$13,000 to \$33,000 for residential homes and \$80,000 - \$100,000 for the Ohura Bed & Breakfast. Council proposed a finance package at 7% interest repaid over 20 years.

### **2.1.2 Community operation and ownership of the plant**

Under this option the community would own the plant and be responsible for its day to day operation. This option has not been deemed viable given the low quality of incoming water and the current level of treatment required. Additionally, the Ministry of Health has long-standing reservations about communities running a water supply.

### **2.1.3 Alternative rating method**

Two alternative rating options have been proposed; an explicit subsidy (Ohura water costs paid by the General Rate) and a district wide flat water rate (a district-wide uniform charge on water rates). Both options would require agreement from all of the district's ratepayers through a submission process to the next Exceptions Annual Plan when rates are set.

Ruapehu District Council reviewed the option of a district-wide flat water rate for the 2009 and 2012 Long-term Plan and this was rejected as a viable option by Council. The proposed Waimarino Water Scheme which will supply water to Ohakune, Rangataua, Raetihi and vegetable growers, was a major factor in council's decision<sup>1</sup>.

## **2.2 Legislative requirements**

There are a number of legislative requirements to be considered. These include the Local Government Act 2002, Building Act 2004, Food Hygiene Regulations 1974 and the Food Act 1981.

### **2.2.1 Local Government Act 2002: Closure or transfer of a small water supply**

The Local Government Act 2002 (LGA02) refers to a small water system as a water service being delivered to 200 or fewer persons who are the usual resident population in the district, region or other subdivision.

Prior to the closure or transfer of Ohura's water supply Ruapehu District Council is required to follow a prescribed process set out in the Local Government Act 2002 s131. The views of the Medical Officer of Health must also be sought and information received must be made publicly available in a balanced and timely manner. The proposal of closure must also be supported in a binding referendum conducted under section 9 of the Local Electoral Act

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<sup>1</sup> Personal communication, CE, Ruapehu District Council

2001 and in the case of a proposal to close down a water service a minimum of 75% of the votes of the affected area's eligible ratepayers and residents is required<sup>3</sup>.

### **2.2.2 Building Act 2004 and Health Act 1956 - Individual water supplies**

Statutory control of individual water supplies falls under the Health Act 1956 (s23), the Local Government Act 1974 and the Building Act 2004. The Building Act 2004 requires premises to be provided with potable water for consumption, oral hygiene, utensil washing and food preparation. Under s39 of the Health Act 1956, it is illegal to let or sell a house unless there is a supply of potable water.

### **2.2.3 Food Hygiene Regulations 1974 and Food Act 1981**

All premises involved with the sale and supply of food such as the Ohura Cosmopolitan Club and the Ohura Bed and Breakfast, must have a wholesome potable safe supply of water. It is the local authority that determines what they require from the operator to provide proof of this practice. Some local authorities may insist on a treatment system while others may want to take periodic water samples to ensure compliance. Clause 11 of the first schedule in the food Hygiene Regulations 1974 states that *the premises shall be provided with an adequate supply of clear, wholesome water*<sup>8</sup>.

The Food Act 1981 places a responsibility on everyone who sells food to ensure it is not contaminated or tainted and safe for human consumption<sup>9</sup>.

## **3 Method**

### **3.1 Development of this HIA**

There are four main phases to HIA: screening, scoping, appraisal and evaluation. The HIA undertaken in Ohura was a 'rapid HIA' completed in short timeframe, to inform pending decisions by Ruapehu DC.

#### **3.1.1 Screening**

In December 2013 it was decided HIA was appropriate for the Ohura Water Supply by utilising a screening checklist (Appendix 2).

#### **3.1.2 Scoping**

A meeting was held with Ruapehu DC in December 2013. Council has already carried out a significant level of work and consultation with the Ohura community prior to Population Health's involvement, and this helped shape and confirm the key focus areas for this HIA. These focus areas were water quality, water security and water affordability.

#### **3.1.3 Appraisal**

A DHB-led consultation/appraisal meeting with members of the Ohura community was held on Thursday 27<sup>th</sup> February 2014. The meeting was facilitated by staff from Population Health including the Medical Officer of Health and assisted by the external advisor from Synergia Ltd.

The meeting explored community perspectives of the health and wellbeing implications of the alternatives for water supply proposed by Ruapehu DC. The engagement approach was based on an adaptation of established health and wellbeing impact assessment practice and utilised small groups to answer a range of questions relating to the proposals and other health issues in the area.

The meeting specifically explored potential issues relating to water supply, quality and affordability, of the potential options.

### **3.1.4 Stakeholder interviews**

In addition to the appraisal workshop key stakeholders were identified and interviewed by telephone to ensure that their views were represented. These stakeholders included:

- Ministry of Health
- Ohura Bed & Breakfast
- Cosmopolitan Club Secretary
- Ohura Valley Primary School Principal
- Residents (2)

In addition, attempts were made to obtain the views of local Maori and the Volunteer Fire Service. However, due to the rapid timeframe of this HIA these viewpoints were not available for inclusion.

### **3.1.5 Literature review**

A literature review was carried out which focused on a number of key areas which emerged from the work already undertaken by Ruapehu DC. These areas include water quality, water supply and water affordability. Relevant literature was identified primarily by use of the computerised Pubmed database, Google Scholar database and Google search engine. A wide range of search terms were utilised including the determinants of health being investigated, 'rain', 'water', 'tanks' and 'roof harvested'. Publications were limited to the English language. Articles found through this methodology were then searched for relevant information, and further articles identified through the bibliographic references.

It is important to note that this review is not systematic and should not be considered an in-depth study of issues related to water supply and health.

## **4 Water quality**

Having reliable access to safe drinking water is vital for all but even more so for more highly socio-economically deprived communities because of their limited ability to provide independently for their needs. For isolated rural communities such as Ohura, these difficulties are compounded.

### **4.1 Summary of literature**

#### **4.1.1 Rainwater tanks**

About 10% of New Zealanders are dependent on roof-collected rainwater systems for their drinking water; particularly in rural areas not served by reticulated town water supplies.

Public reticulated water supplies are normally subject to regulation and monitoring to ensure the quality and safety of water delivered to the consumer.

In contrast the operation and maintenance of rainwater tanks is generally the responsibility of the individual householder. The quality of water from rainwater tanks is therefore likely to be more variable than the water from a reticulated supply<sup>2</sup>.

There are a number of potential health risks associated with consumption of water from rainwater tanks, which can relate to microbiological or chemical contaminants in the water.

#### 4.1.2 Microbiological contamination

Roof collected rainwater may contain a variety of micro-organisms. These include bacteria such as Salmonella and Campylobacter, and protozoa such as Cryptosporidium and Giardia<sup>1</sup>. Infections with these microorganisms would usually result in short term illness, but can range from mild disease of one or a few days duration to severe illness of several weeks<sup>2</sup>. In rare cases death may result. In a small minority of people, longer term health effects may occur<sup>2</sup>. Children under the age of five years, the elderly, pregnant women and those with damaged immune systems are more vulnerable to the health risks associated with contaminated drinking water<sup>10</sup>.

The microbiological quality of stored roof-collected rainwater is directly impacted by roof catchment and run-off contamination. Faecal contamination comes from birds, frogs, rodents, possums, dead animals and insects on the roof and in the gutters or in the water tank itself<sup>11</sup>. There is strong evidence of faecal contamination of rainwater tanks both in New Zealand and internationally<sup>1, 11-13</sup>. Disease causing organisms have been identified in roof collected rainwater and several disease outbreaks have been associated with tank water<sup>1, 14</sup>.

Reports of illness associated with rainwater tanks are not common, although this is thought to be due to under-reporting<sup>1</sup>. Most rainwater tanks serve individual households of only a few people, who are unlikely to seek medical attention unless their illness is severe.

#### 4.1.3 Chemical contamination

Rain water can pick up chemical contaminants as it falls through the atmosphere or from dust and contaminants on the roof surface. Rain water has an acid pH compared to tap water and may therefore be more likely to leach metals and other contaminants from storage tanks and plumbing materials than tap water<sup>2</sup>. Contamination could potentially be caused by lead from roofing materials, agricultural spraydrift and combustion products from fires.

A more extensive literature review on water quality issues can be found in Appendix 3.

### 4.2 Ohura reticulated water supply

Ohura's water supply is categorised as a small supply i.e. has a small population of 101 to 500 people, inclusive. Ruapehu DC has a duty to take all practicable steps to comply with the Drinking Water Standards of New Zealand 2005 (Revised 2008) for the Ohura supply. The Ohura water treatment plant was assessed for its performance against the standards. Both the treatment plant and the Ohura distribution zone achieved bacteria compliance for the 2012/2013 year. The water treatment plant was not compliant for protozoa during this period with a number of exceedences above the required turbidity level. Elevated turbidity levels (i.e. cloudy water) are an indicator that disease causing protozoa, which are not killed by chlorination, *could* be present.

