



Te Puna Environmental Monitoring Results (Update January 2015)

Introduction

Many of the Bay of Plenty's coastal communities are served by on-site wastewater treatment systems. In areas of more concentrated dwellings located near sensitive water bodies or in areas utilised by the public, there is the potential for adverse environmental effects from on-site treatment systems. Adverse effects can include: odours; contamination of surface waters; addition of nutrients to water bodies; contamination of shellfish and foreshore environments; and negative health effects of water body users.

What Bay of Plenty Regional Council Monitor

Methods employed to detect contamination in the environment involve surveying surface waters (drains, seepages, streams) and groundwaters and using analytical and microbiological techniques to determine contaminant concentrations and/or loadings. Water samples are commonly analysed for nitrogen and indicator bacteria (*Escherichia coli* (*E.coli*) and faecal coliform). Similarly, lake or harbour waters are also monitored for indicator bacteria as a potential symptom of contamination.

What do the results tell us?

Nitrogen, particularly in its ammonia form ($\text{NH}_4\text{-N}$) and to a lesser extent in its oxidised form, nitrate –nitrite-nitrogen (NNN) is used to help detect the presence of wastewater in water. Elevated results can indicate sewage contamination. Washing powders and liquids contain phosphorus which can pass through septic tanks and contaminate groundwater. This is reported as Dissolved reactive phosphorus (DRP) and an elevated level in groundwater indicates contamination from septic tank systems.

Micro-organisms such as bacteria, protozoa and viruses can be removed from septic tank effluent in the top soil layers, dependant on soil pH, moisture, temperature, and soil microbial population. If effluent mixes with a saturated zone (e.g. elevated water table) connected to surface waters then faecal micro-organisms and pathogens can be readily transported into the environment. Elevated results of these indicators or the presence of them in shellfish can indicate a contamination problem. Bacterial contamination may have human or animal origin.

Microbial Source Tracking

New technology is also emerging to help identify sources of faecal contamination. Microbial source tracking (MST) is a technique in which *E. coli* or enterococci, are isolated from water samples. These isolates are then fingerprinted using either DNA-based or phenotypic/biochemical based-methods. Results can be compared to a library of DNA based markers to identify sources.

Monitoring Sites

Drains and seeps have been sampled in many locations around the foreshore (see figure below). Bathing surveillance monitoring is undertaken weekly from late October to mid-March at a site in the main channel adjacent to the boat ramp.



Results

Several drains show high bacterial contamination (Figures 1 & 2) typical of poorly treated septic tank effluent. The highest bacterial contamination occurs on the western side of Te Puna where a number of dwellings are located on flat low lying land. Median *E.coli* levels above the microbiological water quality guideline (red action mode) occur in two of the drains on the east side and one on the west side (Figure 1). This is similar to results reported in 2006.

Several of these west side drains as well as two of the drains on the north side of the Waitui Reserve have elevated ammonium-nitrogen ($\text{NH}_4\text{-N}$) concentrations (Figures 3 & 4). Drains on the eastern side have lower ammonium-nitrogen concentrations. Conversely, drains on the eastern side have higher nitrate-nitrite-nitrogen (NNN) concentrations than their western counterparts. Elevated phosphorus levels on the eastern side also indicate some potential effluent influence.

