Otuihau / Whangārei Falls water quality partnership scoping report

December 2015

NORTHLAND REGIONAL COUNCIL

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Introduction

Rationale

In March 2015, the Northland Regional Council (NRC) received a request from Whangārei District Council (WDC) to carry out a scoping study to identify the fencing and planting requirements for tributaries of the Otuihau catchment. The WDC-hapu strategic partnership forum, Te Kārearea, had identified improving water quality at Otuihau Falls as a priority focus for both the health and well being of the local community swimming there and because this area is a key tourism site for Whangārei.

Water quality monitoring at the falls has been done during the summer swimming season since 2004. Over the period from 2004 to 2015, the bacterial levels in the water were within Ministry of Health (MOH) and Ministry for the Environment (MFE) recreational bathing guidelines approximately 64% of the time. That figure rose to 75% of the time from November 2012. High levels of contaminants usually occur as pulses during and just after a heavy rainfall event, when it is unlikely many people will be swimming. Further, personal comments by Northland District Health Board staff suggest that there are no formal records of illness caused by swimming at the falls.

However, monitoring results do show contaminants in the water. This is a concern for the local community and signs warning of water pollution at a popular tourist site are likely to detract from the experience of visitors.

Therefore the current scoping report outlines work undertaken by NRC staff to identify key actions required to improve water quality in this catchment.

Collaborative group members

An initial NRC/WDC collaborative group formed in May 2015 to initiate scoping of the project. The group has met three times since then to discuss water quality issues and likely scoping requirements. Key personnel involved so far have been:

- Northland Regional Council (NRC) staff: Lorna Douglas, Darryl Jones, Duncan Kervell, Carol Nicholson, Jean-Charles Perquin;
- Whangārei District Council (WDC) staff: Joanna Wilson, Andrew Carvell, Thane Richardt, Andre Hemara; WDC councillor: John Williamson;
- Hapu representatives: Mike Kake, Pehiaweri Marae; Hona Edwards, Ngā Kaitiaki o Ngā Wai Māori.

Ground-truthing work undertaken

Water quality monitoring

NRC's state of the environment (SOE) team has been monitoring water quality at the falls since 2004 as part of the summer Recreational Swimming Water Quality Programme. In July 2014 a further three permanent sampling sites upstream of the falls were established to identify problem areas. All four sites (including the one at the falls) are sampled monthly throughout the year on the same day, at the same time of the month and at the same time of day. Measurements include water temperature, dissolved oxygen, visual clarity, conductivity, turbidity, *E. coli*, nutrients and faecal source tracking.

Four extra sampling sites were monitored for five weeks only during May-June 2015. These sites were chosen because of their potential to identify contaminants flowing into the Waitaua Stream or because they were in a previously untested tributary of the Hātea. The same suite of tests was undertaken at these sites as the permanent SOE sites.

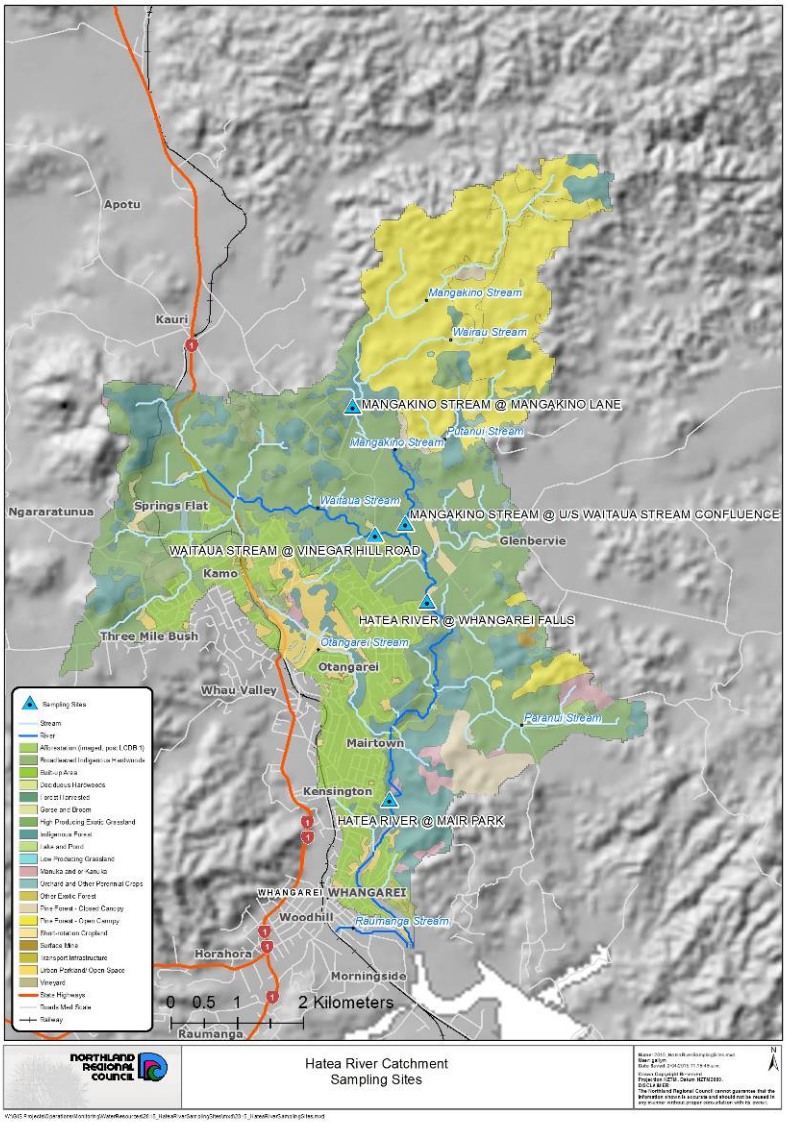


Figure 1: Hātea River catchment water quality sampling sites

Stream surveys

The majority of streams in the catchment were surveyed between 27th August and 9th October 2015 by NorthTec practicum student Jenny Gillanders accompanied by an NRC staff member. Landowners in the catchment were informed of the intended surveys via a mailbox letter drop prior to the surveys starting.

Streams were walked either in the stream or on the banks close to the water, depending on access, topography, vegetation, etc. Surveying focussed mostly on the presence or absence of stock exclusion fencing, but also noted the presence of stock water troughs; stream bank erosion; presence of weeds; presence of water takes or discharges; fish passage barriers and/or other water obstructions. All data observations were recorded in a data collection programme *Fulcrum,* with GPS co-ordinates transferred to NRC's GIS mapping system.

Results

Monitoring

The main points of the SOE sampling are:

- The Mangakino Stream appears to contribute significant *E.coli* to the Hātea River. Both Mangakino Stream sites also have high turbidity levels which are possibly linked to forestry operations at the head of the catchment.
- The Waitaua Stream results frequently had ammoniacal nitrogen (NH_4) levels above ANZECC 2000 guidelines, as well as elevated nitrate/nitrite nitrogen (NNN) levels.
- Dissolved reactive phosphorous (DRP) appears to be an issue at all sites.
- Microbial source tracking (MST) in the Waitaua and Mangakino Streams identified ruminant and wildfowl sources.

Further detail can be found in the SOE monitoring department memo in the Appendices.