### 4.3 Water tank maintenance

The risk of microbial contamination of stored roof-collected rainwater can be reduced by preventative measures including appropriate design and installation of the collecting and storage system and in particular, regular maintenance and cleaning. This requires understanding, motivation, some equipment and unless the home owner can purchase assistance, a considerable degree of fitness, strength and agility (Appendix 3).

Rain-water tanks can provide a suitable drinking water supply if the water-collection system is well maintained. However, a number of surveys have found that maintenance in NZ is poor. For example fifty percent of households surveyed in one study of 560 households had no measures in place to safeguard the water against microbiological contamination<sup>11</sup>. Only 10% reported to filtering water but samples taken showed that 71% of the filtered water was

contaminated. Ten percent said they never cleaned their gutters and 30% reported to never cleaning their tanks.

Roof-collected rainwater, one option proposed for Ohura residents, carries risks that are difficult or impossible to manage at the household level. These risks can in general be managed reasonably effectively as part of a water treatment process.

## 5 Water Supply

Water is essential for life<sup>15</sup>. Ensuring access to safe clean water remains the basic foundation for good health<sup>16</sup>. Water must be available in a sufficient quantity for meeting personal and domestic requirements of drinking, cooking, food preparation, personal hygiene, dish and laundry washing and cleaning<sup>17</sup>. Water is also important for gardening.

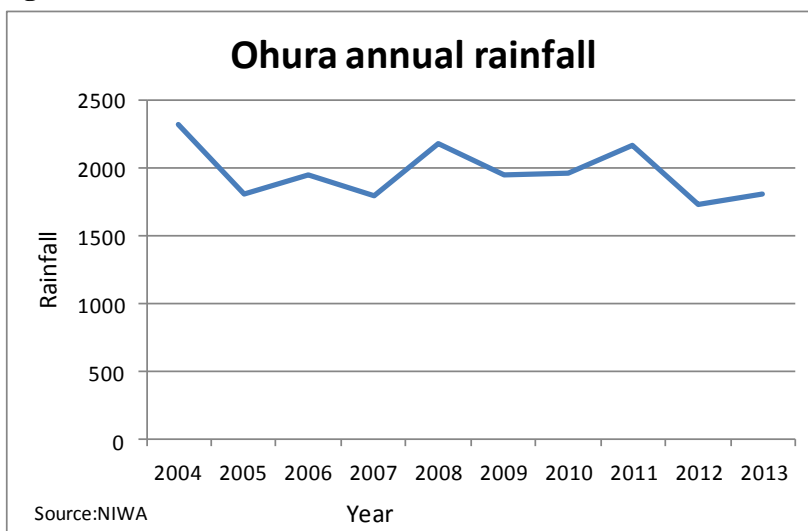
Water usage per person in NZ is estimated at around 250-300 litres per day<sup>3</sup>. Ruapehu DC reports that the estimated usage per person in Ohura is 289 litres per day. Use in Ohura is therefore not excessive.

Access to a supply of water can be reduced by drought when relying on roof collected rainwater. Climate change may result in an increase in the frequency of drought in some areas of the country<sup>18</sup>.

### 5.1 Rainfall data

Ten-year rainfall data from NIWA, taken from the site in Ohura Road, shows variation in the annual rainfall (Figure 2).

**Figure 2: Ohura annual rainfall**



Data over the previous 5 year period shows that January through to April and often into May are the driest periods in Ohura with extended periods (greater than 3 weeks) of very little rain during the driest months (January through to April). Ohura has experienced drier summers during the previous five years than when compared with the previous 10 years' worth of data. The driest summer over the previous 10 year period occurred in 2006/07 where Ohura received 247.6 mm of rain, in contrast the wettest summer occurred in 2011/12 where Ohura received 529.2 mm of rain (Table 3).

**Table 3: 10-year and 5-year monthly average rainfall 2009-2013**

<b>10-year monthly average 2004-2013</b>		<b>5-year monthly average 2009-2013</b>	
<b>Months of the year</b>	<b>Average Rainfall (mm)</b>	<b>Months of the year</b>	<b>Average Rainfall (mm)</b>
January	114.0	January	138.0
February	132.8	February	94.2
March	110.3	March	94.1
April	112.5	April	105.9
May	169.0	May	190.8
June	184.8	June	179.9
July	195.1	July	157.2
August	194.1	August	167.5
September	194.6	September	244.0
October	249.0	October	250.7
November	130.8	November	105.5
December	182.0	December	195.0
<b>Monthly Average</b>	<b>164.1</b>	<b>Monthly Average</b>	<b>160.4</b>

Source: NIWA

Using historical rainfall data and a range of assumptions the volume of a rain water tank can be calculated over a period of time using a predictive model (Appendix 7). Assuming a 30,000L tank and a three person household utilising 866 litres per day (the current average utilisation), a house in Ohura would have received sufficient rainfall over any winter spring period in the last 10 years to meet demand. However, the same household would have experienced a water shortage during the wettest summer and autumn period (2010/2011) and a significant water shortage during the driest summer and autumn period (2007/2008) of the last 10 years (Figure 3 and 4).

Residents of Ohura may attempt to conserve water over the summer months to prevent water shortages if relying on rain water tanks. If a three person household reduced consumption to 200L per person per day, a total of 600L, they would still have experienced a water shortage during the driest summer/autumn period (2007/2008) in the last 10 years (figure 5), but not during the wettest summer/autumn period (figure 6).

There are two registered water carriers in Taumarunui. One carrier charges \$350 + GST for 9000 litres of water and the other approximately \$480 (GST incl) for 8000 litres of water delivered over 53kms. The cost will vary dependent on number of kilometres travelled. A 9000L tank of water would last the family of three for approximately 10 days if they continued utilising water at the same rate.

Figure 3:

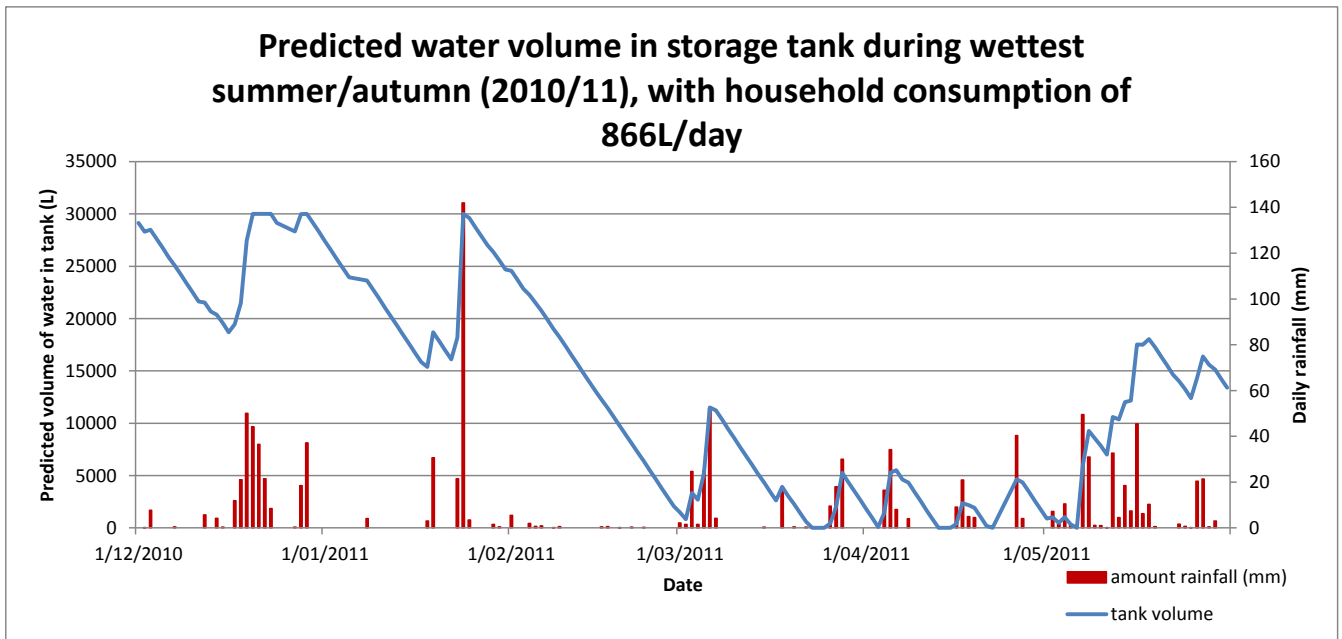


Figure 4:

