New Plymouth District Council
New Plymouth Wastewater Treatment Plant
Marine Outfall and Sludge Lagoon
Monitoring Programme Biennial Report
2012-2014

Technical Report 2014-122

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Executive summary

The New Plymouth District Council (NPDC) operates a wastewater treatment plant (NPWWTP) located on Rifle Range Road between New Plymouth and Bell Block. This report for the period July 2012 to June 2014 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess NPDC's environmental performance during the period under review, and the results and environmental effects of NPDC's activities.

In relation to the operation of the NPWWTP, NPDC holds six resource consents, which include a total of 69 conditions setting out the requirements that NPDC must satisfy. NPDC holds a consent to allow it to discharge treated wastewater into the Tasman Sea, two consents relating to sludge disposal, two consents relating to structures and one consent to discharge emissions into the air at the site.

During the monitoring period, NPDC demonstrated an overall 'improvement required' level of environmental performance with the resource consents.

The Council's monitoring programme for the two years under review included reviewing data supplied by NPDC, six site inspections, seven water samples collected for physicochemical analysis (including inter-laboratory comparison), two marine ecological surveys at five sites, 13 samples collected at five sites for analysis of bacteriological water quality, three mussel samples collected for trace metal analysis, seven mussel tissue samples analysed for norovirus and faecal coliform levels. Additional monitoring was also conducted by NPDC and the Council in relation to upgrade work undertaken on the aeration basins, included more than 40 samples collected at four sites for analysis of bacteriological water quality.

During the 2012-2014 period major upgrades were undertaken at the NPWWTP and as a result improvement is required with regards to environmental performance and compliance with the resource consents. There were 32 recorded incidents, two abatement notices and two infringement notices issued during the two year period. These non-compliant events were a mixture of unauthorised incidents (generally sewage discharges to water), and non-compliance with consent conditions (mostly elevated suspended solids, biological oxygen demand, or low chlorine concentrations). It is anticipated that improved compliance with consent conditions will be achieved in the next monitoring period now that upgrade work is complete.

Elevated norovirus levels were detected in mussel flesh towards the end of the WWTP upgrade. There were no other significant detectable effects in the receiving environment resulting from wastewater discharges from the plant during the 2012-2014 monitoring period.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents. In the 2013-2014 year, 60% of consent holders achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance. This report includes recommendations for the 2014-2015 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the biennial report for the period July 2012-June 2014 by the Taranaki Regional Council (the Council) on the monitoring programme associated with the New Plymouth wastewater treatment plant (NPWWTP). New Plymouth District Council (NPDC) is the consent holder for the operation which is situated on Rifle Range Road at New Plymouth, in the Waiwhakaiho catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by NPDC that relate to the discharge of treated wastewater and sludge, a marine outfall structure, a permit for a culvert and the air discharge permits held by NPDC to cover emissions to air from the site.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of NPDC's use of water, land, and air, and the foreshore, and is the nineteenth combined report by the Council for NPDC's NPWWTP.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by NPDC, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at the NPWWTP.

Section 2, 3 and 4 presents the results of monitoring during the period under review, including scientific and technical data.

Section 5 outlines incidents and the result of the response to these, associated with the NPWWTP.

Section 6 discusses the results, their interpretation, and their significance for the environment.

Section 7 presents recommendations to be implemented in the 2014-2015 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

1.1.3 The Resource Management Act (1991) and monitoring

The RMA primarily addresses environmental `effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

(a) the neighbourhood or the wider community around a discharger, and may include cultural and socio-economic effects;
(b) physical effects on the locality, including landscape, amenity and visual effects;
(c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
(d) natural and physical resources having special significance (for example, recreational, cultural, or aesthetic);
(e) risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of `effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the consent holder during the period under review, this report also assigns a rating as to NPDC's environmental and administrative performance.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year.
Administrative performance is concerned with the consent holder's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

- **High** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment .The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

- **Good** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

  For example:

  - High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
  - Strong odour beyond boundary but no residential properties or other recipient nearby.

- **Improvement required** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

- **Poor** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

- **High** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

- **Good** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason

was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

- **Improvement required** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

- **Poor** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents. In the 2013-2014 year, 60% of consent holders achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance.

1.2 Process description

The NPWWTP (Photograph 1) treats the municipal wastewater from the New Plymouth urban area, Bell Block, Oakura and Inglewood, by a process of extended aeration activated sludge. There is also a substantial industrial load, equivalent to approximately 25% of the total biochemical oxygen demand (BOD) load, treated by the plant. The plant was commissioned in 1984, and has had its capacity expanded several times since.

Photograph 1 The New Plymouth Wastewater Treatment Plant

The wastewater enters the plant at the milliscreening building (Figure 1) to remove plastics and solids from the wastewater, followed by the removal of grit. The solids are collected and removed regularly for land disposal. Following this preliminary treatment, the wastewater enters the aeration basins where micro-organisms, collectively called "activated sludge", breakdown the organic matter in the wastewater. Pathogens and heavy metals stick to the activated sludge, and are removed at a later stage of the process. The mix of wastewater and activated sludge then overflows into clarifiers, which separate the activated sludge from the water. The clear water overflows into the chlorine contact tank for disinfection prior to discharge through a 450 m marine outfall offshore of the mouth of the Waiwhakaiho River.

The activated sludge remaining in the clarifiers is returned to the aeration basins to maintain biological levels, while the surplus is diverted to the thermal drying facility (TDF) for sterilisation and disposal by alternative use (soil conditioner).