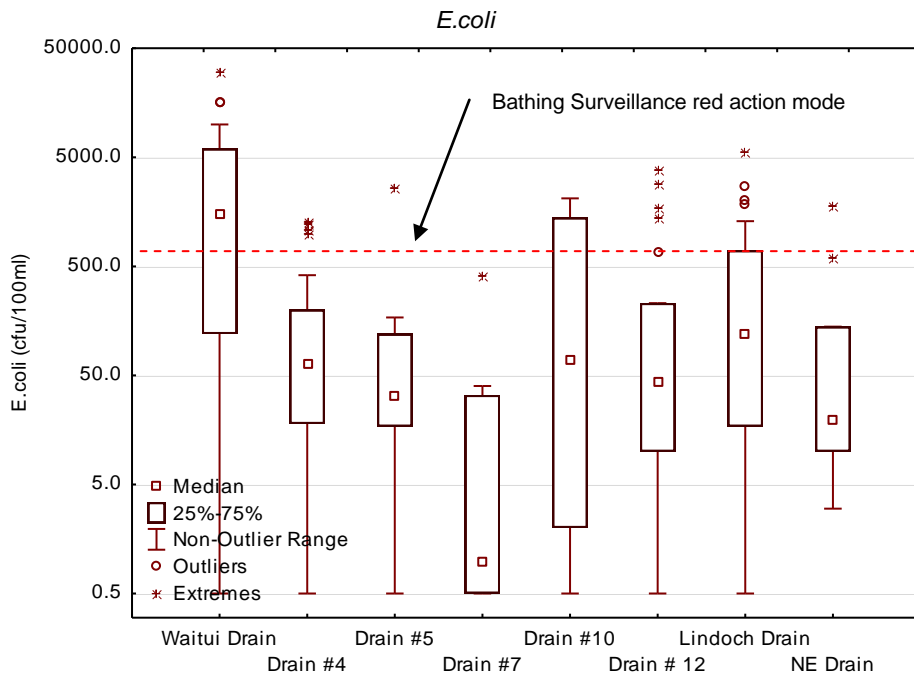


Figure 1 Box-whisker plots of *E. coli* concentrations, Te Puna drains, 2006 to 2015.

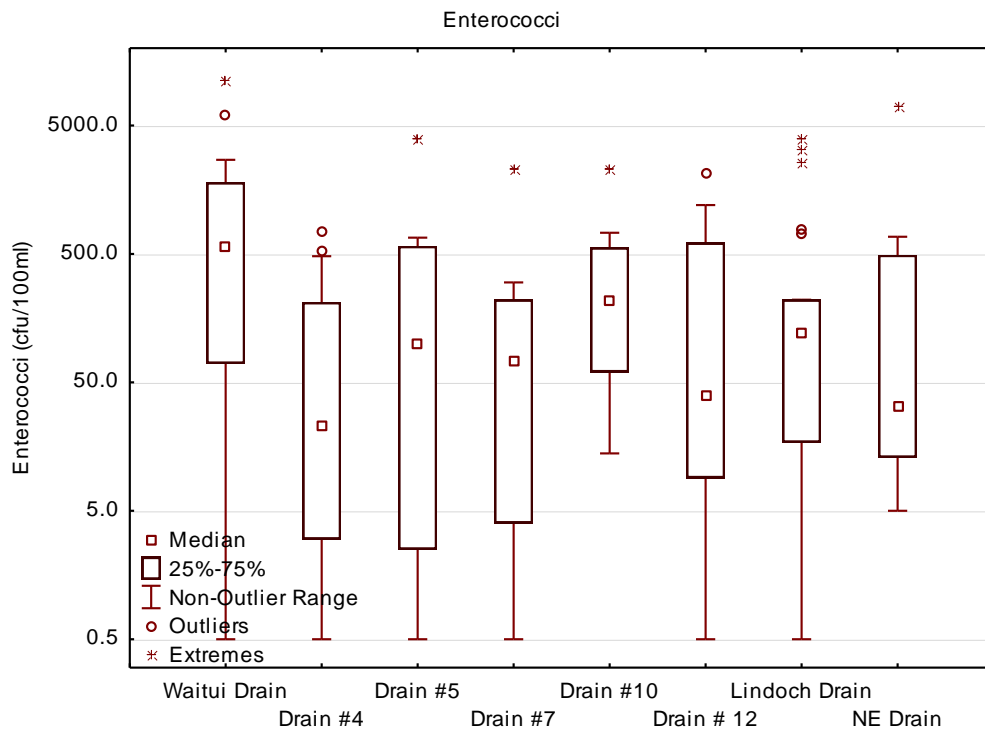


Figure 2 Box-whisker plots of enterococci concentrations, Te Puna drains, 2006 to 2014.