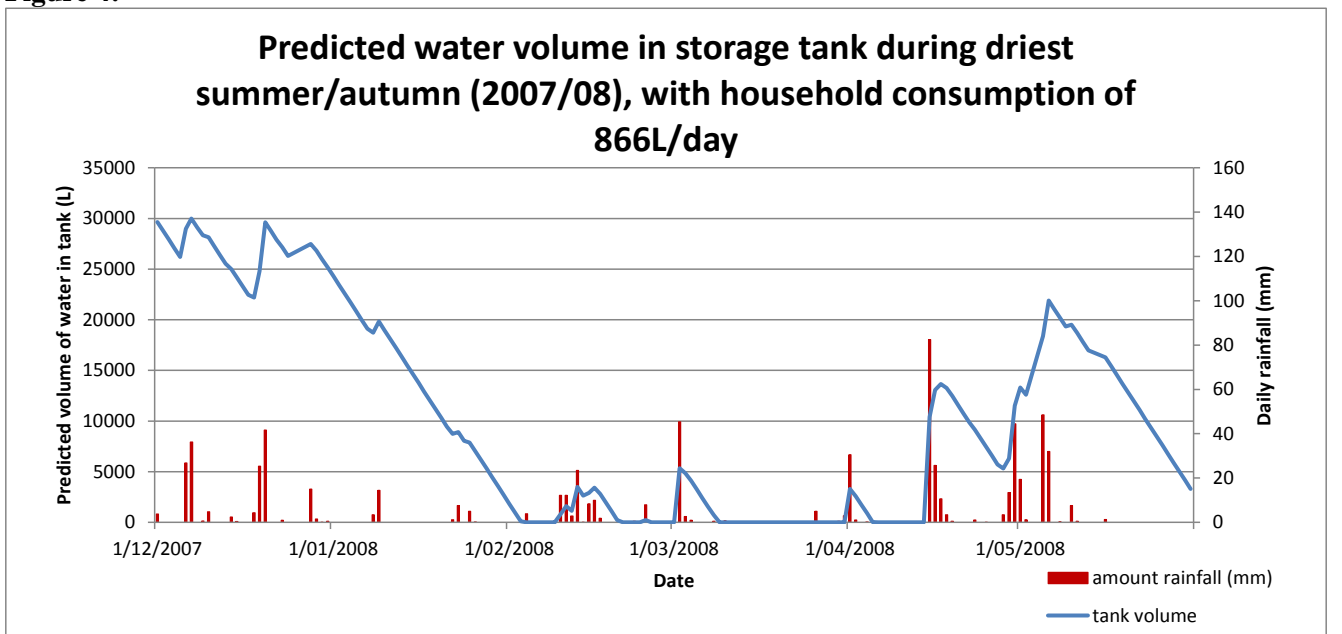




Figure 5:

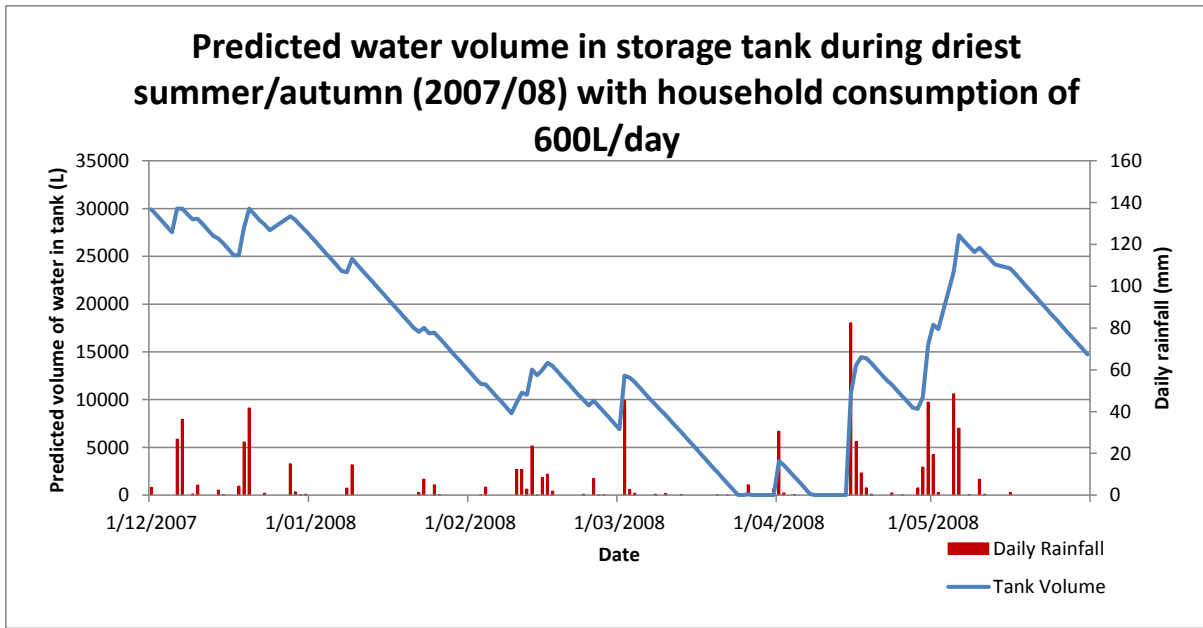
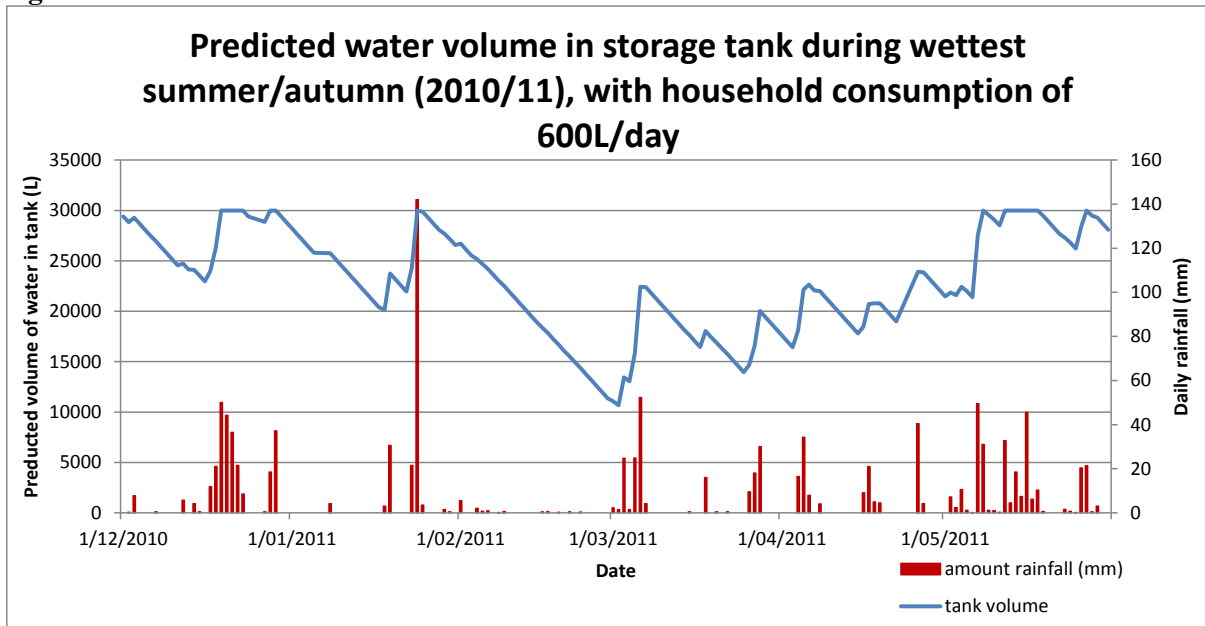


Figure 6:



Rain-collected roof water therefore poses a risk which is contrary to protecting and promoting the public health of the community.

The current Ohura reticulated water supply has been able to provide a continuous supply of water to the community, even during periods of summer drought (although water restrictions have been in place during such periods).

## 6 Water affordability

Within New Zealand there is a socio-economic gradient in mortality, with low income groups having a higher risk of dying at every age than wealthier groups of people<sup>19</sup>. Similarly, low incomes are associated with poorer overall health<sup>20</sup> and higher morbidity for a number of different conditions<sup>19</sup>. Low incomes limit the ability of people to meet their basic needs as well as their ability to participate in wider society<sup>20</sup>.

Water charges add to housing costs. High housing costs relative to income are often associated with severe financial difficulty, and can leave households with insufficient income to meet their other needs, such as food, clothing, transport and medical care<sup>20</sup>. High outgoings-to-income ratios are not as critical for higher-income households, as there is still sufficient income left for their basic needs<sup>20</sup>. The benefits of increased wealth to health status are not linear. At high levels of deprivation increased wealth tends to produce marked increases in health<sup>21</sup>.

In NZ the top decile receives 8.5 times the income of the bottom decile after tax. Ohura residents are on average, in the lowest decile (table 4) and are therefore least well placed to accommodate increased costs for their water whether it is reticulated and treated or individually collected.

**Table 4: NZ Deprivation and home ownership**

Area	NZdep	Home ownership rate
Taumaranui	10	58.40%
Owhango	6	68.00%
National Park	8	37.00%
Raetihi	9	50.00%
Ohakune	8	38.60%
Ohura	10	80.00%
Waiouru	6	10.30%

Source: 2006 Census

Ohura residents currently spend over 10% of the median personal income for the community on water charges, a higher proportion than for other towns within the Ruapehu District (table 5). The use of a district wide flat water rate would lower this proportion to approximately five percent of income for Ohura residents. Increased water charges in other parts of the district would not increase their proportion of income spent on water to this level.