The monitoring at the extra four sites was undertaken in too short a period to infer any meaningful trends, but did produce some interesting results. The main issue identified was elevated NNN at three out of the four sites. Two sites were referred on to NRC's monitoring team, whose investigations revealed:

- Illegal greywater systems from two residential properties on Pipiwai Rd, which possibly accounted for high nitrate/nitrite nitrogen readings at the downstream site. These systems have since been upgraded to meet NRC rules. Results of further monitoring were inconclusive, however compliance staff at NRC feel that the high N readings have possibly been influenced by a small seep/tributary upstream of the lower site, as this area is filled with decomposing vegetation.
- Monitoring a drain near Greenfingers showed high turbidity and high levels of ammonia (NH_4) and nitrate/nitrite nitrogen. Investigations at the Greenfingers site highlighted a need for their stormwater ponds to be cleared, which was subsequently done. However, the monitoring site described in this report was upstream of the

Greenfingers stormwater discharge, so further investigation is probably warranted to identify the source(s) of contaminants.

Pathogen testing at Whangārei Falls

Pathogen sampling was undertaken at the Whangārei Falls site on three occasions – June 2014, January and August 2015, to investigate the relationship between the concentration of faecal indicator bacteria (FIB) and the presence of pathogens in water.

Some pathogens were detected in June 2014 and August 2015 when FIB levels exceeded the MfE/MoH swimming water quality guideline of 550 *E. coli*/100mL, whereas no pathogens were detected in January 2015 when FIB levels were below guidelines. Of the pathogens tested for, only campylobacter species and one *Giardia lamblia* cyst were detected. No salmonella species, *Escherichia coli O157 (*per 100 mL sample – 1 E. coli O157 was detected in a 1 L sample collected on 11/06/14*), Cryptosporidium parvum* oocysts and enteric viruses were detected.

Campylobacter can cause gastroenteric illness in humans. They are found in the gut and faeces of warm-blooded animals, including humans, ruminants and birds. The testing undertaken did not differentiate what the likely source of the campylobacter detected was.

Stream surveys

GIS mapping shows that only a small percentage of the catchment has stock exclusion fencing. Approximately 30% (29kms) of waterways in the catchment are in land under pasture. Of those 29kms, approximately 90% do not have effective stock exclusion fencing; i.e. approximately 53 kms of fencing is required to exclude stock from both sides of the tributaries of the falls (including upgrading existing fencing and establishing new fences).

Indicative costs to complete fencing of these streams (53 kms) would be approximately $318,000 for 3WE fencing @ $6/m or $477,000 for post & 5 wire fencing @ $9/m.

Observation also noted that the waterways are currently being used as stock drinking water in many, if not all, paddocks adjacent to unfenced streams.

Letters put in letterboxes advising landowners of the upcoming stream surveys, were generally well received, with those landowners spoken to directly supportive of the intent of the project.

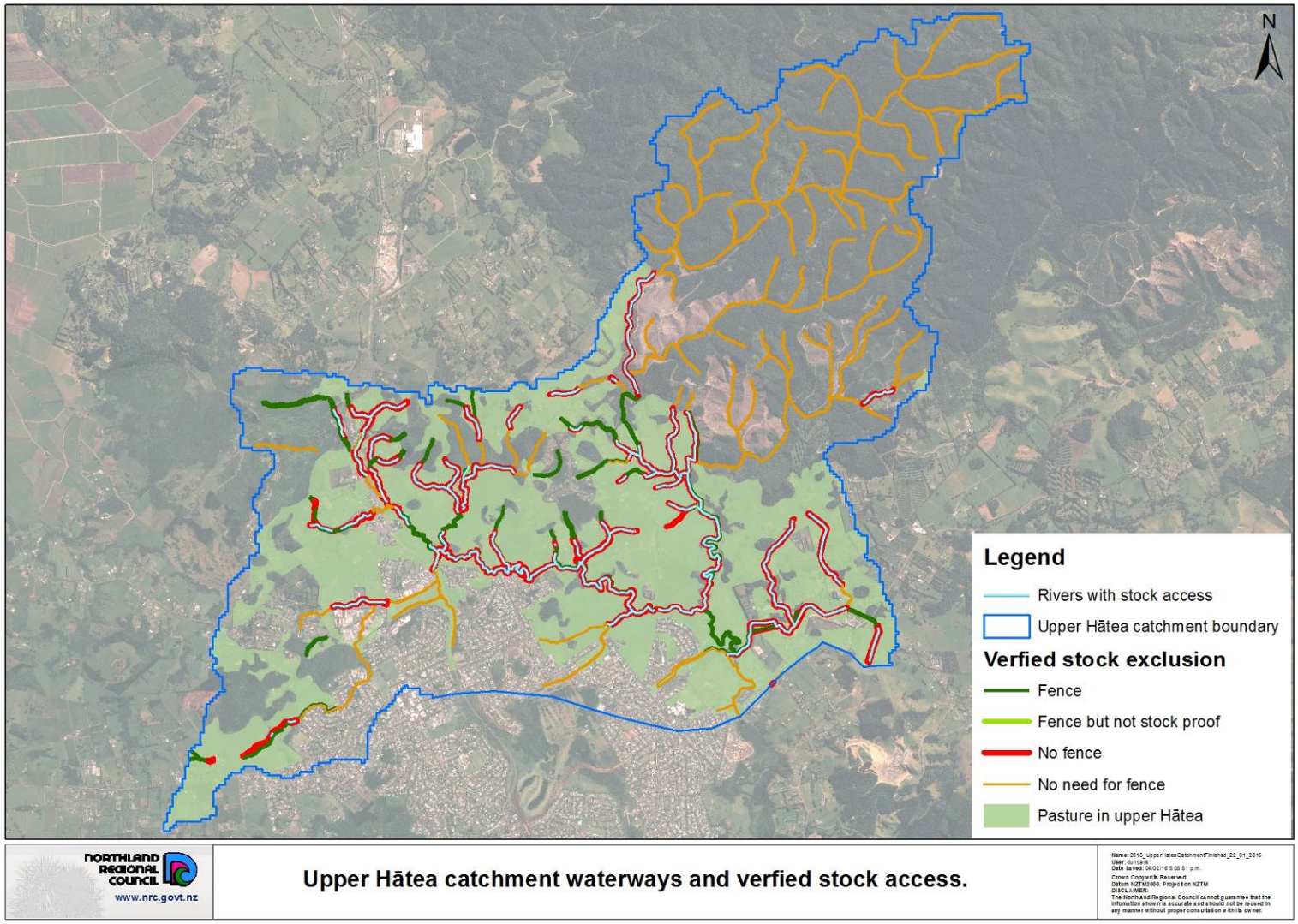


Figure 2: Waterways in the upper Hātea catchment requiring fencing, based on 2015 stream surveys

Discussion

Monitoring result issues

Of the two main sources of faecal contaminants identified in the MST results (both earlier testing and the most recent results), concentrating on removing stock (ruminant) access to the waterways and creating riparian buffer zones would be the most practical way of reducing bacteria levels in the catchment.

Fencing off waterways and wetlands to prevent access by grazing stock is one of the most effective water quality improvement measures that can be implemented on farmland. Animal effluent (dung and urine) add nutrients and bacteria to water, either directly when stock are standing in or near streams, or via paddock runoff. Stock accessing streams can also contribute considerable amounts of sediment to waterways from bank erosion and disturbance of stream beds.

Turbidity in the Mangakino Stream is likely to be connected to on-going harvesting operations in Glenbervie Forest. Results from the SOE monitoring sites on the Mangakino Stream and at the falls are consistent with long term NRC monitoring being done in the forest itself. Sites lower down the catchment (i.e. lower Mangakino and at the falls) or in areas not yet completely harvested have returned lower turbidity results, as would be expected.

This forest was originally planted for soil conservation purposes, whilst providing an economic output. Production forestry does cause a spike of sediment yield for a few years post harvest, but studies have shown that over the period of a rotation, the total sediment yield of a production forest is considerably less than on similar land under pasture. For the Mangakino Stream therefore, it is likely that forestry operations are causing a spike in turbidity levels, which may reduce once new plantings have grown and groundcover is re-established.