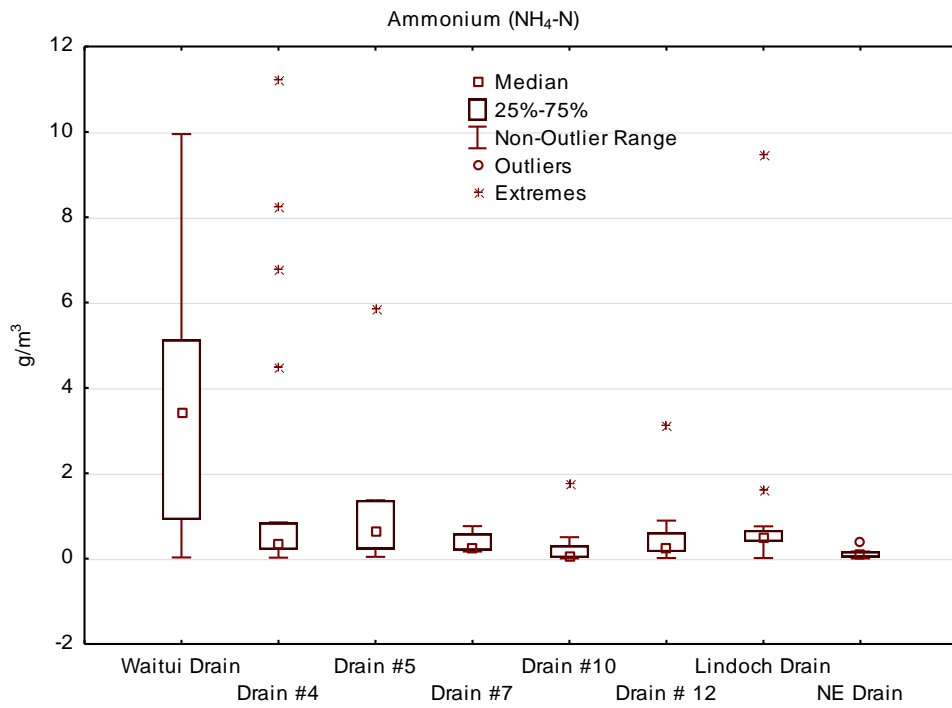


Figure 3 Box-whisker plots of NH₄-N concentrations, Te Puna drains, 2006 to 2014.