A change to water tanks does not appear to increase affordability for Ohura residents within the short to medium term. Ruapehu District Council has estimated a cost per dwelling of \$13,751 for the installation of a rain water collection system and tanks<sup>3</sup>. Council has proposed a finance package at 7% interest repaid over 20 years, which would require a repayment on this loan of \$1,300 per annum. This would equate to 11.3% of median income, a higher proportion than the current water charges. Since then an independent assessment of costs involved in installing water tanks for five residential properties varied between \$12,000 and \$33,000 and for the Ohura Bed and Breakfast, cost varied between \$80,000 and \$100,000. In addition to loan repayments there are likely to be additional costs related to maintenance, and purchasing water during times of drought.

A change to water tanks may provide some stability in costs over the next 20 years, with annual loan repayments remaining stable but water rates otherwise increasing over time. However, this stability is likely to be at least partially offset by the additional costs.

Attempts by the community to reduce costs by not installing water quality measures, such as filters, UV lights and first flush diverter, or irregular maintenance increases the risk of contamination of the water and associated negative health outcomes. Maintenance activities may be difficult for some groups in the community, such as the elderly, which increases the risk of either maintenance activities being avoided, with an increased risk of contamination, or having to pay somebody else to conduct the maintenance, further increasing costs and reducing affordability of this option.

In the longer term, once loan payments have been completed, water tanks may become more affordable than the current water rate charges. However the water tanks and roof collecting rain water equipment will at some point require replacing. The life span of this system is unclear. The cost of replacement may not be achievable for most residents if there is no further support from council.

Approximately 80% of Ohura residents own their own homes (Table 4), a higher rate of home ownership than in other areas of the district. Home owners will be responsible for the water costs, or costs of installing a rainwater collection and storage system if this were to occur.

**Table 5: Percentage of personal income spent on water rates across the Ruapehu district**

Area	2006 median personal income (aged 15+)*	2006 water charge**	Current water charge**	2006 water charge as percentage of median income	Current water charge as percentage of median income	District wide flat water charge as percentage of median income
Taumarunui	\$17800	\$482	\$570.40	2.71%	3.20%	3.25%
Owhango	\$23100	\$322	\$512.90	1.39%	2.22%	2.51%
National Park	\$27900	\$479	\$900.45	1.71%	3.23%	2.08%
Raetihi	\$19100	\$426	\$612.95	2.23%	3.20%	3.04%
Ohakune	\$24700	\$366	\$451.95	1.48%	1.83%	2.35%
<b>Ohura</b>	<b>\$11500</b>	<b>\$605</b>	<b>\$1199.45</b>	<b>5.26%</b>	<b>10.43%</b>	<b>5.04%</b>
Waiouru	\$29900	\$168	\$580	0.56%	1.94%	1.94%

Source: \* 2006 census. \*\*Ruapehu District Council

## 7 Key findings from community engagement

### 7.1 What key stakeholders said

A number of key stakeholder interviews were carried out during February 2014. The stakeholders interviewed were the Ministry of Health, Ohura Valley Primary School Principal, Ohura Cosmopolitan Club (Secretary), Ohura Bed & Breakfast and two residents.

Overall, there was support for the current water supply to continue. Business would be affected if the switch to rainwater tanks occurred and there was fear Ohura would lose its economic ability if this were to happen. The implications for the school and the wider community were also of concern. The Ministry of Health were disturbed to learn that the current water supply was under threat following the recent drinking water subsidy. They report that safe drinking water is a necessity for public life and Ohura would be deprived of their drinking water supply if the current supply was abandoned. The total benefits to the

community were greater if the current reticulated supply was maintained; particularly alongside a district-wide flat water rate.

A more detailed account of the stakeholder interviews appears in Appendix 4.

## 7.2 What the community said

A community workshop was held on February 27, 2014 for the purpose of exploring community perspectives of the health and wellbeing implications of the alternatives for water supply proposed by Ruapehu DC. The workshop specifically explored potential issues related to water quality, supply and affordability including potential options going forward. Approximately 20 people attended the meeting, which was held at the local memorial hall.

Among those attending, there was no consensus between reticulated supply and rainwater tanks, but there was a general concern about the implications of the costs that will be incurred by either continuing with a reticulated supply or moving to individual rainwater collection and the effect this will have on the viability of the township (Table 6).

**Table 6: Overview of key local water concerns**

	Existing supply	Rainwater tanks
<b>Water supply</b>	Few concerns about supply  Support that supply provides to local services and amenities, and to enable gardening	Dependent on regular steady rainfall to ensure sufficient quantity in summer and times of drought.  Impact on town at times of drought; viability of local services and amenities
<b>Water quality</b>	Concern among some of quality of current supply; others satisfied with supply	Concern among some of difficulty maintaining quality of water in tanks over time; others keen on tank option
<b>Water affordability</b>	Burden of high water rates	Burden of the cost of tank installation, house retrofitting, and loan repayments to council

A more detailed and comprehensive account of the community workshop appears in Appendix 4, 5 & 6. Other health concerns expressed can be found in Appendix 8.

## 8 Discussion

The literature findings for this HIA indicates that roof collected rain water is more likely to be contaminated than water from a reticulated supply. Contaminated water is likely to be associated with a higher risk of disease. This risk will be higher for vulnerable populations such as young children, the elderly and those with impaired immune systems. The risk of rain water contamination can be lowered through appropriate installation and maintenance of the tank and equipment. However maintenance of rain water tanks has been found to be poor in New Zealand, and socioeconomic deprivation within Ohura may further increase the risk of poor installation and inadequate maintenance. Regular monitoring of the reticulated water supply provides some protection to the community that would not be available from a rainwater tank.

A continuous supply of water is required for good health. The current reticulated water supply has provided a continuous supply of water to the community, although water

restrictions have been required during the summer months in some years. In contrast, use of water from rain water tanks at the current average rate would likely result in household water shortages during most summer/autumn periods. Household water conservation efforts may reduce the likelihood of water shortages occurring. However it is likely that lack of experience with water tanks may limit such conservation efforts during the initial years following their introduction. The community reported significant concerns about water shortages if utilising rain water.

A number of community members have suggested that they maintain a dual water supply in which they utilise rain water for cooking and drinking, but would continue to have access to an untreated reticulated supply for other activities, in particular watering the garden. Such a scheme would improve access to a continuous water supply. However bringing untreated water into a dwelling could lead to a risk of inadvertent consumption of contaminated water if the wrong tap was used or if young children swallowed water in the bath or shower. In severe drought residents may be tempted use the untreated water for consumption rather than pay a water carrier for potable water. A dual water supply with untreated water is therefore not recommended.

The current cost of water makes up a significant proportion of median income for the Ohura community when compared to other local communities. Water is less affordable in Ohura than in other towns within the district, both as a result of the high cost and low medium income. A change to using rainwater tanks does not appear to increase affordability for Ohura residents in the short to medium term. Predicted annual loan repayments would be higher than current water fees, and recent quotes suggest that even higher repayment amounts would be required. Additional costs associated with maintenance and water purchase would further reduce affordability. These high costs impact the health of the community and have, for example, limited access to health care for some residents.

Some community members have indicated that water tanks and other equipment could be purchased cheaper than has been quoted to them, and could be self-installed. This may reduce loan repayments for some residents, but risks a reduction in water quality. It is unlikely that all residents would be willing or able to take this cheaper option.

In the longer term, when loans are repaid, rain water tanks may become much more affordable. However at some point the tank and equipment will require replacing. The life expectancy of this system remains unclear. The cost of replacement may not be achievable for most residents if there is no further support from council.

The community has indicated that a change to rain water tanks may lead to the closure of the Ohura Bed and Breakfast. This would result in a further cost to the community, with the potential loss of jobs.

A flat water rate across the Ruapehu District would assist water affordability for the people of Ohura. Some other towns in the district would consequently have a reduction in their water affordability. The negative health impacts from this reduction in affordability in other towns would be likely to be minimal in comparison to the benefit in Ohura. Most of the other communities have less socio-economic deprivation than Ohura, and the increase in costs would be significantly smaller than the reduction in costs in Ohura.

### **Limitations**

There are several limitations to this HIA. While there is strong evidence of rainwater tank contamination in New Zealand, there is less evidence that this contamination leads to disease. While this is widely thought to be due to under reporting rather than absence of disease, it means that it is not possible to quantify the risk of illness from rain water consumption.

Only limited data is currently available from the 2013 census and consequently this HIA has relied on some data from the 2006 census. While the current population and incomes can be expected to have changed since 2006, relative differences in proportions between towns are likely to have remained similar.

## 9 Recommendations

This HIA was undertaken with a view to informing the Ruapehu DC decision on water supply, in a manner that best protects and promotes the health of residents of the area.

From our evidence review and engagement on this issue, Population Health, Waikato DHB, is of the view that the current water treatment system, with monitoring and improvements where needed, is best placed to provide both surety of supply and quality drinking water.

Rainwater tanks are generally able to give supply, but have capacity risks at time of drought. The New Zealand evidence available indicates that maintenance of rainwater tanks is variable and would suggest that over time, the water quality will, for many, deteriorate.