Figure 1 Layout of the New Plymouth Wastewater Treatment Plant

Thermal drying of the sludge results in a dry granular solid (biosolid) with a moisture content of 5-10%. The temperatures used in the process are such that there is sterilisation of the micro-organisms and pathogens present in the sludge. The biosolid is registered for sale as *Taranaki Bioboost 6-2-0* fertiliser.

During the reporting period, major construction works were undertaken as part of the upgrade of the NPWWTP. Details of the upgrade, including work undertaken on the aeration basins, the clarifiers, the milliscreens and the thermal drying facility are provided in an annual report provided by NPDC as per consent 0882-4, condition

20[1]. These works necessitated sections of the treatment process to be out of use while upgrade work was underway.

The upgrade involved major modification of the plant's two existing aeration basins to make them more efficient. Only one basin was taken offline for modification at a time, with wastewater treated through the other basin. Upgrade of the first aeration basin was undertaken between December 2012 and May 2013 (189 days out of service). Upgrade of the second aeration basin occurred between June 2013 and December 2013 (161 days out of service).

1.3 Resource consents

1.3.1 Discharge permits

Section 15(1) (a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

NPDC holds coastal permit **0882-4** to cover the discharge of treated municipal wastewater from the NPWWTP through a marine outfall structure into the Tasman Sea.

The recommendations involved with this permit were heard by a panel of independent commissioners, and a decision was reached on 15 November 2011. The permit was issued by the Council on 13 December 2011 under Section 119 of the RMA. It is due to expire on 1 June 2041.

There are 24 special conditions attached to the permit.

Condition 1 requires that the consent holder adopt the best practicable option to minimise adverse environmental effects.

Condition 2 requires that the consent holder maintain a diffuser system to ensure a minimum ratio of dilution of 13:1.

Conditions 3, 4 and 5 stipulate the concentration of various components of the discharge which shall not be exceeded.

Conditions 6 to 9 deal with the eventuality of aeration basins being taken offline.

Condition 10 requires that total available chlorine residual in the effluent is at least 0.3 g/m^3.

Condition 11 deals with screen size the effluent must pass through.

Conditions 12 to 18 relates to monitoring requirements.

[1] Section 3 of the NPWWTP Discharge Consent 0882-4 Annual Report 2012-2013

Condition 19 requires the consent holder to provide a technology report on two occasions, while Condition 20 requires an annual report. Condition 21 states that the consent holder must maintain a contingency plan for the site.

Conditions 22 and 23 require the consent holder to meet with Council, iwi and interested parties regarding the operation and monitoring of the consent.

Condition 24 is a review provision.

NPDC holds discharge permit **2982-4** to cover the discharge of up to 60 m^3/day of leachate from a sludge stabilisation lagoon to groundwater in the vicinity of the Waiwhakaiho River. This permit was issued by the Council on 17 October 2002 under Section 87(e) of the RMA. It is due to expire on 1 June 2020.

There are five special conditions attached to the permit.

Condition 1 requires that groundwater in the vicinity of the lagoon is monitored, while condition 2 stipulates that the unnamed tributary adjacent to the lagoon be monitored.

Condition 3 stipulates that there be no direct discharge of contaminants to any surface water body.

Condition 4 requires that there be no adverse impacts on ground or surface waters.

Condition 5 deals with review provisions.

1.3.2 Discharge to land

Section 15(1)(b) of the RMA stipulates that no person may discharge any contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

NPDC held discharge permit **3989-2** to cover the discharge of up to 85 m^3/day of waste dewatered activated sludge or equivalent dry weight of thermally dried activated sludge from the NPWWTP onto land at the New Plymouth Airport. This permit was issued by the Council on 18 October 2002 under Section 87(e) of the RMA. The consent expired on 1 June 2014 and will no longer be included in the NPWWTP monitoring programme.

There were 20 special conditions attached to the permit.

Condition 1 requires the consent holder to comply with their obligations, responsibilities and duties under Section 17 of the RMA.

Condition 2 stipulates that the consent only be used in the case of an emergency, and defines such an event.

Condition 3 requires the consent holder to notify the Council of their intention to exercise the consent.

Condition 4 requires the consent holder to provide a written report detailing various factors if the consent is exercised.

Condition 5 requires the consent holder to provide an analysis of a representative sample of dewatered sludge prior to the exercise of the consent, and gives parameters to be tested.

Condition 6 requires the consent holder to provide an analysis of representative samples of soil from each application.

Conditions 7, 8 and 9 deal with a management plan for the site.

Conditions 10, 11 and 12 deal with sludge and solids application.

Condition 13 requires the consent holder to provide an analysis of any surface or ground waters within the sludge/biosolids application site.

Conditions 14, 15 and 16 relate to heavy metals at the site.

Conditions 17, 18 and 19 deal with the restriction of access to the site following disposal.

Condition 20 deals with review provisions.

1.3.3 Air discharge permit

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

NPDC held air discharge permits **4740-1** and **5480-1** to cover the discharge of contaminants into the air from sludge processing activities (relating to different buildings). Both expired on 1 June 2008.

On 29 May 2008, NPDC was granted air discharge permit **4740-2**, a combination of both 4740-1 and 5480-1, to discharge contaminants into the air from sludge drying and processing activities at the NPWWTP. This permit was issued by the Council under section 87(e) of the RMA and is due to expire on 1 June 2026.

There are seven special conditions attached to the permit.

Condition 1 requires the consent holder to adopt the best practicable option to minimise environmental effects.

Condition 2 requires that the sludge management processes are managed to maintain discharges at a minimum, while condition 3 requires that discharges not give rise to any offensive or objectionable odours beyond the property boundary.