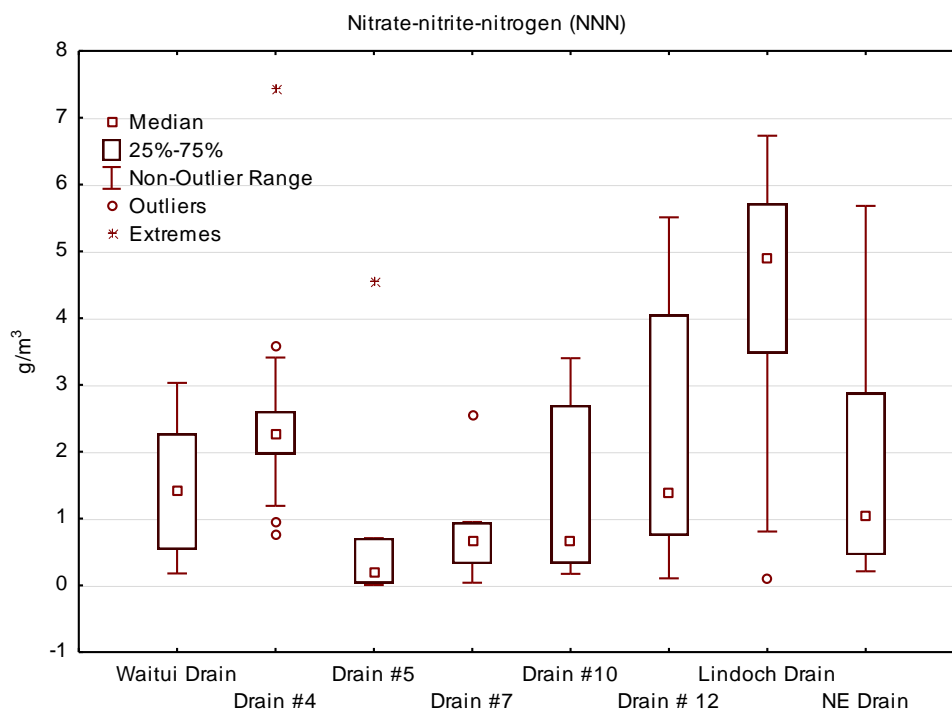


Figure 4 Box-whisker plots of NNN concentrations, Te Puna drains, 2006 to 2014.

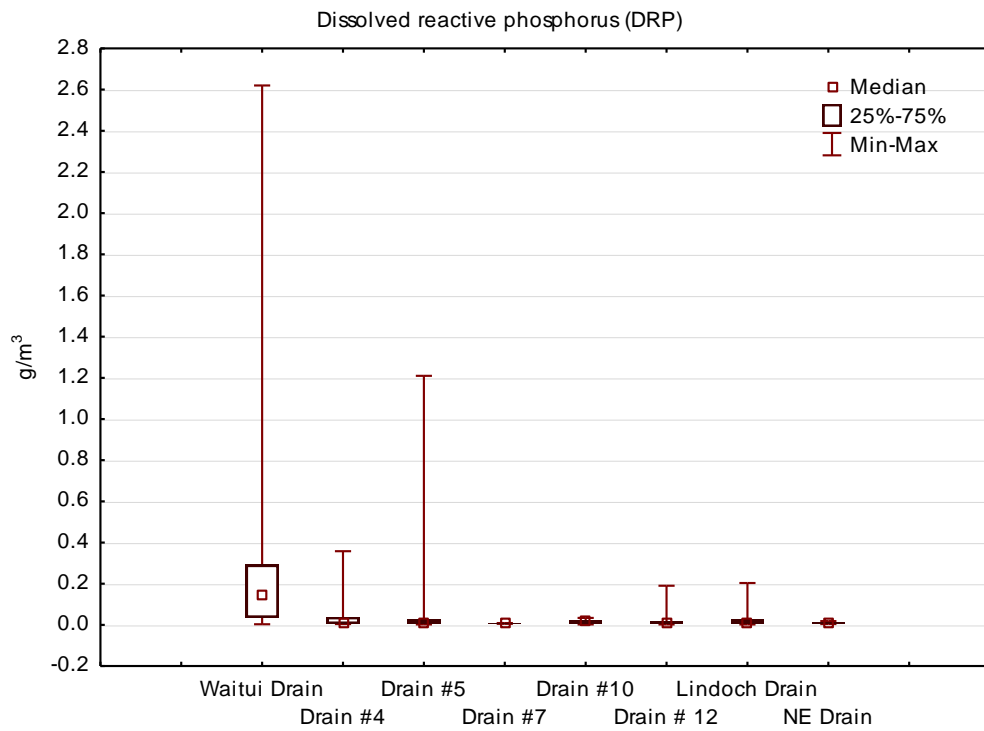


Figure 5 Box-whisker plots of DRP concentrations, Te Puna drains, 2006 to 2014.