### Recommendation 1

Population Health, Waikato DHB **strongly recommends** Ruapehu District Council continue to supply treated reticulated water to the Ohura community.

### Recommendation 2

Population Health, Waikato DHB **strongly recommends** Ruapehu District Council explore and utilise an alternative water rating system, such as a district wide flat water rate or targeted subsidies, to increase affordability of water for the Ohura community.

The evidence review and consultation discussed above, together with recommendations, will provide the basis of the Medical Officer of Health's consideration, if and when a formal approach is made following Council decisions on this issue.

# **Appendices**

## Appendix 1: About HIA

The HIA process includes the collation and analysis of relevant evidence and data, along with key stakeholder and community engagement with the aim of identifying:

- how health and wellbeing effects can be enhanced
- how negative health and wellbeing effects can be lessened or removed
- ways in which health inequalities may be reduced or widened as a result of the policy or plan.

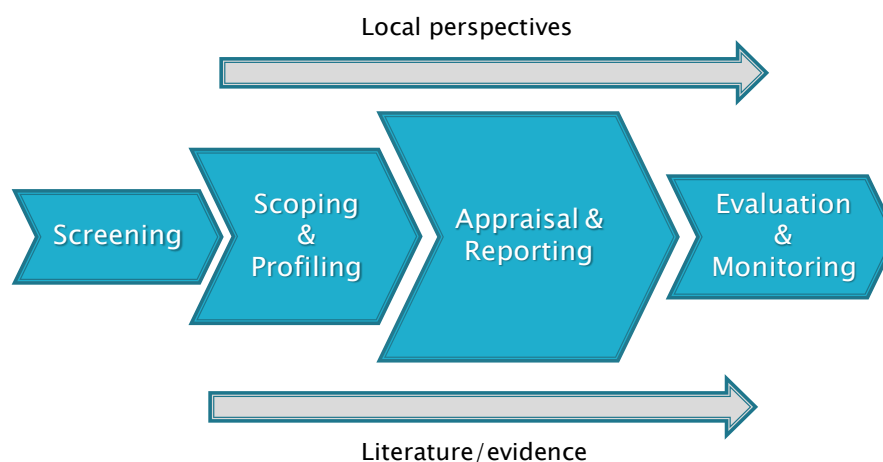
New Zealand's Public Health Advisory Committee recommended HIAs be used by all government departments responsible for developing policies, especially when there are likely to be impacts on the health and wellbeing of people affected by the policy. The tool has been extensively applied in local government settings, and can also be used by non-government organisations.

HIA methodology is based on the core principles of equity and fairness i.e. creating equal opportunities for improving and maintaining health and well-being and supporting community participation in decision-making processes. Once the direct and indirect impacts are identified the HIA develops a set of recommendations to inform policy decision-making process. These recommendations aim to mitigate the negative impacts and strengthen the positive impacts on health, well-being and health equity of the proposed policy<sup>22</sup>. Recommendations are evidence-based and outcomes-focused.

HIA combines research evidence with community and stakeholder engagement. This occurs in four key phases (figure 5).

1. Screening identifies whether HIA is required by asking what you need to know in relation to a particular policy, plan or programme.
2. Scoping identifies the key issues that need to be considered to define and shape the HIA according to available resources and capacity; a working group is established and key themes for investigation are identified.
3. Appraisal and reporting identifies and explores the potential benefits and risks to health and wellbeing, with wide-ranging stakeholder input.
4. Evaluation both process and impact evaluation can be used to assess the effectiveness of the HIA process and provide information that can be useful for further HIA's.

**Figure 5. HIA Process**





## Appendix 2: HIA checklist<sup>23</sup>

The results of the table will help indicate whether a health impact assessment should be done. The information gained may also be useful in justifying a decision to conduct an HIA (or a decision not to go ahead). If this process leads to a decision to undertake an HIA, proceed to the next step – the scoping stage.

<b>Table 1: Screening Checklist<sup>19</sup></b>			
<b>Pose these questions</b>	<b>Put your answers here</b>		
<b>To your knowledge:</b>	<b>Should conduct an HIA</b>	<b>No need to conduct an HIA</b>	<b>Estimated level of certainty for your response to the questions (high, medium, low)</b>
Is there potential for positive health impacts as a result of the proposed policy change? (Think about whether it will affect the determinants of health such as socioeconomic or environmental factors or lifestyle – see Table 3 in Appraisal section.)	Yes/don't know	No	
Is there potential for negative health impacts as a result of the proposed policy change?	Yes/don't know	No	
Are the potential negative health impacts likely to affect a large number of people? (Include consideration of future and intergenerational impacts.)	Yes/don't know	No	
Are the potential negative health effects likely to cause death, disability or hospital admission?	Yes/don't know	No	
Are the potential negative health impacts likely to be disproportionately greater for disadvantaged or vulnerable groups in the population? (Think about which groups in the population could be affected.)	Yes/don't know	No	
Are the potential negative health impacts likely to be disproportionately greater for Māori?	Yes/don't know	No	
Are there public or community concerns about potential health impacts of this policy change?	Yes/don't know	No	
Is there uncertainty about what the potential health impacts might be?	Yes/don't know	No	
Is there support from the policy-makers involved, or political support within the organisation to carry out an HIA?*	Yes/don't know	No	

## Appendix 3: Water quality literature review

The quality of drinking-water is a powerful environmental determinant of health<sup>24</sup>. Unsafe water and sanitation account for almost 10% of the global burden of disease<sup>16</sup>. In New Zealand, more than 10% of the population are dependent on roof-collected rainwater systems for their drinking water; particularly in rural areas not served by reticulated town water supplies<sup>1</sup>.

There is a common perception that rainwater is pure and safe to drink. The risk of disease associated with the consumption of roof collected rainwater can be low, if the water is visibly clear, has little taste or smell, and regular maintenance of the storage tank and roof catchment system is carried out<sup>1</sup>. However there are a number of potential health risks associated with consumption of water from rainwater tanks, which can relate to microbiological or chemical contaminants in the water. Public reticulated water supplies are normally subject to regulation and monitoring to ensure the quality and safety of water delivered to the consumer. For example, Ohura's current water supply:

- provides treated water to residents,
- is managed and monitored by those with expertise in the area of water treatment,
- has regular funding provided by Ruapehu DC,
- is assessed on its performance at annual intervals,
- will be subject to regular identification and mitigation of its public health risks via the revisions of its Public Health Risk Management Plan (now called the Water Safety Plan), and
- transgressions are reported to Population Health Waikato DHB.

In contrast the operation and maintenance of rainwater tanks is generally the responsibility of the individual householder. The quality of water from rainwater tanks is therefore likely to be more variable than the water from a reticulated supply<sup>2</sup>.

### Water tanks

#### Microbiological contamination

Roof collected rainwater may contain a variety of micro-organisms, including bacteria and protozoa. Many of these micro-organisms will be harmless; however disease can be caused by the presence of pathogenic micro-organisms from faecal contamination. These include bacteria such as Salmonella and Campylobacter, and protozoa such as Cryptosporidium and Giardia<sup>1</sup>. Infections with these microorganisms would usually result in short term illness, but can range from mild disease of one or a few days duration to severe illness of several weeks<sup>2</sup>. In rare cases death may result. In a small minority of people, longer term health effects may occur<sup>2</sup>. Children under the age of five years, the elderly, pregnant women and those with damaged immune systems are more vulnerable to the health risks associated with contaminated drinking water<sup>10</sup>

The microbiological quality of stored roof-collected rainwater is directly impacted by roof catchment and run-off contamination. Faecal contamination comes from birds, frogs, rodents, possums, dead animals and insects on the roof and in the gutters or in the water tank itself<sup>11</sup>.

The risk of contamination with viruses appears to be low, as most viruses affecting humans do not have natural animal hosts and human faecal contamination of rooftops would be rare.

Algae and cyanobacteria may grow within water tanks, depending on the light levels, nutrients and temperature. Some of these could produce toxins which could be harmful to human health<sup>2</sup>.

The microbiological quality of drinking water is commonly measured by testing for *Escherichia coli* (E. Coli) or faecal coliforms. This provides an indicator of faecal contamination and hence the possible presence of disease causing micro-organisms<sup>1</sup>. It should be noted that there has been some debate about whether the presence of these faecal indicators is significantly correlated with the presence of disease causing organisms<sup>14</sup>. There are a number of studies, conducted both internationally and within New Zealand, which have demonstrated the presence of faecal indicators in roof collected rain water tanks<sup>1, 11-13</sup>. For example a recent five year study conducted in New Zealand examined roof collected rainwater samples of 560 private dwellings, primarily in the lower half of the North Island. The study found that over 50% of water samples exceeded the minimal acceptable New Zealand standards for contamination and 41% showed evidence of heavy faecal contamination<sup>11</sup>.

Studies which have looked directly for disease causing organisms within roof collected rain water tanks are less common. However bacterial pathogens such as *Salmonella*, *Campylobacter*, *Legionella* and *Clostridium perfringens* have been isolated from roof collected rain water samples both in New Zealand and internationally<sup>1, 12, 14, 25, 26</sup>.