Condition 4 requires the consent holder to supply a statement of how the biofilters are to be maintained and operated.

Condition 5 requires a contingency plan addressing events at the NPWWTP that could give rise to abnormal odour release potential.

Condition 6 deals with removal of sludge from No. 2 lagoon while condition 7 deals with review of the consent.

1.3.4 Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

NPDC holds coastal permit **4593-2** to erect, place, maintain and use a marine outfall within the coastal marine area as part of the NPWWTP system. This permit was issued by the Council on 24 July 1996 under Section 87(c) of the RMA. It was due to expire on 1 June 2014 and was renewed as consent 4593-3 on 10 September 2014 with a new expiry date of 01 June 2041.

There are five special conditions attached to the permit.

Condition 1 requires that the consent holder maintain the structures authorised by the consent.

Condition 2 requires the consent holder to notify Council prior to undertaking maintenance works.

Condition 3 requires that all practicable measures are undertaken to prevent undue disturbance to reefs and marine life during maintenance works.

Condition 4 stipulates that the structure is removed when no longer needed.

Condition 5 deals with review provisions.

1.3.5 Land use consent

Section 13(1)(a) of the RMA stipulates that no person may use, erect, reconstruct, place, alter, extend, remove, or demolish any structure in, on, under, or over the bed of any lake or river, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

NPDC holds land use consent **1826-2** to erect, place and maintain a twin box culvert on the Mangaone Stream for road access purposes. This permit was issued by the Council on 16 January 2002 under Section 87(a) of the RMA. It is due to expire on 1 June 2020.

There are eight special conditions attached to the consent.

Condition 1 requires that the structure is maintained.

Condition 2 stipulates that maintenance be undertaken between November and April inclusive.

Condition 3 requires the consent holder to notify the Council prior to maintenance.

Condition 4 requires the consent holder to adopt the best practicable option to avoid or minimise effects on the streambed or water quality during maintenance.

Condition 5 requires that streambed disturbance is kept to a minimum during maintenance.

Condition 6 stipulates that the structure does not obstruct fish passage.

Condition 7 requires that the structure be removed and the area reinstated if and when no longer required.

Condition 8 deals with review provisions.

Copies of the NPWWTP consents are attached to this report in Appendix I.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets out an obligation for the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations, and seek information from consent holders.

The monitoring programme for the NPWWTP consisted of nine primary components during the 2012-2014 monitoring period.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application:

- in discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

Six scheduled inspections were undertaken at the NPWWTP site during the monitoring period. With regard to consents for the discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Water quality sampling

The final effluent was sampled on seven occasions, with the samples analysed for faecal coliforms, enterococci and chlorine (total and free).

Four inter-laboratory comparisons between the Council and NPDC were performed during the 2012-2014 monitoring period. The comparisons were performed to verify the validity of monitoring results reported by NPDC, and to provide an independent check on compliance with consent conditions. Effluent samples were analysed, by both the Council and NPDC, for cadmium, chromium, copper, nickel, lead, mercury, zinc, cyanide, phenolic compounds, free available chlorine, total available chlorine, faecal coliform and enterococci bacteria.

1.4.5 Review of New Plymouth District Council monitoring data

NPDC routinely monitors the discharge effluent for a number of chemical, biochemical and bacteriological parameters.

Once a month, flow-proportional composite samples are taken over a 24 hour period and are analysed for pH, ammonia, chemical oxygen demand (COD), oxidised nitrogen, reactive phosphorus, cyanide, phenols, cadmium, chromium, copper, nickel, lead, zinc, and mercury.

Daily influent composite samples and effluent grab samples are also collected and analysed for pH, suspended solids, alkalinity, BOD, COD, ammonia, nitrate and faecal coliforms.

Regular grab samples were also collected and analysed for total available chlorine.

Monitoring of the sludge lagoon is focused on the potential contamination of groundwater and of the drainage channel located next to the lagoon. Three groundwater bores are located around the lagoon. Samples from these bores were analysed for pH, ammonia, faecal coliform bacteria, total dissolved phosphorus, oxidised nitrogen and COD once a month. The drainage channel was also sampled once a month at two sites, one upstream and the other downstream of the sludge lagoon. The drainage channel samples were analysed for pH, ammonia and faecal coliform bacteria.

The analysis of the samples discussed here was performed by NPDC and results were forwarded to the Council each month. These results are summarised in section 3.1.3.1 and 3.1.3.2 of this report.

1.4.6 Marine ecological surveys

Annual intertidal ecological surveys were carried out at three potential impact sites and two control sites during the 2012-2014 monitoring period. The objective of these surveys was to indicate any change in intertidal community structure attributable to discharges from the NPWWTP outfall.

1.4.7 Shoreline bacteriological surveys

A survey of shoreline bacteriological water quality at four seawater sites in the vicinity of the marine outfall is carried out every second year during the summer months. Thirteen samples were collected at each site under dry weather conditions during 2012-2013 and the samples were analysed for enterococci, faecal coliform and *E. coli* bacteria and conductivity. The survey is next due to be undertaken in the summer of 2014-2015.

1.4.8 Metals in mussel tissue

Mussels are collected from three sites around the outfall (Waiwhakaiho Reef, Bell Block and Arakaitai Reef) on a biennial basis and tested for trace metals. This monitoring was undertaken in the 2013-2014 period.