Further investigation is needed to identify the source(s) of the frequently high nitrogen (NH_4 and NNN) levels at the Waitaua Stream site. The Waitaua Stream catchment has a variety of land uses, including well established residential housing and large lifestyle properties. Most likely sources of the different forms of nitrogen are stock access to the streams and non-compliant domestic wastewater systems spread throughout the catchment.

Sources of avian bacteria

Managing contaminants deposited by wild fowl would be far less straight forward than stock exclusion from waterways. A variety of ideas have been discussed in the collaborative group meetings, such as signage to discourage feeding the ducks at the falls and the occasional judicious cull. However, research both in New Zealand and overseas suggests that campylobacter bacteria found in wild fowl isn't as infectious to humans as types found in cattle and poultry (Elaine Moriarty, ESR, Oct. 2015 pers. comm.). Further analysis of the water at the falls to determine if the types of campylobacter present there are types seen in humans would be useful to help determine if wild fowl need to be managed for human health impacts.

Interestingly, the Whangārei District Health Board has not reported many cases of illness related to bathing at the falls. There could be several reasons for this, for example locals may have built up immunity to the pathogens in the water there, whereas if tourists became ill from bathing at the falls, they may have travelled elsewhere by the time the illness showed. Further, a lack of reporting doesn't necessarily mean there isn't a link between bathing at the falls and illness.

Stock exclusion fencing requirements

Under the operative Regional Water and Soil Plan for Northland, there are no rules requiring stock to be excluded from waterways, with the exception of the coastal marine area (CMA), where stock have been required to be excluded since 2010. The Northland Regional Policy Statement and regional plans are currently under review and it is possible that some form of stock exclusion requirements may be introduced to the new regional plan for specific high value waterways.

However, enforcement of landowners with stock that contaminate waterways is a time consuming and costly exercise, because of the difficulty of capturing proof of offending stock ownership. Therefore, the established council focus of working alongside landowners rather than using an enforcement regime is likely to remain the status quo for much of the region in the foreseeable future. Council land management staff work with landowners, providing advice and offering financial support for waterway fencing through the council's contestable, annual environment fund which can provide up to 50% of fencing costs.

Establishing fences at a recommended distance of at least 5m (wider in sloping areas) away from stream banks would create buffer strips which would slow paddock runoff, allowing sediment and other particles to drop out of the water and be captured by riparian vegetation. Excluding stock from streams has been shown in other areas to reduce sediment contributions to water by 80% over a seven year period as the banks stabilise.

To be effective, riparian fencing needs to be on the outside of any bush or tree line that might shade the river. Contrary to popular belief, the shaded area under trees has little ability to filter sediment in runoff where no ground cover exists.

Stock drinking water

Because many paddocks adjacent to waterways didn't appear to have troughs, getting those paddocks fenced is only the first part of dealing with the problem of stock access to water. The cost of setting up a reticulated water supply for stock is often considerably more expensive than the associated riparian fencing. NRC's environment funding does not currently cover water systems, so stock water supply may be an issue that inhibits increasing lengths of streams fenced.

Planting

The biggest water quality benefit to be gained in this catchment is likely to come from stock exclusion fencing. While riparian planting can help improve water quality, in some cases it is likely to be adding more benefit to increasing habitat for native species than water quality. Certainly planting is not recommended in areas where there is still stock access. Planting is recommended where there is evidence of bank erosion. In areas of severe bank erosion, shrubby willows are recommended, with poplar poles in adjacent areas of earthflow erosion.

Native species such as ribbonwood (*Plagianthus regius)* and species with fibrous root systems such as flax and various *Carex* species are recommended for less severe bank erosion.

Recent work undertaken by other agencies in the catchment

Community planting at Balmoral Reserve coordinated by Mountains to Sea Conservation Trust (MTSCT) staff has completed riparian planting of this reserve strip. Unfortunately land on the other side of Waitaua Stream from the planting site remains unfenced. This riparian planting is likely to be improving habitat and aesthetic values more than water quality.

Kim Jones - (MTSCT) and WDC staff have identified next year's community planting site on WDC reserve land adjacent to Waitaua Stream, upstream of the Balmoral Reserve planting. WDC will also be supporting Mountains to Sea Conservation Trust programmes to undertake some community based water quality sampling and associated signage over the next year. The water quality sampling sites have been chosen in consultation with NRC staff to help complement monitoring programmes already in place.

Where to next

Promotion of stock exclusion fencing of all waterways is likely to be the most useful action given microbial source tracking results. This will in many cases also require reticulated stock drinking water which will probably be more costly than fencing.

- Education / advocacy via NRC Water quality improvement plans for all properties
- Where to start? Upper catchments, low hanging fruit/ hotspots?
    - Letters have been sent to four landowners with land adjacent to Waitaua Stream opposite next year's proposed community planting sites to try to reduce stock damage to the plants.
- Promotion of efund for fencing
- Sources of financial support for setting up reticulated water systems?
- Riparian planting post fencing – what support is available for funding, planting, maintenance?

Hydrological processes and the contour of the pool above the falls could also be contributing to base levels of contamination. Possibly regular swimming in the pool is stirring up sediment, which remains suspended because of a low level of flushing. Further investigation into this issue, in the context of flow rates of the river, is recommended.

Potential funding sources

NRC environment fund

WDC

Reconnecting Northland

Potential community partners

Those already engaged in the catchment include:

- Mountains to Sea Conservation Trust (MTSCT) -Whitebait Connection & Drains to Harbour: (Kim Jones)
- Pehiaweri Marae (Les Wakefield)
- Tikipunga / Glenbervie networkers group (Kathryn McKenzie), including Tiki Pride
- Northland District Health Board
- Schools in the area (Often already involved via WBC / DTH)
    - Tikipunga High School
    - Kamo High School
    - Kamo Intermediate School
    - Glenbervie Primary
    - Tikipunga Primary
    - Totara Grove Primary
    - Kamo Primary
    - Hurupaki Primary
    - Te Kura Kaupapa Māori o Te Rawhiti Roa

Others to approach:

Rayonier (Glenbervie Forest)

Totara Parklands Estate

Farmlands Kamo

Greenfingers Kamo

Appendices

MEMO

NORTHLAND REGIONAL COUNCIL

Te Kaunihera a rohe o te Tai Tokerau

Date:	30th October 2015
To:	Lorna Douglas – Land Management Advisor
From:	Carol Nicholson – Environmental Monitoring Officer – Freshwater Ecology
Subject:	Hātea catchment water quality results (*E. coli* and nutrients) July 2014 – September 2015

This memo updates interim water quality results from a previous memo produced on the 1st May 2015 for Hātea catchment monitoring sites which are sampled as part of the Whangārei Harbour Wairoa Northland Water priority catchment programme. It aims to help identify water quality problem areas within the Hātea catchment, focusing mainly on faecal contamination (indicated by levels of the indicator bacteria *E. coli*) commonly occurring at the Hātea at Whangārei Falls swimming site. Five sites are monitored within the catchment as shown in Table 1 and

Figure 1.

Sites are sampled monthly on the same day at the same time of the month and at the same time of the day. Measurements include water temperature, dissolved oxygen, visual clarity (black disc), conductivity, turbidity, *E. coli*, nutrients and faecal source tracking. Results are also presented from targeted monitoring at four further sites in the Waitaua catchment carried out in May and June 2015. This memo concentrates on *E.coli* and nutrient results only.