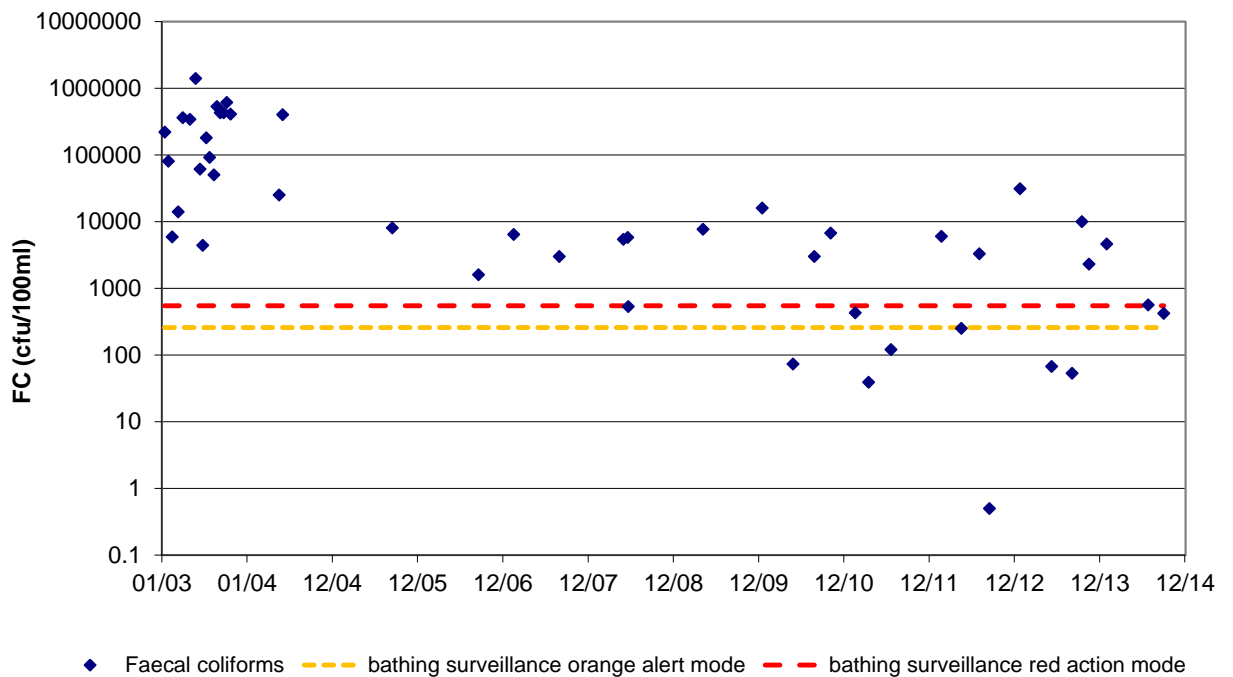


Figure 6 Waitui drain faecal coliform concentrations.

One of the main stormwater drains, the Waitui drain, has not only high indicator bacterial levels but also elevated nutrient levels, indicating contamination from on-site effluent treatment systems. Figure 6 indicates that faecal contamination was high in 2002, 2003. This has returned to a more moderate contamination level in recent times possibly due to septic system servicing, with the most recent samples being low probably due to lower flows at time of sampling. Other faecal indicator bacteria (*E.coli* and enterococci show similar results as does a reduction in ammonium-nitrogen (Figure 7).