1.4.9 Mussel flesh norovirus analysis

Mussels were collected from three sites (Waiwhakaiho Reef, Bell Block and Oakura) on three occasions and analysed for norovirus GI and GII by ESR. Influent and effluent samples were collected by NPDC on two occasions and analysed for norovirus GI and GII by ESR. The initial sampling was undertaken as part of the upgrade monitoring. Following review of the monitoring programme in 2013, norovirus analysis of mussel flesh and influent and effluent from the NPWWTP was added as a new component of the monitoring programme in accordance with condition 14 (e) of consent 0882-4.

1.4.10 Additional water quality monitoring during upgrade

Both NPDC and the Council undertook additional monitoring during the 2012-2014 period in relation to plant upgrades. NPDC analysed additional effluent grab and composite samples for suspended solids and BOD which were reported weekly to the Council. Compliance with condition 5 of consent 0882-4 was assessed.

An additional survey of shoreline bacteriological water quality at three seawater sites (Fitzroy Beach, 300 m NE of the outfall and Bell Block Beach) and one river site (Waiwhakaiho River opposite Lake Rotomanu) was undertaken during the period of the aeration basins upgrade works. Over 40 samples were collected from each site under all weather conditions. The samples were analysed for enterococci, faecal coliform and *E. coli* bacteria and conductivity.

2. Results 2012-2013

2.1 Water

2.1.1 Inspections

Four scheduled site inspections were performed at the plant, on 12 December 2012, and 16 January, 1 May and 10 June 2013. These inspections involved a visual assessment of the plant effluent and plant processes, a check of the final effluent chlorine data, a brief consultation with operations and/or laboratory staff, and an inspection of the foreshore and seawater adjacent to the outfall. The plant and surrounds were found to be tidy and well managed during each visit.

An aeration basin upgrade was in progress during the monitoring period and as such the effluent appearance was a turbid brown during the first three inspections. This was due to part of the influent flow being bypassed around the aeration basin and then mixing back in with the treated effluent prior to the chlorine contact tank. The new aeration basin was operating during the June inspection and the appearance of the effluent was more typical, this being clear and low in particulate matter.

The effluent plume was either not visible, or visible as a small clear patch above the diffuser. There was no evidence of contamination of foreshore or shoreline water during three of the inspections, however some fat particles were seen amongst the detritus in the tideline during the inspection undertaken in January 2013.

2.1.2 Results of discharge monitoring

2.1.2.1 Grab samples

Grab samples were collected of the final effluent in conjunction with the inspections. The samples were analysed for faecal coliform and enterococci, total available chlorine, and free available chlorine (Table 1).

Table 1 Effluent grab samples 2012-2013 (site SWG002002)

Parameter	Unit	Date			
		12-Dec-12	16-Jan-13	1-May-13	10-Jun-13
Faecal coliform	cfu/100 ml	7,600	20	190	8
Enterococci	cfu/100ml	17,000	67	31	3
Total available chlorine	g/m^3	2.3	1.5	-	-
Free available chlorine	g/m^3	-	<0.1	-	-

The results of these grab samples show that the consent condition (which requires the total available chlorine level in the final effluent to be maintained at a level not less than 0.3 g/m^3) was met on both sampling occasions tested.

Relatively low levels of both faecal coliform and enterococci bacteria were recorded in the final effluent on three occasions. Levels were high in the sample collected on 12 December 2012. This was during major upgrade work at the NPWWTP when one of the aeration basins was offline.

2.1.2.2 Inter-laboratory comparison

Two grab samples of the final effluent (a 24 hour composite sample) were collected and split in order to perform an inter-laboratory comparison. The samples were analysed for cadmium, chromium, copper, nickel, lead and zinc (all acid soluble), cyanide and mercury (total) and phenols (Table 2).

Table 2 Inter-laboratory effluent grab samples 2012-2013

Parameter	Unit	12 December 2012			10 June 2013			Consent limit
		TRC	NPWWTP	Agree	TRC	NPWWTP	Agree	
Cadmium	g/m^3	< 0.005	< 0.002	√	<0.005	< 0.002	√	0.04
Chromium	g/m^3	< 0.03	0.03	√	<0.03	<0.02	√	0.15
Copper	g/m^3	0.04	0.05	√	<0.01	<0.02	√	0.1
Cyanide	g/m^3	0.003	0.07	**	0.001	0.02	**	0.1
Mercury	g/m^3	<0.0002	< 0.001	√	< 0.0002	< 0.001	√	0.002
Nickel	g/m^3	< 0.02	< 0.008	√	<0.02	< 0.008	√	0.15
Lead	g/m^3	< 0.05	< 0.03	√	<0.05	< 0.03	√	0.1
Phenol	g/m^3	0.02	0.06	**	<0.03	<0.05	√	1.0
Zinc	g/m^3	0.15	0.15	√	0.022	<0.04	√	0.2

√ = satisfactory agreement
* = result within 10 -25 % of the mean
** = result > 25 % from mean

The results of the inter-laboratory comparison show that, apart from cyanide and phenol, the results obtained were mostly in good agreement, and all results were within levels prescribed by consent conditions. The majority of metals were below detection limits.

2.1.3 NPDC self monitoring

2.1.3.1 Effluent monitoring

A summary of the results of effluent monitoring undertaken by NPDC, from July 2012 to June 2013, is presented in Table 3, along with a summary of previous results (1990 to 2012). A full table of results for the period under review can be found in Appendix II. Results from 1990 onwards are included in Appendix III.

The total available chlorine reported in the final effluent was below the 0.3 g/m^3 (minimum) required by the consent during August and December 2012, and February, March, April, May and June 2013. The chlorine in a composite sample can decrease over the 24 hour period during which the effluent is sampled, therefore reported values may be lower than when the discharge sample was collected. However the high numbers of faecal coliforms in the effluent reflect inadequate disinfection (with the exception of June 2013, faecal coliform numbers were between 1000-7000 cfu/100 ml).