The Whangārei Falls site has been sampled and analysed for *E. coli* since November 2004. Over the overall sampling period bacteria levels were within the Ministry for the Environment (MfE) and Ministry of Health (MoH) Microbiological Water Quality Guidelines for Marine and Fresh Water Recreational Areas (2003) 64.3 percent of the time. Over the two years from November 2012 to March 2015 the guidelines were met 74.5 percent of the time. Microbial source tracking (MST) results for the Hātea at Whangārei Falls site has identified wildfowl, ruminants and dogs as the sources of contamination causing elevated *E. coli* levels. Both ruminant and wildfowl are identified as sources in the Waitaua and Mangakino Streams, which are tributaries of the Hatea, both located upstream of the Whangārei Falls.

Table 1: Water quality monitoring sites in the Hātea catchment

Site Number	Catchment	Site Name
100194	Hātea	Hātea at Mair Park
105972	Hātea	Hātea at Whangarei Falls
109982	Hātea	Mangakino upstream Waitaua confluence
109795	Hātea	Mangakino at Mangakino Lane
108738	Hātea	Waitaua at Vinegar Hill Road

A large amount of data is generally required to accurately assess water quality and this is even more critical in regions subject to high rainfall events such as Northland where contaminants wash off the land into waterways. Only limited data is currently available for the Hātea catchment where water sampling began in July 2014 for most sites listed above. More data is available for two sites – Hātea at Whangārei Falls and Hātea at Mair Park –these sites have been monitored for a number of years as part of other water quality monitoring programmes, i.e. the Recreational Swimming Water Quality Programme (RSWQP) and the State of the Environment (SOE) River Water Quality Monitoring Network (RWQMN) programme respectively.

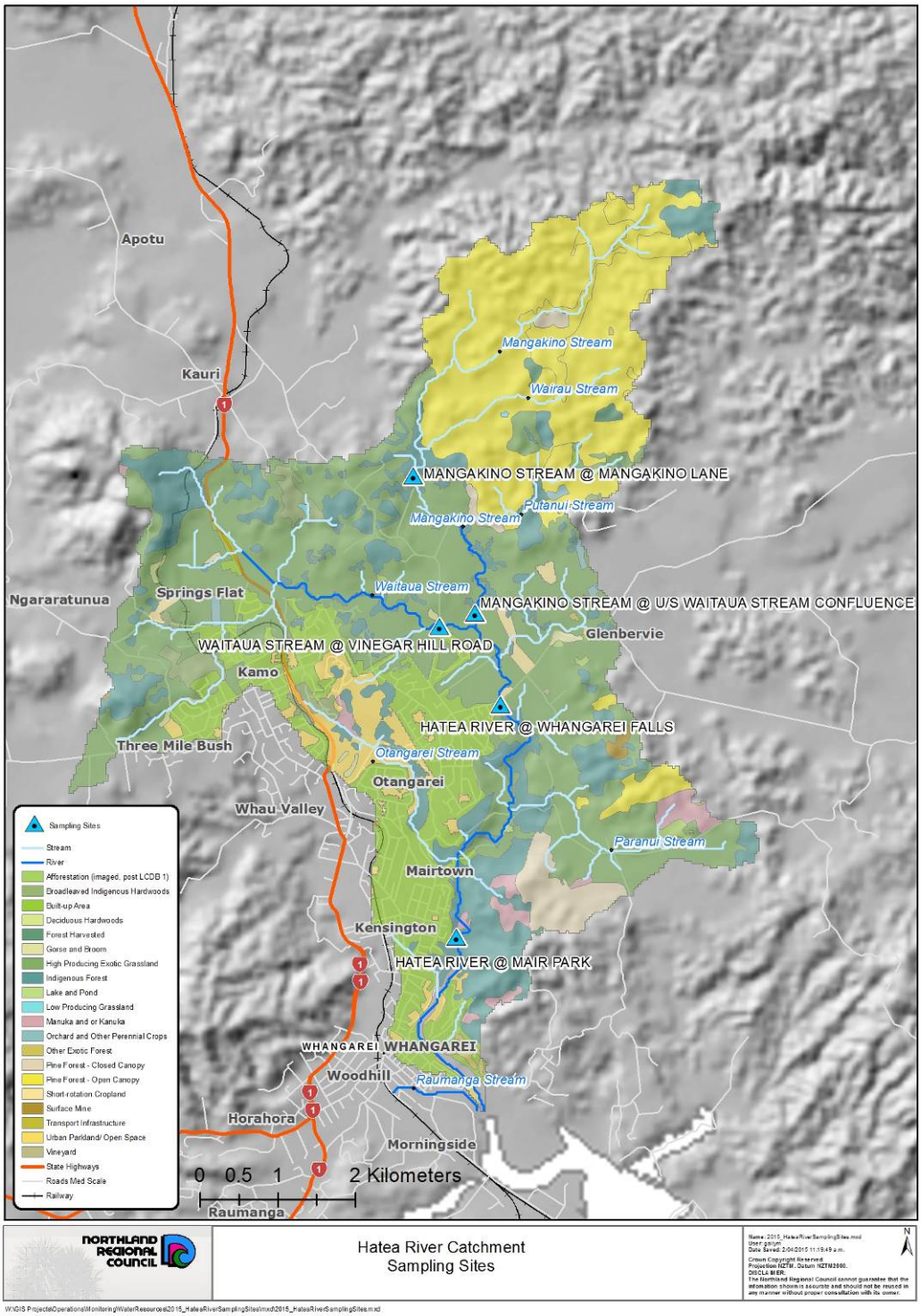

Apotu
Kauri
Mangakino Stream
Wairau Stream
MANGAKINO STREAM @ MANGAKINO LANE
Putanui Stream
Mangakino Stream
Ngararatunua
Springs Flat
Waitaua Stream
MANGAKINO STREAM @ U/S WAITAUA STREAM CONFLUENCE
Glenbervie
WAITAUA STREAM @ VINEGAR HILL ROAD
Kamo
HATEA RIVER @ WHANGAREI FALLS
Three Mile Bush
Otangarei Stream
Otangarei
Whau Valley
Paranui Stream
Mairtown
Kensington
HATEA RIVER @ MAIR PARK
WHANGAREI
WHANGAREI
Woodhill
Raumanga Stream
Horahora
Morningside
Raumanga
0 0.5 1 2 Kilometers
Sampling Sites
Stream
River
Afforestation (imaged, post LCDB 1)
Broadleaved Indigenous Hardwoods
Built-up Area
Deciduous Hardwoods
Forest Harvested
Gorse and Broom
High Producing Exotic Grassland
Indigenous Forest
Lake and Pond
Low Producing Grassland
Manuka and or Kanuka
Orchard and Other Perennial Crops
Other Exotic Forest
Pine Forest - Closed Canopy
Pine Forest - Open Canopy
Short-rotation Cropland
Surface Mine
Transport Infrastructure
Urban Parkland/ Open Space
Vineyard
State Highways
Roads Med Scale
Railway
NORTHLAND REGIONAL COUNCIL
Hatea River Catchment
Sampling Sites
N

Figure 1: Location of Northland Regional Council water quality monitoring sites in the Hātea catchment.

Although the following observations are based on limited data, results to date suggest that:

- The Mangakino Stream, in particular the reach between the Mangakino at Mangakino Lane and the Mangakino upstream Waitaua confluence, may be a significant source of *E. coli* in the Hātea River. The Mangakino upstream Waitaua confluence shows consistently elevated *E. coli* levels which frequently exceed the MfE and MoH Microbiological Water Quality Guidelines for Marine and Fresh Water Recreational Areas (2003) of 550/100ml for primary contact recreation (i.e. swimming and/or activities which may involve full immersion). These results are reflected at the downstream Hātea site at Whangarei Falls. In contrast, the upstream site at the end of Mangakino Lane remains within the swimming guidelines on all but one sampling occasion (Figure 3).

- While the Waitaua Stream site predominantly remains within guidelines, *E. coli* levels can become elevated and affect downstream Hātea River sites (Figure 3).