In 2001 *Campylobacter* was found in five percent of roof water samples collected from rural locations in the North Island of New Zealand<sup>25</sup>. *Cryptosporidium* was found in 48%, and *Giardia* in 26%, of 45 water samples from roof collected rainwater in the United States in 1996<sup>26</sup>. In contrast a 2001 New Zealand study, found just two out of 50 roof collected rain water samples contained *cryptosporidium* and no *Giardia* was found<sup>12</sup>.

### **Disease outbreaks**

Reports of illness associated with rainwater tanks are not common, although this is thought to be due to under-reporting. Most rainwater tanks serve individual households of only a few people, who are unlikely to seek medical attention unless their illness is severe. For the illness to be recorded the person must go to a doctor who must collect appropriate samples for analysis, with only positive results included in statistics. Small outbreaks are likely to be contained to the number of people in a household and therefore go undetected<sup>11</sup>. Contaminated rainwater is more likely to be the source of sporadic disease episodes, because a proportion of those exposed may have developed immunity over time and others may experience asymptomatic infection<sup>1</sup>. Visitors may therefore be at greater risk from waterborne diseases from contaminated roof water. Certain groups of people may be more vulnerable to disease from untreated water, such as the immunocompromised, elderly and young children<sup>10</sup>. Currently the Ministry of Health recommends boiling water for formula fed children under 2 years using rainwater as compared to just those under three months for those on treated reticulated supplies<sup>27</sup>.

A small number of outbreaks have been reported in New Zealand which have been associated with roof collected rain water. Others have been reported internationally<sup>14</sup>. Within New Zealand, roof collected rainwater was considered the probable source of *Salmonella typhimurium* infection in a family of four in 1997<sup>14</sup>. A 2003 report of an outbreak of *Salmonella enteric* infection in New Zealand found that five of 170 cases had consumed roof collected rainwater in which the bacteria was detected<sup>28</sup>.

In 2006 three cases of legionella (resulting in one death) in Beachlands (a small community in South Auckland) were associated with three different roof collected rainwater household water supplies<sup>29</sup>. The supplies were found to be contaminated with *Legionella Pneumophila*

SG1 and filters attached to taps were also contaminated. Aerosols containing legionella were discharged by a marina water blaster, which may have infected the cases directly or may have contaminated the roof collected rainwater systems resulting in the cases being exposed by aerosols in the shower.

In 2009, 93 cases of norovirus gastroenteritis were reported amongst Turoa ski feild staff on Mount Ruapehu. It was hypothesized that snow made from a contaminated pond had landed on the roofs of buildings, contaminating the water tanks<sup>14</sup>.

### **Epidemiological Studies**

A small number of epidemiological studies have been carried out to investigate the risk of disease from utilising roof collected rain water for drinking.

In 2006 a South Australian longitudinal cohort study of gastroenteritis, among 1000 four to six year old children, found that children drinking tank rainwater were not at a greater risk of gastroenteritis than children drinking public mains water<sup>30</sup>. However the children had drunk rainwater for over a year prior to the study and so may have been exposed to low level contamination and developed immunity to some organisms. Furthermore no water testing was performed and a high proportion of the roofs were free from overhanging trees and had their gutters cleaned within the last year<sup>14</sup>.

A case control study for giardiasis among school children in Auckland found that consumption of roof collected rainwater significantly increased the risk of this disease<sup>31</sup>. A study of Salmonella infections in Tasmania found that 81% of cases had consumed untreated tank rainwater<sup>32</sup>.

A 1997 multicentre analysis of gastroenteritis caused by Campylobacter in New Zealand found that consumption of roof collected rainwater was associated with a threefold greater risk of campylobacteriosis than that of non-consumers<sup>33</sup>. An estimated two percent of campylobacteriosis in New Zealand was likely to be explained by the consumption of rainwater<sup>33</sup>.

### **Maintenance**

The risk of microbial contamination of stored roof-collected rainwater can be reduced by preventative measures including appropriate design and installation of the collecting and storage system, and regular maintenance<sup>14</sup>.

Maintenance activities should include: clearing gutters, leaf guards, and first flush diverters, cleaning and replacing filters if necessary and trimming back trees overhanging the roof<sup>34</sup>. Three monthly inspections for these activities are recommended. An annual inspection should involve cleaning the tank to remove accumulated sediment<sup>34</sup>.

Several New Zealand surveys have investigated whether rainwater supplies are designed and maintained appropriately. Abbott et al. surveyed 560 households and found very little evidence of any water treatment<sup>11</sup>. Fifty percent of households surveyed had no measures in place to safeguard the water against microbiological contamination. Only 10% reported filtering water but samples taken showed that 71% of the filtered water was contaminated. Ten percent said they never cleaned their gutters and 30% reported to never cleaning their tanks. While a third of households did report to having down-pipe debris screens in place, a number of these were inaccessible for maintenance and cleaning and some sported birds' nests.

In 1997, a survey of 40 homes using roof water supplies in Pauatahanui revealed a lack of maintenance, poorly designed delivery systems and tanks, and failure to adopt physical measures to safeguard the water against contamination<sup>1</sup>. A study of 20 households on Waiheke Island in 2000 found that 55% did conduct maintenance, but of those only 45% had done any maintenance in the previous six months<sup>1</sup>. A study of 125 rainwater supplies in rural Auckland districts in 2000 showed only 35% of households ever cleaned their storage tanks and 25% never cleaned their guttering.

Foliage was found to overhang the roof in 19% of supplies. In 1996 a study of 20 rainwater supplies of rural schools in the South Auckland area found that only 20% of schools cleaned their roofs, 65% cleaned their gutters every one to three years, and only 42% regularly cleaned their rainwater storage tanks<sup>1</sup>.

## **Chemical contamination**

Rain water can pick up chemical contaminants as it falls through the atmosphere, or from dust and contaminants on the roof surface<sup>1</sup>. Chemical contamination may also originate from roofing, guttering or storage tank materials. Rural areas are less likely to have chemical contamination of water than urban areas, as there is limited air pollution from industry or traffic. However there is a potential greater risk of contamination from agricultural chemicals, including pesticides and fertilisers in rural areas.

Rain water has an acid pH compared to tap water. In a clean atmosphere the pH of rain is approximately five to six, primarily as a consequence of absorption of carbon dioxide from air<sup>2</sup>. Rain water may therefore be more likely to leach metals and other contaminants from storage tanks and plumbing materials than tap water.

There are a number of chemicals which could contaminate roof collected rain water from a variety of sources. This review will consider some of them.

## **Lead**

Roof harvested rain water can potentially become contaminated with lead from lead based roof paint, lead headed nails, lead roof flashings and lead solder joining copper pipes. Lead from exhaust emissions has previously been a source of contamination in urban areas, but would be now be an unlikely source as New Zealand has changed to unleaded petrol, and rural areas have low traffic volumes<sup>12</sup>. The long term consumption of water which contained elevated levels of lead could pose a serious health threat<sup>35</sup>. Lead accumulates in the body over time and can be particularly harmful to children.

Simmons et al. found that 14.4% of 125 roof water supplies in the rural Auckland area exceeded the Drinking Water Standards maximum acceptable value (MAV) for lead of 0.01mg/L, despite low traffic densities in the area<sup>12</sup>.

Auckland Regional Council has examined roof run off from different roof types. Lead levels were low for new roofs made from colour steel tiles, concrete tiles, decramastic and long run colour steel. However run off from galvanised roofs in fair to poor conditions had a mean total lead concentration exceeding the MAV<sup>1</sup>.

## **Spray drift**

Agricultural spray drift can be deposited on roofs in rural areas, where it can then be washed into water tanks. Volatile pesticides will evaporate before being washed into the tank if there is even a short period of sun between the time when spray is deposited on a roof and rainfall<sup>36</sup>.

A number of Australian surveys of rainwater quality in rural areas found that most samples did not contain detectable concentrations of pesticides<sup>37</sup>. Pesticides were detected in some samples but at concentrations well below Australian drinking water guidelines<sup>37</sup>. However precautions should be taken to reduce exposures to pesticides if spraying in the area is evident, such as disconnecting the water tank until the roof has been cleaned or until after it has rained. Flushing and replacing the tank water is prudent if spray contamination of tank water is likely to have occurred<sup>36</sup>.

### **Combustion products**

Fires produce smoke, soot and ash that may settle onto roofs and have potential to be washed into rain water tanks causing contamination. Coal and treated timber contains arsenic and boron which could be present in the soot and wash into rain water tanks<sup>1</sup>.

Polyaromatic hydrocarbons (PAH) form from incomplete combustion of organic matter and are classified as carcinogens. They have been related to the high incidence of stomach cancers in a part of Iceland where houses were heated with coal and oil. The soot settled on the roofs and was washed into barrels used for drinking water<sup>1</sup>. However an Australian survey of rainwater collected from roofs with wood heater flues did not find PAH at concentrations above guideline values in the Australian Drinking Water Guidelines<sup>37</sup>. A study of rainwater tanks in an area of Victoria affected by extensive bushfires in 2003 also did not find results greater than the Australian Drinking Water Guidelines for PAH or arsenic<sup>38</sup>. All participants reported the presence of smoke on their properties as being very bad and only nine of 48 participants used first flush diverters, which would be likely to reduce tank water contamination from fires.