Condition 5 of consent 0882-4 allows an increase in the levels of suspended solids in the effluent, from 25 to 110 g/m^3, during construction for upgrade of the NPWWTP system. Work was undertaken during December 2012 to May 2013 and increased levels of suspended solids reflected this, with four of the 12 monthly composite samples exceeding the 110 g/m^3 limit.

When the first aeration basin was offline the weather was unusually dry for an extended period of time resulting in lower influent flows. As a result the concentration of the influent was higher than usual. When blended with the treated effluent the high concentration of the bypassed effluent resulted in exceedance of the suspended solids limit. Refer to section 4 for results of additional monitoring undertaken during the upgrade, and also 5 for further discussion of incidents.

The results of all other parameters were within the consent limits as set out in Table 3. Although there is no consent limit imposed on ammonia and COD, it is noted that both these parameters increased compared with historical values (refer to graphs in Appendix III) during the upgrade works undertaken in December 2012 and early 2013.

Table 3 Summary results of effluent composite samples collected by NPDC

Parameter	Unit	Consent limit	2012-2013			1990-2012		
			Median	Range	Number	Median	Range	Number
pH			7.6	7.3 – 8.0	12	7.6	7.0 – 8.1	259
NH_3	g/m^3		8.3	0.1 – 17.9	12	0.8	0.05 – 21.8	259
Suspended solids	g/m^3	**25/110***	44	<5 – 318	12	<5	<5 – 234	263
COD	g/m^3		86	20 - 380	12	22	10 – 126	253
Faecal coliforms	n/100ml		555	1 – 7200	12	<2	< 2 – 7500	257
NOx	g/m^3		3.71	<0.1 – 9.4	12	6.95	0.1 – 19	252
Phosphorus	g/m^3		1.9	0.5 – 2.5	12	2.2	0.16 – 6.8	250
Free chlorine	g/m^3		<0.2	<0.2	12	<0.2	< 0.2 – 0.4	261
Total chlorine	g/m^3	**>0.3**	0.2	<0.2 – 0.7	12	0.4	<0.2 – 1.3	261
Cyanide	g/m^3	**0.1**	0.03	0.01 – 0.01	12	0.03	0.005 – 0.1	250
Phenols	g/m^3	**1.0**	<0.05	<0.05 - 0.11	12	<0.05	< 0.05 – 0.08	247
Zinc	g/m^3	**0.2**	0.05	<.0.02 – 0.15	12	0.03	< 0.02 – 0.11	255
Copper	g/m^3	**0.1**	0.01	0.01 – 0.05	12	<0.01	< 0.01 – 0.05	255
Chromium	g/m^3	**0.15**	<0.05	<0.05	12	<0.05	<0.05	255
Nickel	g/m^3	**0.15**	<0.02	<0.02 – 0.02	12	<0.02	<0.02 – 0.07	255
Cadmium	g/m^3	**0.04**	<0.008	<0.008	12	<0.008	<0.008	255
Lead	g/m^3	**0.1**	<0.02	<0.02	12	<0.02	< 0.02 – 0.04	255
Iron	g/m^3		0.24	<0.05 – 1.96	12	0.06	<0.05 – 0.6	254
Manganese	g/m^3		0.06	0.03 – 0.15	12	0.04	<0.02 – 0.13	254
Mercury	g/m^3	**0.002**	<0.001	<0.001	12	<0.001	< 0.001	244

NB: Chlorine in composite sample can decrease over 24 hour period which the effluent is sampled, therefore values may be lower than when they are discharged.

* The consent limit for suspended solids increases from 25 to 110 g/m^3 during upgrade work as per condition 5 of 0882-4

NPDC also provided the Council with a monthly summary of plant performance (influent and effluent grab samples). Treatment of influent at the NPWWTP resulted in a reduction in pH, suspended solids, alkalinity, BOD, COD, ammonia, and faecal coliforms (Table 4). Nitrate generally increased as the ammonia was converted to nitrate by way of nitrification.

Although BOD concentration was high during the later part of 2012 and early 2013, the reported values in the effluent were below the 130 g/m^3 allowed during construction works at the plant.

The concentrations of suspended solids in the final effluent were above the 25 g/m^3 allowed in July 2012, and were also over the 110 g/m^3 allowed while construction was underway in December 2012, February and April 2013.

Table 4 Monthly summary of plant performance (mean values) – comparison of influent and effluent grabs 2012-2013. Data in black are influent values, data in blue are effluent values

Parameter	pH	SS g/m^3	Alkalinity g/m^3	BOD g/m^3	COD g/m^3	NH3 g/m^3	NNN g/m^3	FC g/m^3
July 2012	7.4 7.0	461 42	169 70	216 3	397 18	23 0.23	0.44 5.6	1.5x10^6 1
August 2012	7.3 7.0	522 6	158 65	193 2	450 26	20 0.24	0.89 4.9	9.0x10^5 1
September 2012	7.3 7.1	577 3	180 73	211 2	665 26	23 0.08	0.35 7.1	1.3 x 10^6 1
October 2012	6.8 7.1	449 3	187 78	218 3	420 20	24 0.22	0.36 5.4	2.0x10^6 1
November 2012	7.4 7.1	549 4	193 75	222 1	510 29	26 2	<0.1 *	2.8 x 10^6 1
December 2012	7.4 7.3	283 119	191 141	272 *	340 190	27.0 18	<0.1 *	7.1x10^6 810
January 2013	7.4 7.2	293 106	198 108	207 130	573 *	32 15	0.19 *	2.3x10^7 750
February 2013	7.4 *	318 140	224 *	270 *	570 *	34.0 *	* *	2.7x10^7 440
March 2013	7.5 *	362 *	235 *	335 *	584 *	34 *	<0.1 *	2.3 x 10^7 3.0 x 10^3
April 2013	7.5 7.3	342 118	200 96	273 95	440 *	32 12	0.08 *	1.1x10^7 970
May 2013	7.3 *	266 *	155 *	235 *	425 *	23 *	0.17 *	4.7 x 10^6 71
June 2013	7.4 7.4	317 31	160 104	208 24	415 42	22 8	0.37 2.9	1.3 x 10^7 173

* = results not available

Samples collected 3 x weekly.