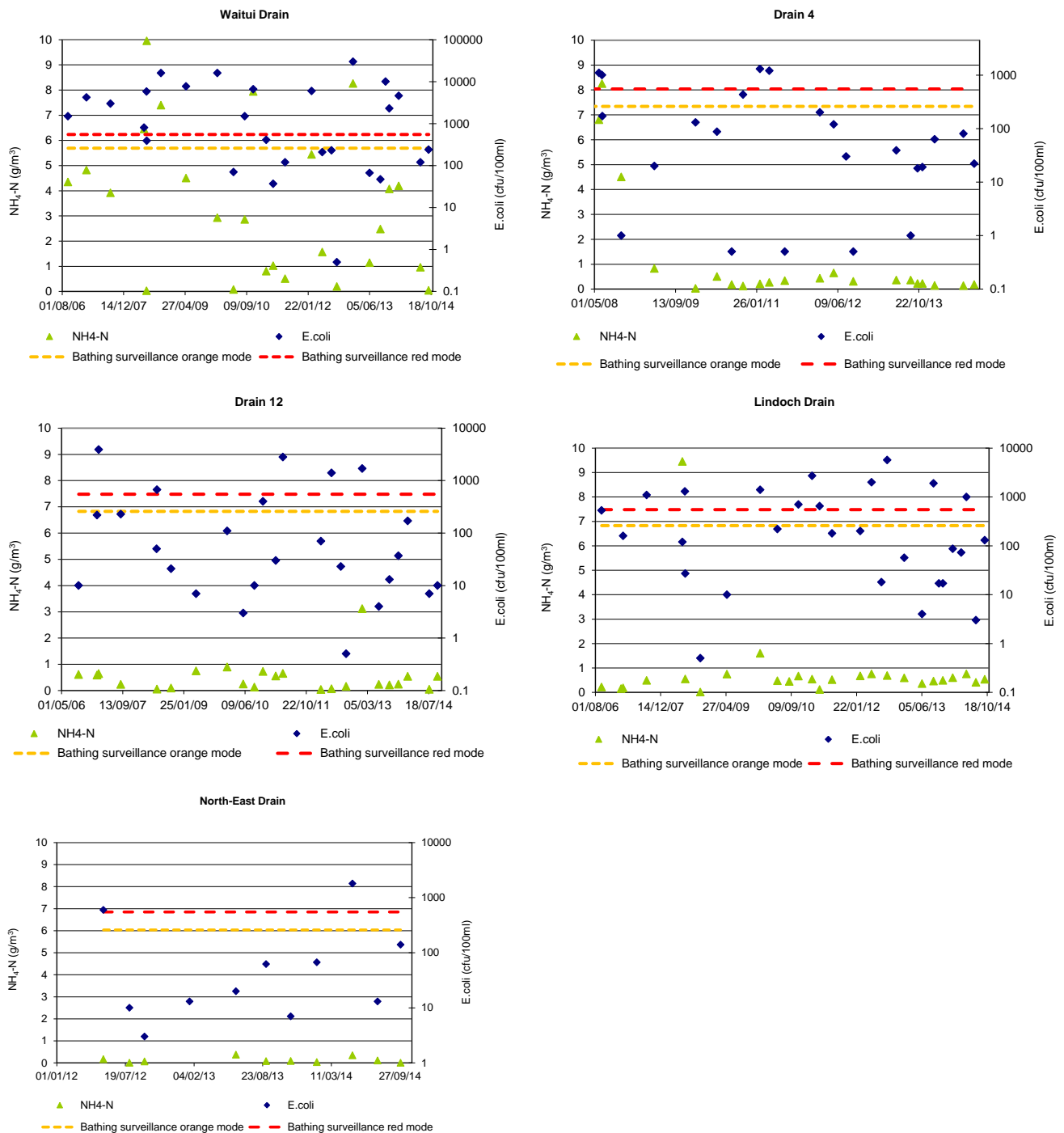


Figure 7 *E.coli* and $\text{NH}_4\text{-N}$ concentrations, Te Puna drains.

Drain 4, also on the western side, shows a similar pattern, whereas the eastern drains (Lindoch and Drain 12) have more consistently low ammonium-nitrogen and at times elevated indicator bacteria levels. As the nitrogen pattern is different in some the eastern side drains compared to the western (i.e. high NNN lower NH₄-H) so an MST sample was taken for Lindoch drain. The sample taken in May 2014 returned positive for human markers indicating septic tank contamination is occurring.

The north-eastern drain show mixed results with a high *E.coli* concentration of 600 *E.coli*/100ml in May 2012, a rain affected sample, and another elevated result (1800 cfu/100ml) in May 2014 (Figure 7). In January 2014 indicator bacteria faecal coliform and enterococci were both elevated indicating some contaminant source. Ammonium-nitrogen levels have remained consistently low, but nitrate-nitrite-nitrogen has been elevated on occasion.

Microbial Source Tracking Results

Three drains have been tested for the presence of human *E.coli* isolets: Waitui drain; Lindoch drain; and NE drain. Both Waitui drain and Lindoch drain have tested positive for two human based isolets (Human BacH and Human BiADO) on two separate sampling occasions: July 2014 and January 2015. No human marker was detected in the NE drain.

