

Appendix 17: Marae Water Supply

1. Introduction

Visiting a marae (sacred meeting place) is the primary Maaori cultural experience for the majority of New Zealanders, with 543,000 people, or one in five New Zealand adults, having done this over a 12-month period in 2001–2. Marae visits were above average in the Waikato region at 25 percent of the population over a year (Statistics New Zealand and Ministry for Culture and Heritage, 2003). With the marae as the centrepiece of Maaori community life, a reliable and safe marae water supply was identified as a priority by the five river iwi (NIWA et al., 2009).

This report provides information for initial scoping of the costs of providing water treatment plants to improve the safety of marae water supplies within the Waikato catchment. There are approximately 67 marae within the Waikato and Waipa River catchments (Table 1) that have been identified as lacking access to a reticulated treated drinking-water supply; only one (Mangatangi Marae) is listed on the New Zealand Community Drinking-Water Supplies database¹.

Table 1: Estimated number of marae with non-reticulated water supplies within the Waikato and Waipa catchments.

Zone	Estimated number of marae
Lower Waikato	15
Waipa	27
Middle Waikato	17
Upper Waikato	8
Total	67

The exact usage of these marae is unknown, but for the purposes of this Study it was assumed that an average marae may have a population as follows:

- 10–20 people on a daily basis.
- 200–400 people once a month.
- 2,000+ people four or five times a year.

A recent national survey of 18 marae (including two in the Waikato catchment) (NZFSA 2008) reported that a wide range of marae-based activities/events, including

¹ <http://www.drinkingwater.co.nz/supplies/supplies.asp>

permanent ongoing programmes including koohanga reo (child's day-care) (69 percent), tourist venues (8 percent), school visits (11 percent) and educational programmes (11 percent). Other activities included events such as weddings, birthday celebrations, tangi (funerals), unveilings, waananga (fora), workshops, land meetings and civil defence meetings. Meetings occur at regular intervals on marae, with an average of six events per month. The number of people at an event ranged from six to over 1,000.

The New Zealand Food Safety Authority survey (2008) results indicate potential safety issues with the water on marae due to the low level of treatment. The frequent use of marae by children (at koohanga reo), who are likely to be vulnerable to water borne infections, heightening the need to provide safe drinking-water. NZFSA found that over half the marae surveyed had their own water supply that included two sources, one of which was a roof supply. Only 38 percent of supplies were treated, and in one third of these cases this was by boiling the water. Only 31 percent of marae had their water supply tested for *E. coli*.

Because of the range of numbers that might be present on a marae at any particular time, it was assumed for this study that water supply planning should be based on a once-a-month sized event. For larger events, tankered water (from a municipal supply meeting national drinking-water standards) will need to be brought in to meet demand and to match the quality standards.

A per person water consumption rate of 400 litres per person per day has been assumed, though this is probably generous. Per capita water demand at marae is typically lower than for residential dwellings. Visitors to the marae, for example, do not necessarily expect to bathe as frequently or wash their clothes as often as they do at home. Water is mainly used for drinking, food preparation, washing hands and toilet flushing.

For most marae a 'point of entry' type water treatment system will be suitable. A reliable source of raw water is required and the system treats the water as it enters the site.

Assistance with funding marae water supply may be available from through the Ministry of Health Drinking-Water Assistance Programme, a \$154 million programme running for 10 years from 2006, which targets small water supplies in more deprived localities².

Actions to improve the quality of source waters prior to treatment are discussed in Appendix 9: Farms, Appendix 10: Faecal Contamination and Appendix 16: Rural

² <http://www.moh.govt.nz/moh.nsf/indexmh/drinkingwaterinnz-assistanceprogramme>

Water Supply. Issues relating to water availability are discussed in Appendix 15: Water Allocation.

2. Goal

The goal is that marae communities have access to safe drinking-water (meeting the national drinking-water standards³) at all times. While the typical day-to-day marae population may be relatively small, there will be times (e.g., hui (meetings) and tangi) where large groups may gather. During these times, the water supply and other sanitary services come under pressure.

3. Actions

In the absence of access to a reticulated treated water supply a suitable standard of treatment can be achieved by a locally available water treatment plant (WTP) package. A range of cartridge filtration/UV disinfection WTPs are available with capacities able to meet the needs of marae with monthly gatherings of 108 to 612 people.

Properly operated and maintained package WTPs should provide water of a sufficient standard, with relatively simple maintenance. The recommended action therefore is that WTPs are installed at all marae.

4. Risks and probability of success

The recommended WTPs are suitable for the numbers expected at a typically sized monthly marae gathering. At larger events tankered water will need to be brought in to cope with demand. It is uneconomic to design a water treatment system for large gatherings of people when it will be used relatively infrequently. Also, such large sudden demands on a water source such as a spring or well can cause flow rates that will draw contaminants into the supply from the surrounding soils.