Condition 10 of consent 0882-4 requires that total available chlorine in the effluent shall be no less than 0.3g/m^3. NPDC collected regular grab samples of the effluent to assess this condition. The results are presented in Table 5.

Table 5 Total Available Chlorine (TAC) in effluent grab samples during 2012-2013

Min TAC	Normal operation		One basin offline		Total	
	Samples	Compliance	Samples	Compliance	Samples	Compliance
0.3 g/m^3	121	99%	125	100%	246	99.6%

Overall, total available chlorine was maintained at an acceptable level in the effluent. Refer to section 5 which details incidents involving low chlorine levels at the plant.

2.1.3.2 Sludge lagoon monitoring

The results of sludge lagoon groundwater and surface water monitoring, undertaken monthly by NPDC, are summarised in Table 6, along with a summary of previous results from 1990 to 2012. No data was able to be collected from Bore 3 during March 2013 as the bore was dry. All of the results from 2012-2013 are presented in Appendix IV. The location of the sampling sites in relation to the lagoon are shown in Figure 2.

Minor changes in pH within all three groundwater bores occurred during the monitoring period. Surface waters within the drain adjacent to the sludge lagoon were generally within the relatively narrow pH range of 6.6 to 6.8.

The process of decomposition of nitrogenous fractions within the sludge biomass generates ammonia. Ammonia concentrations in all three bores during the period under review were relatively low, with 2012-2013 medians lower than historical medians. Levels of ammonia at the open drain sites were similar to historical results.

Table 6 Summary results of sludge lagoon monitoring 2012-2013 (black) and 1990-2012 (blue)

Site	2012 - 2013 1990 - 2012	pH	NH_3 g/m³	Faecal coliforms cfu/100ml	TDP g/m³	NOx g/m³	COD g/m³
Bore 1	Number	12	12	12	12	12	12
	Range	5.5 – 6.7	<0.1 – 8.6	<10	<0.05 - 0.92	<0.05 – 9.1	9 - 23
	Median	6.4	2.3	<10	0.11	0.27	14
	Number	237	237	234	236	237	236
	Range	4.9 – 7.1	<0.1 - 100	<10 – 2,300	<0.01 – 3.3	0.01 – 18.3	1 - 44
	Median	6.2	2.3	5	0.02	0.3	10
Bore 2	Number	12	12	12	12	12	12
	Range	5.7 – 6.5	<0.1 – 4.4	<10 - 100	<0.05	<0.1 – 0.2	21 - 57
	Median	5.9	0.12	<10	<0.05	<0.1	31
	Number	237	236	236	236	237	236
	Range	4.9 – 7.4	<0.1 – 25	<10 – 10,000	<0.01 - 0.36	0.02 - 40	6 - 181
	Median	6.2	2.6	<10	0.02	0.2	15
Bore 3	Number	11	11	11	11	11	11
	Range	5.7 – 6.5	<0.1 – 1.3	<10 – 1,200	<0.05 – 0.23	<0.15 - 2	34 - 216
	Median	5.9	0.14	20	0.05	0.4	85
	Number	231	231	231	228	229	230
	Range	5.0 – 7.3	<0.1 – 198	<10 – 72000	<0.05 - 1	0.02 – 64	1 - 740
	Median	6.4	0.8	<10	<0.05	0.2	15
Open drain point 2	Number	11	11	11			
	Range	6.6 – 6.7	0.58 – 2.1	10 - 3000			
	Median	6.6	0.7	230			
	Number	233	233	232			
	Range	6.0 – 6.9	<0.1 – 7.5	5 – 5000			
	Median	6.6	0.5	70			
Open drain point 3	Number	11	11	11			
	Range	6.6 – 6.8	0.7 – 9.8	20 - 1800			
	Median	6.7	1.9	120			
	Number	232	233	232			
	Range	6.4 – 7.1	0.13 – 27	<10 – 1,970			
	Median	6.7	6.4	95			

The median faecal coliform counts recorded at all three bores were generally low, with medians of <10 cfu/100 ml at Bores 1 and 2 and 20 cfu/100 ml at Bore 3. Occasional high counts (>100 cfu/100 ml) were recorded at Bore 3. The two open drain sites had higher levels of faecal coliforms than the bores, with variation in faecal coliform numbers in the surface waters of the drain affected to a greater extent by fluctuations in drain flow and access by stock and wildlife.

Soluble phosphate is released from the sludge biomass under anaerobic conditions and therefore is the major contributor to dissolved phosphorus levels. Levels at all three bores were low. The generally low levels of total dissolved phosphorus at the bore sites indicate that soluble phosphorus is possibly being absorbed into the ash and clay substrate.

Oxidised nitrogen levels in the groundwater bores generally remained low throughout the monitoring period.