- Both Mangakino Stream sites have high turbidity levels which exceed ANZECC 2000 guidelines on all sampling occasions and appear to be a source of sediment within the catchment (Figure 4). This is potentially related to forestry activities upstream of the site as well as stock access at the Waitaua u/s Waitaua confluence site. Elevated turbidity levels are often associated with high *E. coli* and dissolved reactive phosphorus (DRP) levels. Most phosphate in soils is bound to soil particles, with surface runoff carrying with it soil particles as well as faecal matter.

- In general turbidity results for the Waitaua and Hātea at Mair Park sites are within guidelines (Figure 4). The peak in September 2014 for all sites within the Hātea catchment may be the result of a series of high flow/rainfall events (Figure 2 gives an indication of flow in the Hātea catchment).

- Ammoniacal nitrogen (NH_4-N) levels are generally within ANZECC 2000 guidelines for all sites with the exception of the Waitaua Stream which frequently exceeds the ANZECC 2000 guidelines during the sampling period. The likely influence of this on the downstream site at the Whangārei Falls can be seen on the results for January 2015 (**Figure 5**).

- Nitrate Nitrite - Nitrogen (NNN) levels are frequently elevated in the Waitaua catchment and this is reflected at the downstream sites in the Hātea (Figure 6). NNN results in the Mangakino are low and well below guideline levels.

- Dissolved reactive phosphorus (DRP) levels (Figure 7) for all sites are consistently elevated above ANZECC 2000 guidelines on most sampling occasions.

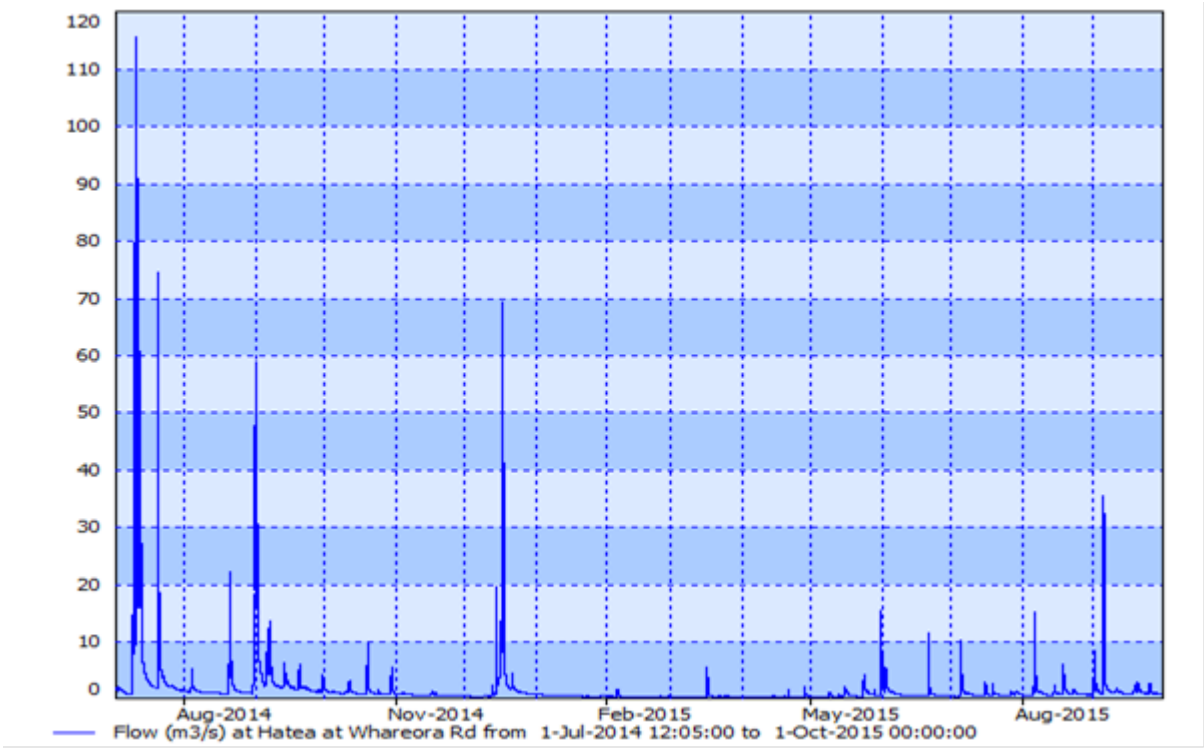


Figure 2: Flow results for Hātea at Mair Park– July 2014-September 2015.

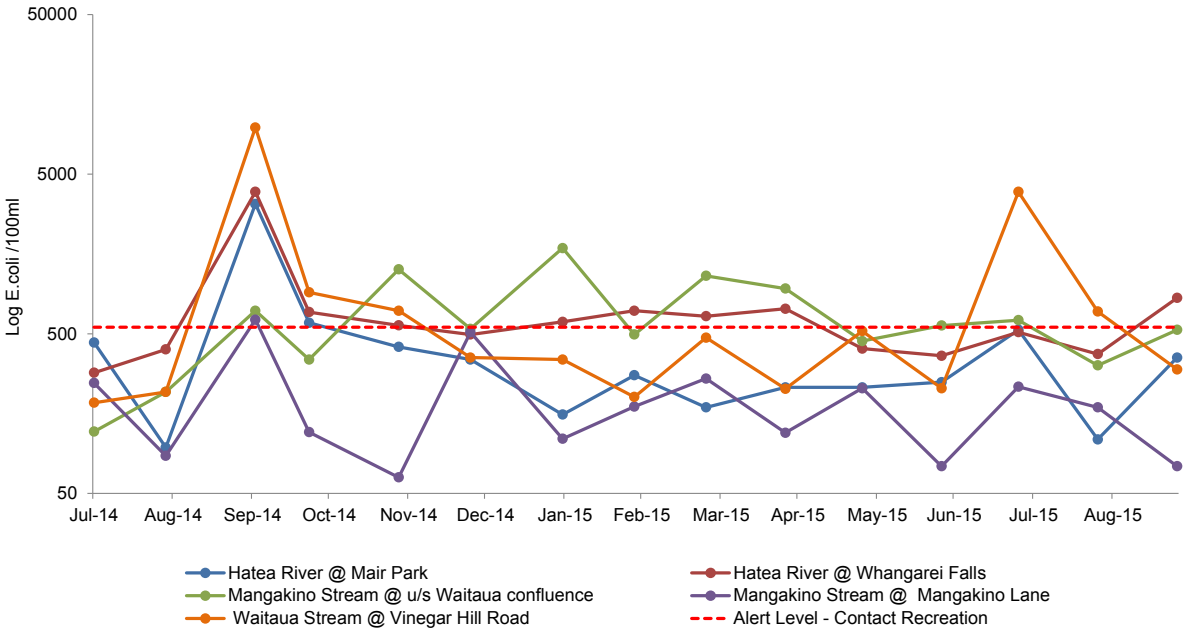


Figure 3: Log. *E. coli* level in the Hātea catchment measured against the MfE and MoH Microbiological Water Quality Guidelines for Marine and Fresh Water Recreational Areas (2003) - July 2014-September 2015.