The reliability of a WTP relies on regular maintenance. A member of the local community will need to be trained to carry out day-to-day maintenance of the plant, including changing the filters. If the plant is not properly maintained drinking-water quality declines.

A reasonable standard of source water has been assumed to be available at all marae. If the source water is of poor quality (e.g., has high turbidity or high concentrations of heavy metals or other contaminants) more extensive treatment

³ [http://www.moh.govt.nz/moh.nsf/pagesmh/8534/\\$File/drinking-water-standards-2008.pdf](http://www.moh.govt.nz/moh.nsf/pagesmh/8534/$File/drinking-water-standards-2008.pdf)

may be required to bring the water to the same quality (at an additional cost). Sources with slightly elevated turbidity may result in higher operating costs, due to the need to replace filters more frequently as they become clogged.

If the water source is not close by, there will be additional costs associated with piping the water to the marae.

It is assumed that the amount of water able to be supplied to the marae is limited by the water treatment plant, and not by the amount of raw water taken from the source (e.g., in summer, low river flows will not restrict the amount of water treated and supplied to the marae). If the reliability of the source is not good, the marae may have to rely on other water sources (e.g., tankered water) during times of short supply. Issues around water supply are discussed in Appendix 15: Water Allocation.

5. Costs and timelines

The following cost estimates are based on an average monthly population of 360 people. This will not be appropriate for some marae where the average size of monthly gatherings could be smaller or larger. Also, costs are based on the assumption that the raw water supply is of a reasonable quality. The actual costs may vary on a case-by-case basis due to differing raw water qualities.

The WTP package includes the following:

- Raw water pump, turbidity meter and settling tank.
- Multimedia sand filter.
- Cartridge pre-filter and filter.
- UV disinfection unit.
- Chlorine storage tanks and dosing equipment.
- pH correction filter.
- Installation.
- Three days' treated water storage.

The cost estimates in Table 2 are based on figures provided by a local WTP supplier who specialises in the supply, installation, commissioning and servicing of water treatment equipment. Note that the cost estimates are GST exclusive.

Table 2: Costs for a package WTP suitable for marae use.

Item	People attending a monthly event			
	108	234	360	612
Capital cost per package plant	\$38,400	\$73,100	\$106,200	\$143,000
Preliminary and general (12%)	\$4,600	\$8,800	\$12,700	\$17,200
Design (5% as package plant)	\$2,200	\$4,100	\$5,900	\$8,000
Contingency (30%)	\$13,600	\$25,800	\$37,400	\$50,500
Total capital cost	\$60,000	\$112,000	\$160,000	\$218,000
Annual operating cost	\$2,000	\$4,200	\$6,300	\$16,100

The total costs to construct package WTPs at all marae within the Waikato/Waipā catchment are given in Table 3. It is likely to take three to six months from time of order for a WTP to be installed.

Table 3: Cost estimates for providing marae WTPs (based on a monthly gathering size of 360 people)

Item	Zone			
	Lower	Waipa	Middle	Upper
Estimated number of marae	15	27	17	8
Cost per package WTP	\$106,200	\$106,200	\$106,200	\$106,200
Annual operating cost per package plant	\$6,300	\$6,300	\$6,300	\$6,300
Subtotal	\$1,590,000	\$2,870,000	\$1,810,000	\$850,000
Preliminary and general (12%)	\$191,000	\$344,000	\$217,000	\$102,000
Design (5% as package plant)	\$89,000	\$161,000	\$101,000	\$48,000
Contingency (30%)	\$561,000	\$1,013,000	\$638,000	\$300,000
Total capital cost	\$2,430,000	\$4,390,000	\$2,770,000	\$1,300,000
Annual operating cost	\$95,000	\$1,700,000	\$107,000	\$50,000

6. Uncertainties and information gaps

The costs for WTP installation could be refined if typical daily and peak monthly population figures could be provided for all of the marae within the catchment which lack reticulated water supplies.

The NIWA led research programme ‘Ecotechnologies for sustainable wastewater management for Māori communities’ will provide information for planning for marae water supplies, training for Māori to undertake water usage monitoring and

educational materials (e.g., on water conservation) specifically for marae communities. This research programme is due to be completed by October 2012 but some of the data relevant to marae water supply planning should be available by July 2011.

7. References

NIWA; Tipa & Associates; Diffuse Sources Ltd; Nimmo-Bell & Co. Ltd; AgResearch; Beca Group (2009). Waikato River Independent Scoping Study – Baseline Report – Framework for Restoration based on Maatauranga Maaori. *NIWA Client Report HAM2009-117*.

Statistics New Zealand & Ministry for Culture and Heritage (2003). A measure of culture: Cultural experiences and cultural spending in New Zealand. June 2003. 165 p.

NZFSA (2008). Te kai manawa ora: Marae food safety initiative survey. *New Zealand Food Safety Authority Position Paper No. 01/08*. 12 p.