Levels of COD increased from Bore 1, to Bore 2 to Bore 3 with levels in all three wells above the historical median. These elevated COD levels indicate that seepage from the lagoon was occurring. The construction of the lagoon was so that the sludge would be forced by hydraulic pressure into the fine river silts and ash which underline the lagoon, thus blinding and sealing the bottom of the lagoon. This has in the most part been achieved, although minimal leakage still occurs as indicated by the monitoring results of groundwater and surface waters in the vicinity of the lagoon.

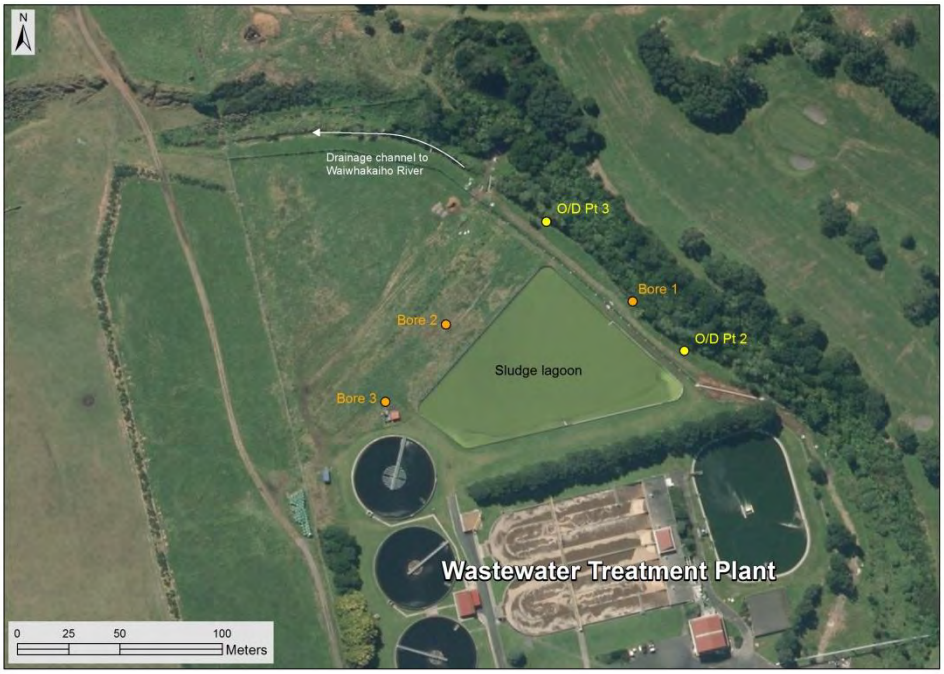

Figure 2 Sludge lagoon showing location of NPDC's groundwater bore and drain sampling sites

2.1.4 Marine ecological surveys

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, ecological surveys were conducted in January 2013 at five sites (Figure 3). These surveys included three potential impact sites (SEA902015, SEA902010, SEA902005) and two control sites (SEA903070, SEA901007), north and south of the outfall. Any adverse effects of the NPWWTP outfall discharge on the intertidal communities would have been evident as a significant decline in species diversity at the potential impact sites relative to the control sites.