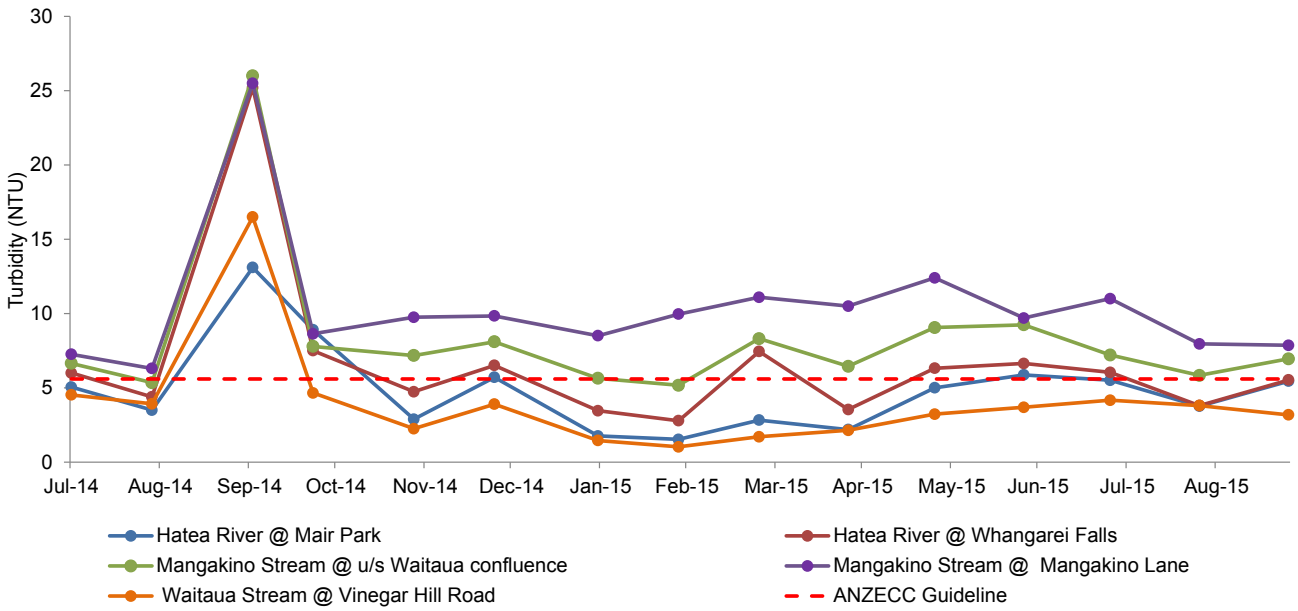


Figure 4: Turbidity levels in the Hātea catchment measured against ANZECC 2000 guidelines – July 2014-September 2015.

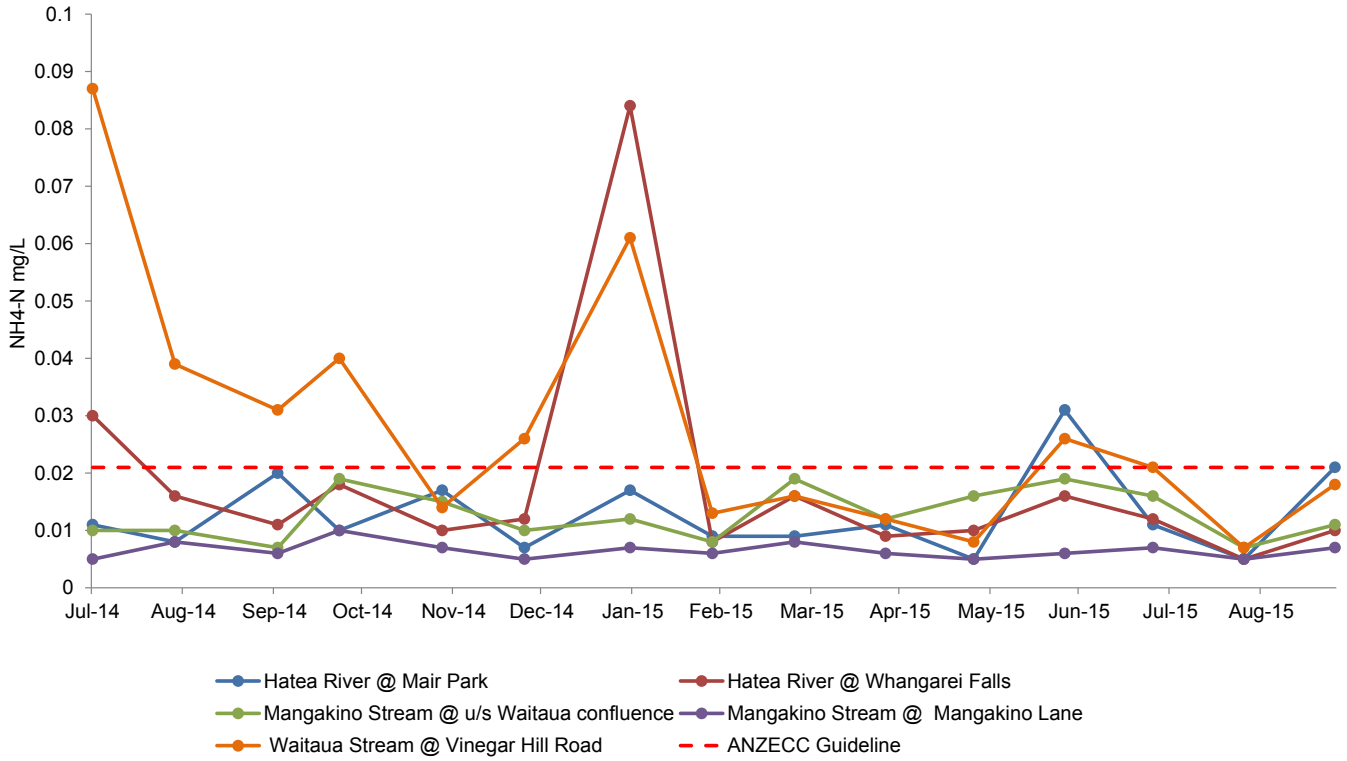


Figure 5: Ammoniacal nitrogen (NH_4-N) concentration in the Hātea catchment measured against ANZECC 2000 guidelines – July 2014-September 2015.