Recreational Water Quality

The microbiological swimming water quality of the Te Puna estuary is good based on monitoring of the indicator bacteria enterococci (Figure 8). Only four results have been above the marine bathing surveillance red alert threshold (280 cfu/100ml) over the past twelve seasons.

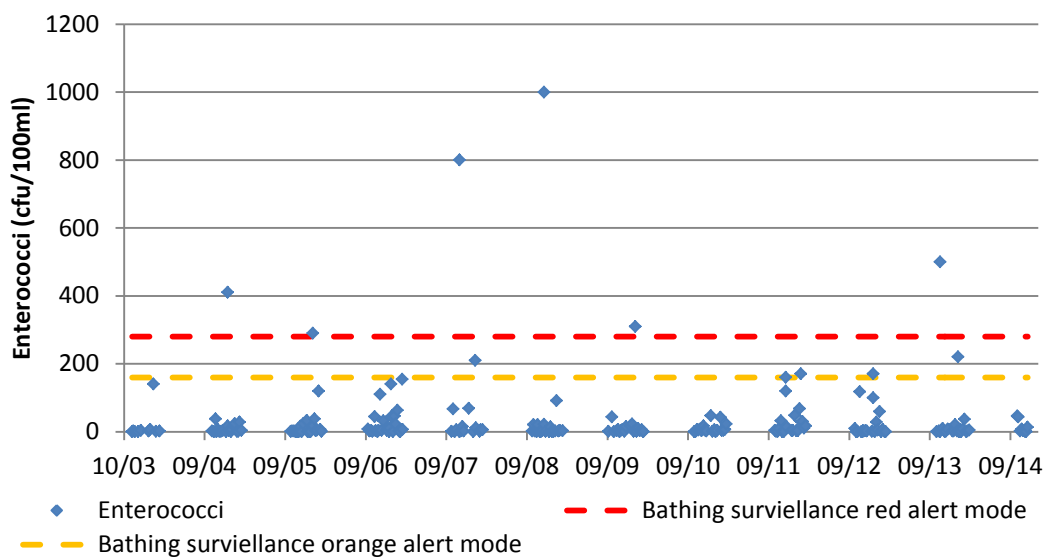


Figure 8 Bathing surveillance monitoring results, Enterococci, Te Puna, 2003 to 2015.

Other factors related to Water Quality at Te Puna

1. Western Bay of Plenty District Council has installed a 'holding tank' at the public toilet in Te Puna and no longer discharges to the environment. The tank is pumped out as required.

2. Properties in Te Puna West are located in a 'Maintenance zone' as specified by rule 1 of the On-site Effluent Treatment Regional Plan 2006. This specifies that septic tanks are subject to a regular pump out and inspection programme.
3. The OSET Regional Plan specifies that septic tanks in Te Puna become discretionary in 1 December 2015. This means that at that time a resource consent will need to be obtained or an advanced wastewater system installed, or (if available) the wastewater connected to a Council sewerage scheme. The Western Bay of Plenty District Council is investigating this option for some Te Puna properties.

Summary

Te Puna west drains continue to show high levels of bacteria and ammonium-nitrogen ($\text{NH}_4\text{-N}$), a sign of septic tank contamination. Drains to the east have occasional high indicator bacteria levels but are distinct from the western drains due to their much higher nitrate-nitrite-nitrogen (NNN) to ammonium-nitrogen ratio. This higher ratio may be due to other catchment influences and transformations of nitrogen from septic tank effluent.

Contact recreation water quality in the estuary remains good despite the high level of bacterial contamination in some drains. The main risk to beach users is the contamination of the foreshore adjacent to contaminated drains.

An intensive survey of oysters on the opposite side of the estuary to the contaminated drains displayed little viral contamination compared to other shellfish beds in the southern end of Tauranga Harbour. During two storm events in 2008 positive F- RNA bacteriophage typical of both animal and human sources were detected. This indicates that contamination from rural sources and septic tanks is occurring.

New technology is also emerging to help identify sources of faecal contamination. Microbial source tracking (MST) results have shown that Waitui and Lindoch drains are contaminated with human faecal material.