In contrast elevated levels of PAH exceeding their MAV have been found in a study of roof run off in Auckland in 2004<sup>1</sup>.

## Appendix 4: Stakeholder interviews

During February 2014 Population Health carried out a number of key stakeholders within the Ohura community and with the Ministry of Health.

A summary of findings are as follows:

### Ohura community

The viewpoints of two residents and two businesses were sought. Contact with the Volunteer Fire Service was unsuccessful.

### Key points

- The Ohura community was described as *having a very good heart, a community very proud of its town and a community who has a bond and cares for each other.*
- There was overall support for the reticulated supply to continue. Many residents already had back-up tanks but these were not used for drinking water. There were concerns and fears for the many elderly residents in Ohura if the current reticulated supply was lost in favour of rain-water tanks. Many residents (about 20 people/couples) are in their 70s and 80s. How will they cope if they run out of water? Ohura is geographically isolated. It's 53km to Taumarunui; expensive to travel for bottled water. It is far better to look for efficiencies in treating the current water. What has Council done to address this? What has Horizon's Regional Council done to monitor the source? They should be involved in this debate.
- Ohura has experienced drought conditions in the last two years and they were asked to conserve water.
- Contamination from bird and animal faeces, crop dusting, and volcanic eruptions was of concern as was the ability of many residents to maintain the quality of water in tanks i.e. many are elderly and would be simply unable to carry out tasks required to maintain a rain-water tank supply.
- If there was a switch to rain-water tanks there would be a number of concerns:
  - Cost of infrastructure particularly for the Ohura B& B who report they would most likely have to close. The B&B currently employs a number of the local residents part-time. This is set to increase as business expands due to the mountain bikers (Forest trail/Forgotten Highway), rally cars, camper vans, tourists and the Forgotten Railway Adventures. The Ohura B&B has retained many features from the Ohura Prison days and this has become a feature and point-of-difference in the tourist market.
  - Currently around 6 tonnes of coal is burned in the winter for heating and hot water. Contamination from soot and ash is a concern if rain-water tanks were required.
  - Rain-water tanks capacity would have to be large given the commercial operation of the B&B. The business would become untenable on rain-water tanks and would most likely close.
  - The Ohura Cosmopolitan Club also expressed concern if the switch to rain-water tanks went ahead. Concerns include capacity needed for cleaning, commercial dish washers, toilets etc.
  - With 150-200 members patronage can vary from 5 or 6 to 100 on a Friday night. The Ohura Cosmopolitan Club also doubles as the community's dairy.

- There is a concern that once the reticulated supply is closed *they (council) will forget all about us once they get us onto tanks.*
- The school would need to purchase rainwater tanks from their five-year property fund with assistance from the Ministry of Education. Maintenance costs would be funded from the school's *bulk grant* at the expense of other items.
- The school has a *vege* garden which supplies students and the community in general with fresh *veges*. This will not be possible if there is a switch to rainwater tanks as the garden would not be watered during the dry months.
- The running and maintenance of the school swimming pool would also need to be reconsidered if the school was to switch to rainwater tanks. There would be additional stress for the principal in organising and ensuring water quality compliance.

## **Ministry of Health**

The following represents the Ministry of Health view on closing or transferring the Ohura Water Supply.

*"Drinking water subsidies are intended to help suppliers in small, disadvantaged communities to improve their drinking-water systems and provide safe drinking water. The subsidies make funding available to suppliers that demonstrate a need for funding to assist them in making the most effective use of the equipment that they already have or to upgrade their facilities, to provide a safe and sustainable water supply. Ruapehu DC was given assistance on this understanding, and that the water supply would be maintained for the reasonable future. Abandoning the current supply will waste the Government's investment and deprive the community of Ohura of their drinking-water supply. Safe drinking water is a necessity for public health."* (Environmental & Border Health, Public Health. Clinical Leadership, Protection & Regulation, Ministry of Health)



## Appendix 5: HIA Appraisal Workshop

### Ohura Community Feedback

#### Background

A DHB-led consultation meeting with members of the Ohura community was held on Thursday 27<sup>th</sup> February. The meeting was facilitated by staff from the Population Health division of Waikato DHB, including the Medical Officer of Health, and they were assisted by an external advisor specialising in health impact assessments.

The purpose of the meeting was to explore community perspectives of the health and wellbeing implications of the alternatives for water supply that were on the table. The engagement approach was based on an adaptation of established health and wellbeing impact assessment practice, in which the health and wellbeing consequences of policy or planning can be tested in a collaborative forum with local people.

Approximately 20 people attended the meeting, which was held at the local memorial hall. The meeting specifically explored potential issues relating to water supply, quality and affordability, and potential options going forward.

#### Water Supply

##### Key concerns

There was general agreement that the current supply had met local needs, in terms of access to water, for many years. This enables not only supply to local homes and gardens, but also supports local services and amenities, such as the fire brigade, public toilets, clubrooms, backpackers, school and swimming pool.

Despite local droughts, the supply had remained operable, and had been of service to the local farming community during droughts.

A key concern of locals was the reliability of ongoing water supply in the township, both to the local population and local services, amenities and the backpackers hostel if there was a switch to water tanks. At times of drought, the supply would be much less assured, would incur extra cost if water had to be trucked in, and would undermine people's ability to grow their own food and maintain gardens. Some suggested maintaining a dual water supply, continuing an untreated reticulated supply for non-potable purposes, and using rain water for drinking.

Some noted that the Ministry of Health had invested substantial amounts in maintaining the town supply. They were concerned about what would happen to that investment if the supply was changed; would it be sold or transferred to another area?

##### Potential health impacts: Water supply

Ohura people raised the following potential health and wellbeing issues:

- Loss of ability to water vegetable gardens in times of drought
- Loss of functionality of key local amenities

## Water quality

### Key concerns

Concerns were expressed with quality of water, both with the current supply and with a switch to water tanks. Some were unsure about the quality of the existing supply, and were concerned that the current supply passes through an old dump site, and can be contaminated by topdressing. Some people noted that a few years earlier, there were contaminants that required the water to be boiled for a time. For some, rainwater tanks were seen as providing a safer water quality option than the existing supply.

Others however were of the view that the current supply was generally good and would continue to serve the area well. They were also concerned that rainwater tanks have their own quality issues, including needing maintenance and treatment, possibility of plastic leaching, and contaminants such as bird droppings, lead-based fittings and material on roofs (such as topdressing spray).

### Potential health impacts: Water quality

Ohura people raised the following potential health and wellbeing issues:

- Illness from contaminated water (whether town supply or rainwater)
- Health concerns with existing water treatment processes

## Water affordability

There was widespread concern among community members about the affordability of the options put forward by council. The DHB was told that the average income in the area was only \$10,000, and the water rates being applied were prohibitively expensive. There was concern that the direct rating applied would only increase in years to come.

The rainwater option was similarly seen to be prohibitively expensive. The properties that had been assessed to date indicated that the building work needed to bring houses to a state (e.g. new roofing and spouting) that they could take rainwater tanks would be well over \$20,000 for many households, and many would not be able to repay loans from the council, particularly retired populations taking on debt. Some queried if the council was genuinely interested in turning the town around and support growth.

### Potential health impacts: Water affordability

Ohura people raised the following potential health and wellbeing issues:

- Stress and erosion of mental health from financial pressure of water costs
- Erosion of social fabric of township as more leave due to unaffordability

## Responses to options put forward

Among those attending, there was no single option that all agreed with, but there was a general concern about the implications of the costs that will be borne by either system.

Some suggested a subsidised or fully-funded shift to rainwater tanks; others were in favour of retaining the current supply at an affordable rate. Some suggested a mixed system of local supply for gardening and other purposes, and rainwater tanks for drinking water. Some favoured a district-wide water rate, which would spread the costs more equally across the

district. This however had already been rejected by council. Others suggested transition arrangements to enable people to shift to a different system more affordably.

There was a widespread call for better engagement with the community on this, and for other options to be explored with the community.

## Appendix 6: HIA Workshop data

Ohura Community workshop feedback feedback – Thursday 27 February 2014

### Supply

- Need to supply local facilities such as fire brigade school, public toilets, cossie club, church, backpackers, rugby club, gardens, swimming pool.
- Will those in flood areas be OK for tanks?
- Don't want it to go dry.
- Don't want to lose it – rate payers rights.
- Is present system the best option – costing lots to get to drinkable quality.
- Who will fill the tanks if not full.
- Are there other options – more options from council.
- Water from Dam for washing, cleaning etc. Tanks for drinking, cooking.
- Who's investment is the current system?