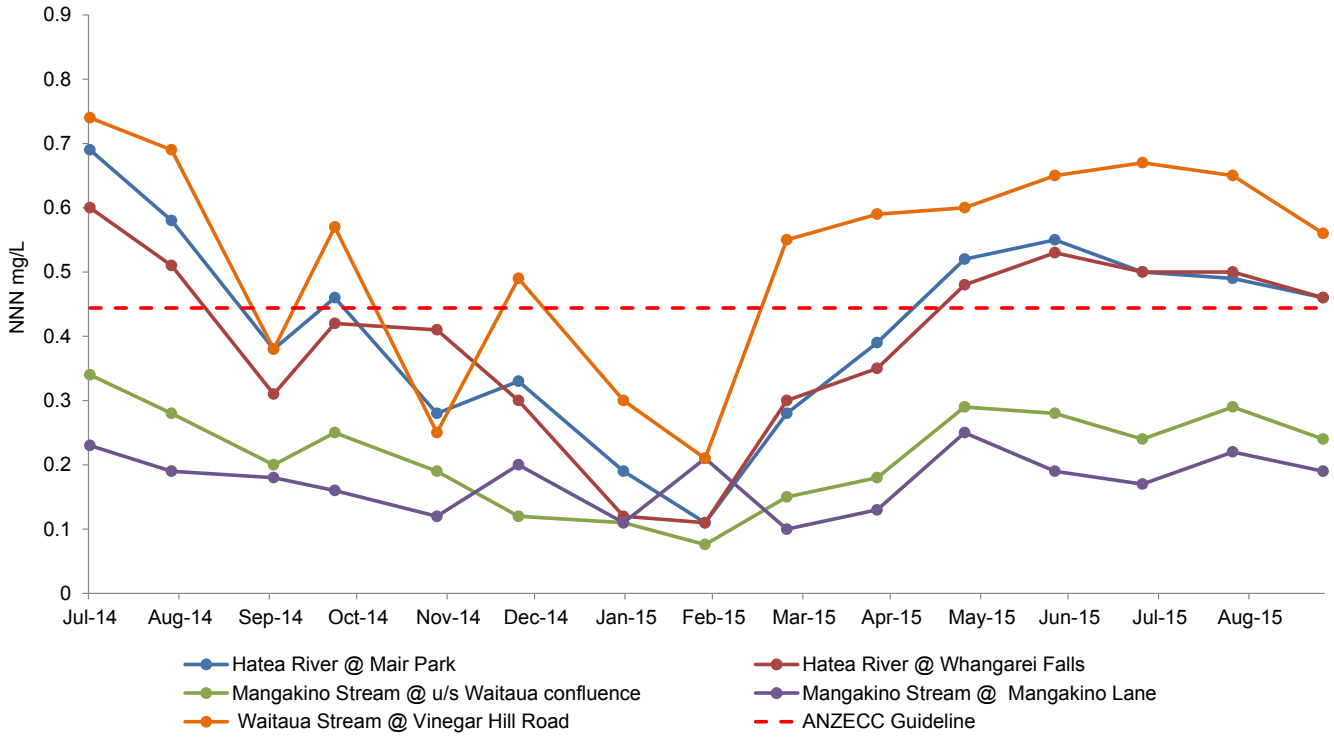


Figure 6: Nitrate Nitrite Nitrogen (NNN) concentration in the Hātea catchment measured against ANZECC 2000 guidelines – July 2014-September 2015.

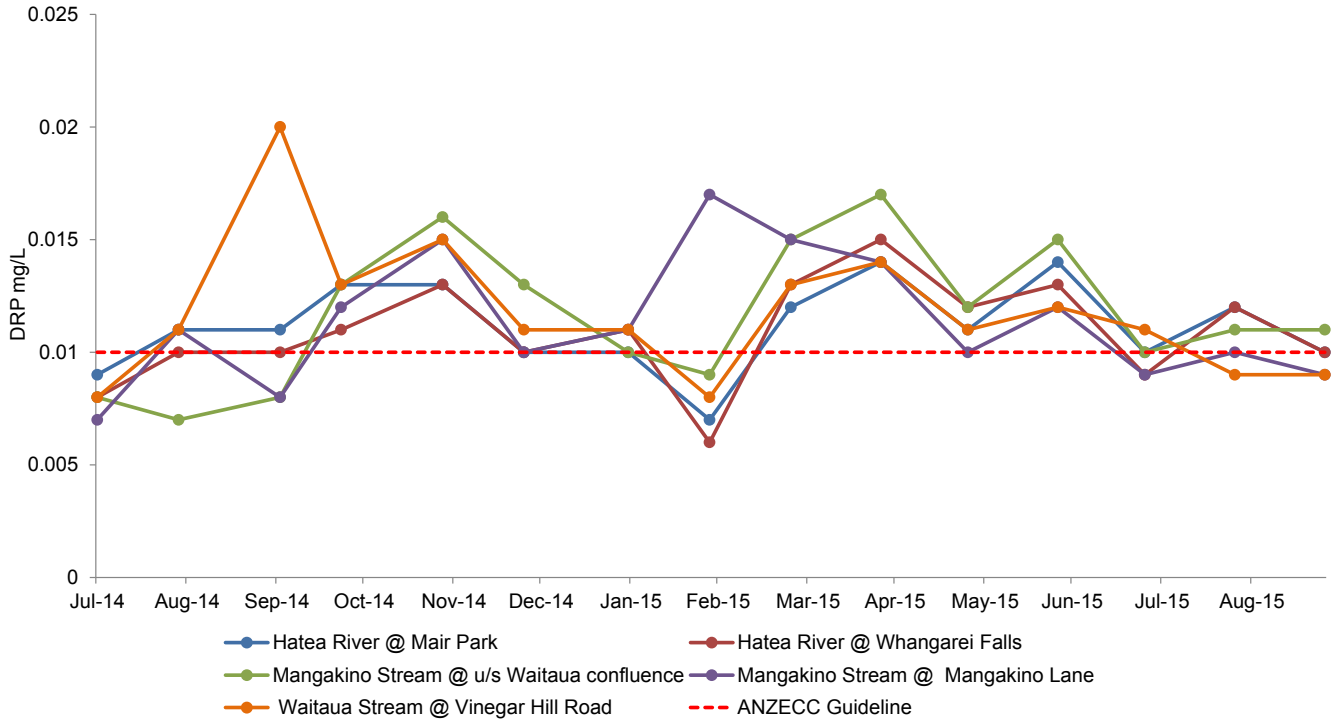


Figure 7: Dissolved Reactive Phosphorus (DRP) concentrations in the Hātea catchment measured against ANZECC 2000 guidelines – July 2014-September 2015.

Additional Monitoring

An additional four sites were monitored weekly from 28th May to 28th June 2015 (Table 2, Figure 8).

Table 2: short term additional water quality monitoring sites in the Hātea catchment.

Site Number	Catchment	Site Name
310012	Hātea	Waitaua Stream UT at 165 Pipiwai Rd
310013	Hātea	Waitaua Stream UT at 131 Pipiwai Rd
310014	Hātea	Waitaua Stream UT drain at Farmlands
310015	Hātea	Hātea River UT at 47A Ngunguru Rd

Results (

Figure 8) indicate the following:

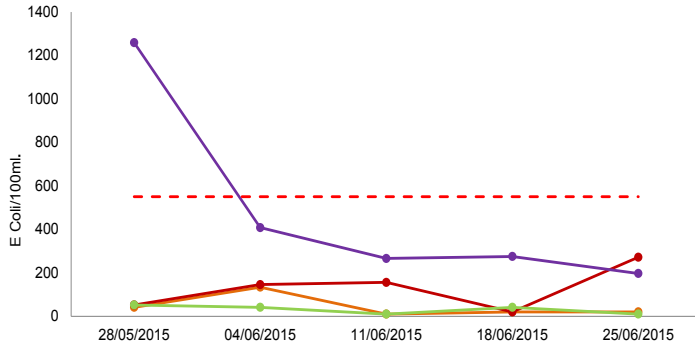
- Consistent with the results from the Waitaua at Vinegar Hill Road site, *E.coli* does not seem to be a major problem in the Waitaua sub-catchment with sites consistently meeting to MfE/MoH guidelines of < 550/100ml.

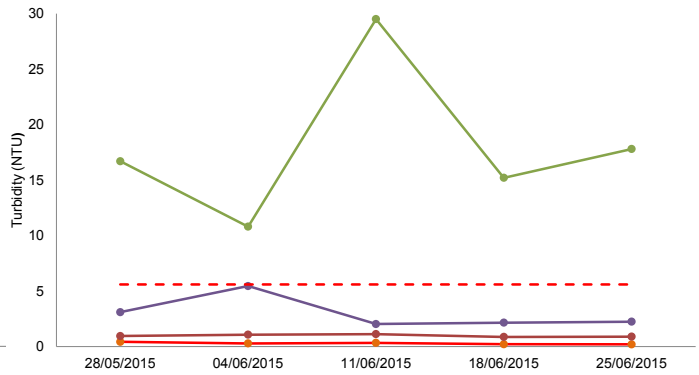
- The Hātea River UT at 47A Ngunguru Road site is potentially a source of *E. coli* during high flow events and shows elevated nitrate/nitrite nitrogen levels.

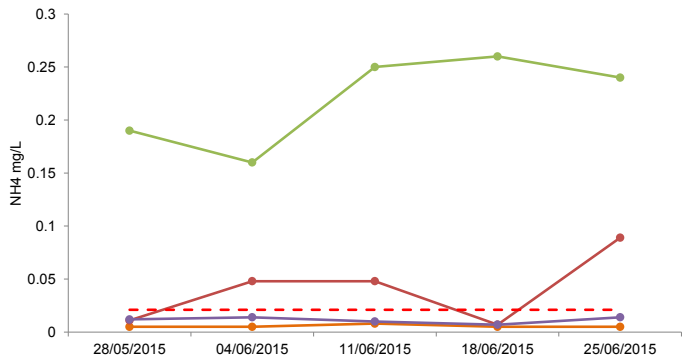
- NH_4-N, NNN and turbidity levels are elevated at the Waitaua UT drain at Farmlands site and do not meet ANZECC 2000 guidelines.

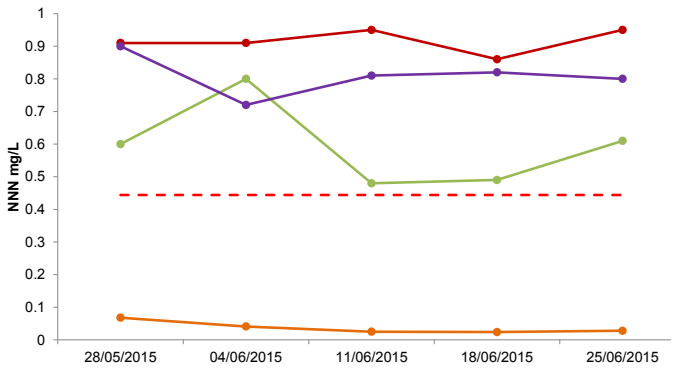
- NNN levels are elevated at all sites except Waitaua Stream UT at 165 Pipiwai Road, higher up in the Waitaua sub-catchment.

- DRP levels meet ANZECC 2000 guidelines at all sites except Waitaua Stream UT at 131 Pipiwai Road.


E Coli/100ml
1400
1200
1000
800
600
400
200
0
28/05/2015
04/06/2015
11/06/2015
18/06/2015
25/06/2015


Turbidity (NTU)
30
25
20
15
10
5
0
28/05/2015
04/06/2015
11/06/2015
18/06/2015
25/06/2015


NH4 mg/L
0.3
0.25
0.2
0.15
0.1
0.05
0
28/05/2015
04/06/2015
11/06/2015
18/06/2015
25/06/2015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0.8
0.7
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25/06/2015

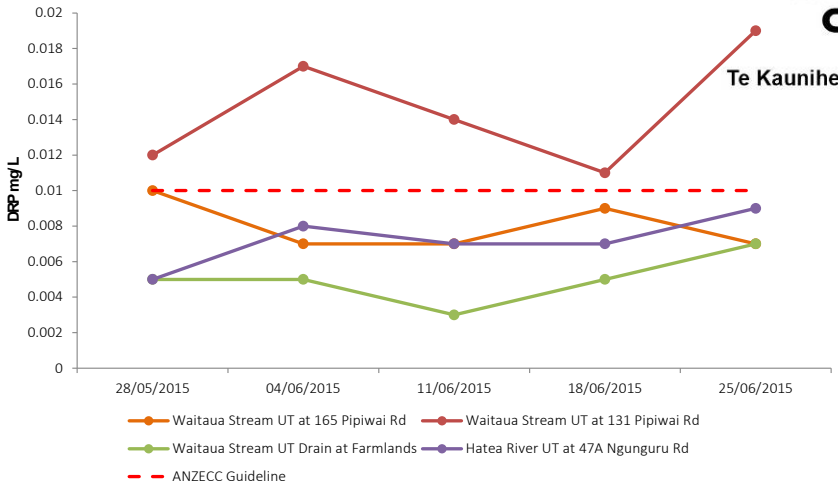

Figure 8: Water quality results in the Hātea catchment for sites monitored from 28th May to 28th June 2015.

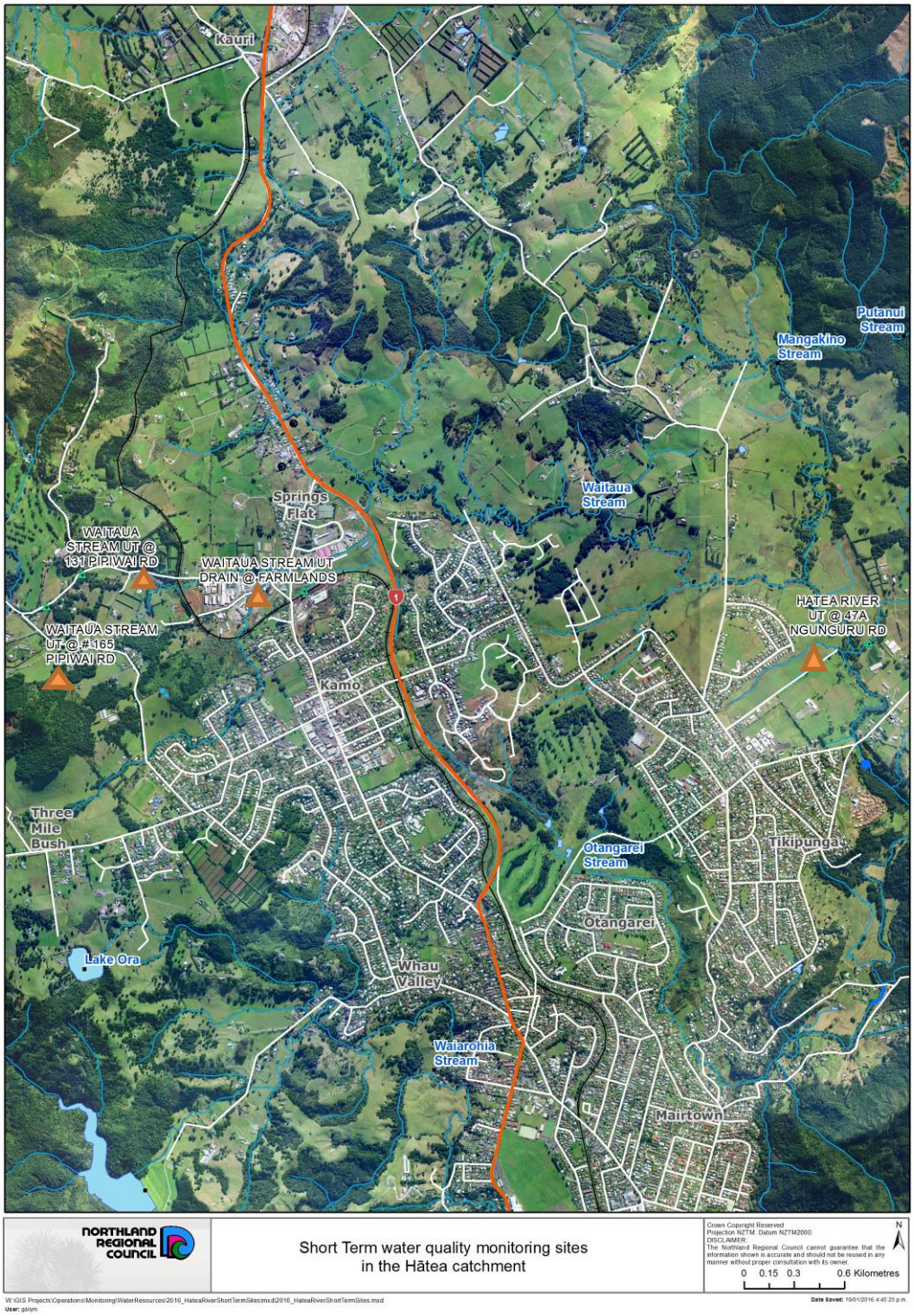

Figure 9: Additional water quality monitoring sites (orange arrows) in the Hātea catchment monitored weekly from 28th May to 28th June.