### Group 2

- No current issues. Haven't run out during drought. Last year drought declared by govt. supplied farming community with water – fire service – fundraising – used for stock.
- This year no rain for 3 weeks.
- Drought 2008. Happens every 5 years.
- Farms get subsidies during drought but towns don't.
- What if there's a flood? Can tanks get washed away – last flood 1998.
- Gardeners – no water for watering.
- \$300-\$500 for 10,000 litres.
- Could get water out of river – untreated.
- Community could pool money for community collection of water.
- Majority/some are elderly.

### Quality

- Present quality monitoring? What is happening now?
- Health issues with tanks. Free from contaminants birds, planes (air pollutants in rainwater), eruptions, lead based fittings etc.
- Possible present source could be dump site.
- Cleaning routines of tanks.
- Would current water source be acceptable under current day?
- Don't want plastic (leaching) prefer concrete.
- Tanks have environmental supply issues.
- Taumarunui supply also not good (query council quality of water).
- What would be the health benefits and gains if going to tanks.
- Will there be a transition period?
- Believe council have not fulfilled statutory requirements.

### Group 2

- No current sign of ill health – few years ago water not so good. Run of people to doctors – may have been caused by town water. Local knowledge saying it was the water causing diarrhoe and vomiting.
- Other communities have problems with town supply as well.
- Good free water from sky. Why are we not using this?
- Current supply i.e. creek is polluted by top dressing, farm animals/wool sheds, old dump site etc. Can use carbon filter, UV system to clean up.

- Need both tanks and town supply i.e. tanks for drinking – sustainability.
- Alumn/chlorine added to water causing contamination.
- Have asked Horizons to test water.

## **Affordability**

### Group 1

- Cost of current system expensive.
- Could we weight up use of old Railway Dam source which would be gravity fed?
- Large cost to options offered – access, quality, cost – council should be addressing in a way that works locally.
- Low income 10% of income on water. \$10,000 average income.
- Life of plastic tanks. When would they need to be replaced?
- Higher house and content insurance cost.
- Retired population taking on debt.
- Ability to repay loans – keep current flat rate.
- Adds to high lines company/electricity costs.
- Flat water rate across district – we are paying for them as well as them for us.
- Has the old source been thoroughly investigated?
- Previous source before amalgamation of councils/borough had sufficient supply for town which had large population (railway dam).
- Why would we give up present system when its OK as is.
- Cost of present system increasing (chemical cost and maintenance).
- Cost of system individually analysed again.
- Cost on top of tanks with roofing/spouting etc to provide tank supply.
- Ongoing cost of a tank system.
- High cost on council estimates query how high they are.
- Costs of inspectors to have building work done + builder – it's the added costs
- 69 occupied homes. Tanks gifted because of high decile rate of community – exchange for equipment in existing system. Cost compared to current of treatment plant would way up against gifting tanks.
- Pumping from river.

### Group 2

- Many will need new roof, spouting.
- Won't reduce the cost as will be paying off loan for 15 years. Might need new tank in 15-20 years.
- Where will the tank be put? Would require additional earth works to get in right location.
- Retrograde step – always had water supply.
- Maintenance costs
- Source of water important to Maori – our livelihood. Ohura water flows through to Whanganui – source of life. Pray to water.
- Top dressing planes fly close to township – garden suffers. Fertiliser – Ohura should be a no fly zone.
- Price of reticulated water going up.
- Once you lose reticulated water you won't ever get it back.

## **Unintended health costs**

- Sewerage – flushing loos less. No long-drops in the built up area.
- Gardening – watering garden, growing kai, live off veges.
- Stress for community.
- Not a clear picture.

- Adding more debt – rates high costs.
- Financial stress.
- No public transport.
- Fire brigade – safety houses burning down.
- Supply and costs for the school.
- Club has used 23,000 litres in last 3 months – not even a tank.

### **Personal health impacts**

- Mental health. Stress of knowing current water has risk of contamination.
- Less gardening so less fresh food – fruit and veges.
- Need to conserve water – won't flush toilet as often – problems with septic tank.
- People will leave area as can't afford tanks.
- 3 x told not to drink water – i.e. *boil water* notice (last year boiled for 2-3 weeks).
- Would like reticulated water and water tanks for drinking.

### **Social cost**

- People will leave area.
- Quoted \$22k but phone around and could get it for \$8K.
- Need to get young people involved to fix up all buildings and water system. Rejuvenate the town.
- Council could foster community through tank conversion – buy in bulk.
- National Park now dropped to less than 200 people – they may face same issue.
- If water rates decreased then properties might be more saleable. Ohura would be more desirable to move to.
- Flat water rate will continue to increase.
- Have council looked at other options for treatment? i.e. sand filters – water trickles through shingle and comes out pure. Other options may be cheaper.
- Water tanks won't involve increasing costs? Maybe.

### **Who will be most impacted?**

- Community.
- Flat water rate – Ohura community benefits.

### **Other things for Population Health**

- Mental health – suicides – only recently been 3-4. Support for locals who are dealing with these instances.
- Lack of care for these people.
- Transport to appointments - 80 year old with son 30-45 years with cerebral palsy/muscular dystrophy looking after son on his own for 15 years since his wife died.
- Added stresses (benefit cuts, depression, self-isolation).
- Not having vaccinations due to cost/distance to appointments.
- Access to services.
- Health days popular in community to have checks.
- Good community – share and care looking after each other.
- Council don't seem to want to turn things around and support growth, distance themselves – are they interested at all?
- Abandoned land because of stress.

### Group 2

- 50kms to nearest doctor. Blood tests Taumarunui each week. Cost of getting to Taumarunui – need bus service or doctor to come here. Used to be doctors room in Hall 9 years ago. Used to have health days – blood person etc.
- Recent suicides – 2 in 12 months – people are socially isolated. Need some mental health care. People with mental health issues move here because its cheap.
- There's no access to WINZ – need them to come out.
- Most houses were insulated under free scheme. Some missed out. Could do stocktake and community help with others.
- Lines company bill separate from electricity – expensive as costs more to get electricity out here. Line company bill stays the same however much is used – can't economise.
- More health harms from cigarettes, alcohol marijuana than water.
- No cell phone coverage – risks in emergencies. Have broadband and landline.

### **Other options**

- Analysis of current system (independent consultant) – water, cost.
- Clarity and support from council
- Rumours on council would like Ohura to die are worrying.

## Appendix 7: Water supply calculations

The predicted volume of water in a rain water tank can be calculated using a number of assumptions and historical rainfall data. The calculations and assumptions are shown below.

Quotable Values (QV) estimates that the average floor area of a house in the Ruapehu district is 114sqft.

### Model assumptions

Fixed Daily water consumption of:

- 866 litres per day per connection, the current council estimate which is based on a three person household in Ohura.
- 600 litres per day, an estimated water utilisation during efforts to conserve water.

House size = average floor area of a house in Ruapehu district is 114 m<sup>2</sup> which equates to a roof surface area of 144 m<sup>2</sup> when taking into account a 30 degree roof angle and .75 m house eave.

Every 1 mm of rain over a 1 m<sup>2</sup> area of roof area equates to 1 litre of water. This number is multiplied by the runoff co-efficient (.95) to estimate the volume of water than is likely to be diverted to the storage tank during any given rain event.

Storage capacity of tank = 30,000 litre

### Model predictions

#### Winter/Autumn

Assuming that the household starts with a full tank (30,000 L) at the beginning of winter (1<sup>st</sup> June), based on historical rainfall data, our model predicts that a house in Ohura relying solely on tank water would have received sufficient rainfall during the winter/spring period (even during the driest and wettest winter/spring periods over the previous ten years) to meet the current household demand of 866 litres per day for a three person household living in a house with an average sized floor area within the Ruapehu district (114 m<sup>2</sup> which equates to a roof surface area of 144 m<sup>2</sup>) and having a 30,000 litre tank attached to the house.

#### Summer/Autumn

Assuming a household starts with a full tank (30,000 L) at the beginning of summer (1<sup>st</sup> December) our model predicts that a three person Ohura household relying solely on tank water would have likely experienced a water shortage during the wettest summer and autumn period (2010/11) and significant water shortage during the driest summer/autumn period when using 866L per day (figure 3 and 4). If conserving water to 600L per day, water shortage would occur during the driest summer/autumn period (figure 5), but not the wettest summer/autumn period in the last 10 years (figure 6).



## Appendix 8: Other health concerns

Ohura residents were also asked about other health issues in the community that the DHB should be aware of. A wide range of concerns were raised:

- Mental health of some in the area. A number of suicides were noted, and concern about the lack of care for these people, as well as the impact this has had on some local people.
- Health and social service access: an example was given of an elderly person with a son with cerebral palsy/muscular dystrophy who had been looking after him for 15 years. More generally, the cost and distance involved in getting to Taumarunui, and lack of transport support options.
- Not having vaccinations and other preventative care due to cost/distance to primary care.
- Access to other services such as WINZ.
- Fuel poverty i.e. cost of line rental for electricity.

Ohura residents were in favour of *Community Health Days*, which would include health checks such as cholesterol, vaccinations, blood pressure, health education and the like.

There are a number of facilities that could host community health days such as the Community Hall or the Ohura Bed & Breakfast.

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