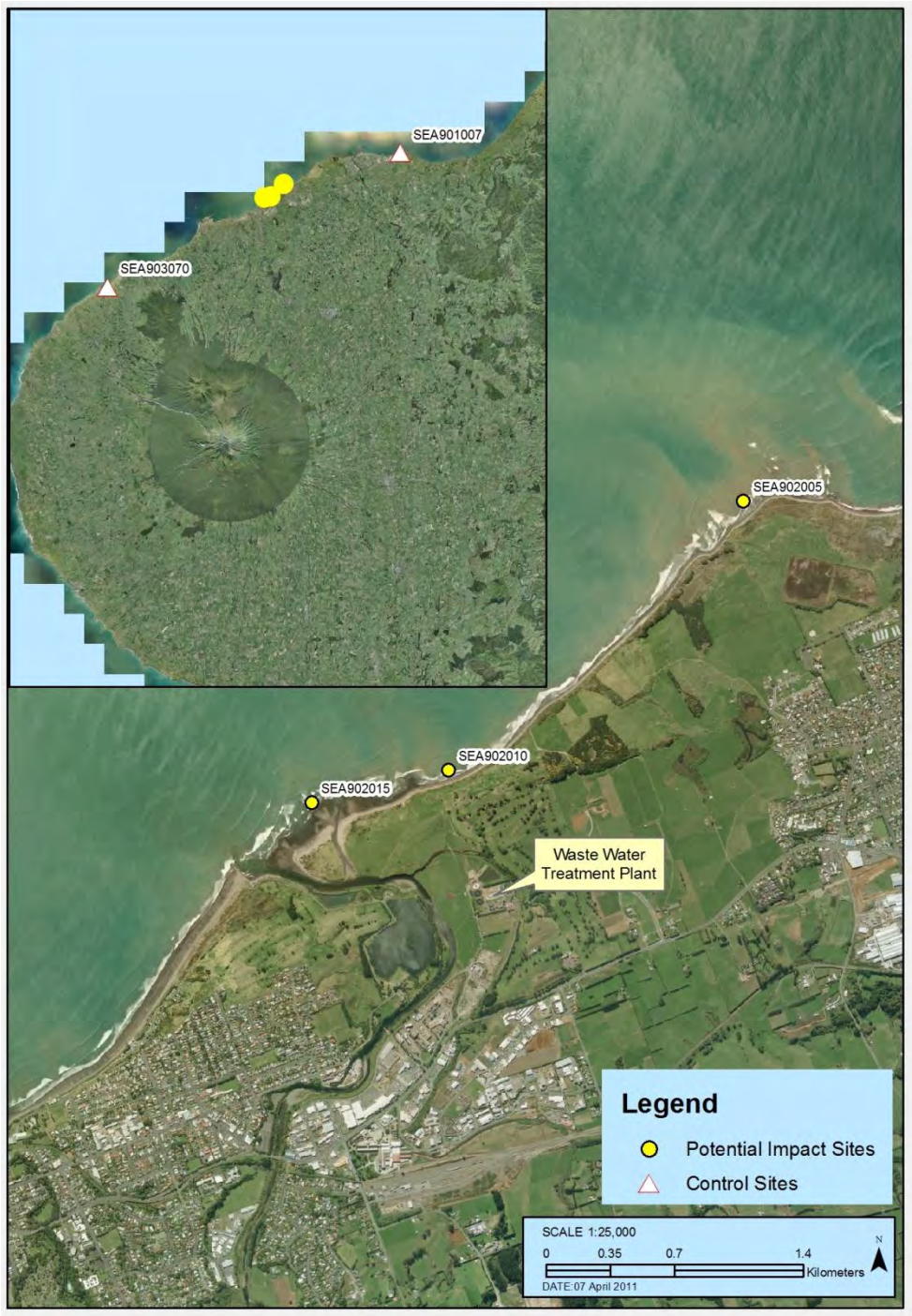

Figure 3 Marine ecological survey sites for NPWWTP

A full copy of the marine ecological survey reports, including a comprehensive analysis and interpretation of results, is provided in Appendix V. In summary, both number of species and Shannon-Weiner index were greater at the potential impact site closest to the outfall relative to the two control sites. In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative to the control sites. The results indicate that the outfall discharge was not having detectable adverse effects on the intertidal reef communities of north Taranaki. Natural environmental factors, in particular sand cover, substrate type and substrate mobility, appeared to be the dominant drivers of species diversity at the sites surveyed.

2.1.5 Shoreline bacteriological water quality

Bacteriological water quality was monitored at four coastal sites in the vicinity of the marine outfall (Figure 4) during the summer months of 2012-2013 to assess whether the discharge from the marine outfall was having any adverse effects on coastal bathing water quality. A site on the Waiwhakaiho River was also monitored in order to determine any influence of the river on coastal water quality. Thirteen samples were collected at each site during dry weather conditions and analysed for enterococci, faecal coliforms, *E. coli* and conductivity.

Figure 4 Location of monitoring sites in relation to the NPWWTP

A full copy of the report on shoreline bacteriological water quality is contained in Appendix VI. In summary, during the 2012-2013 summer season bacteriological water quality was generally good at the Fitzroy Beach, Mangati and 300m NE sites, but poor at the 500m SW and Waiwhakaiho River sites (Table 7). In relation to MfE water quality guidelines (as set out in Appendix VI), Mangati and Fizroy Beach sites remained in 'Surveillance' mode all summer season. The 300m NE site obtained 'Alert' mode on 2 out of 13 occasions sampled. The 500m SW and the Waiwhakaiho River sites had the majority of samples within 'Action' mode.

Table 7 Summary enterococci results for the NPWWTP sites

Site Name	Enterococci (cfu/100 ml)		MfE Guideline Modes (2003)		
	Median	Maximum	Surveillance	Alert	Action
Mangati	5	36	13	0	0
300m NE	27	230	11	2	0
500m SW	340	5600	2	5	6
Fitzroy Beach	3	36	13	0	0
Waiwhakaiho River	880	8700	1*	0	12*

* *Guideline limits for Waiwhakaiho River based on E. coli counts*

Gulls are believed to be the main source of faecal contamination at this site, with bird faeces entering the site from both the Waiwhakaiho River and the Waiwhakaiho Reef (Photograph 2). High numbers of gulls have been observed and results from faecal source tracking support these observations.

If the wastewater discharge from the outfall was having a greater influence on water quality, higher faecal indicator bacteria counts would be expected at the East of the Outfall site taking into consideration the north easterly prevailing flow. Such a pattern did not occur.

Photograph 2 Gulls at the mouth of the Waiwhakaiho River

2.2 Air

2.2.1 Inspections

Air inspections were undertaken in conjunction with scheduled site inspections on 12 December 2012 and 16 January, 1 May and 10 June 2013. An assessment of the odour performance of the milliscreen and sludge filter buildings was made during each visit.

During three of the four inspections there were slight to moderate odours in the vicinity of the sludge drying/dewatering areas. Strong odours were present in the vicinity of the holding pond at the rear of the milliscreen building during the inspection undertaken in May 2013. The cause of the odour was exposed sludge dumped on the pond edge. No odours were noted beyond the plant boundary on any occasion.

3. Results 2013-2014

3.1 Water

3.1.1 Inspections

Two scheduled site inspections were performed at the plant, on 19 December 2013, and 5 June 2014. These inspections involved a visual assessment of the plant effluent and plant processes, a check of the final effluent chlorine data, a brief consultation with operations and/or laboratory staff, and an inspection of the foreshore and seawater adjacent to the outfall.

The plant and surrounds were found to be tidy and well managed during each visit. Upgrade commissioning was still underway during the first inspection. The clarity of the effluent was good during both visits, with some clumps of algal filaments present. There was some foam on the outgoing effluent in the first inspection. The effluent plume was visible as a small clear patch above the diffuser. There was no evidence of contamination of foreshore or shoreline water during the inspections.

3.1.2 Results of discharge monitoring

3.1.2.1 Grab samples

Grab samples were collected of the final effluent on three occasions. The samples were analysed for faecal coliforms, enterococci, total available chlorine, and free available chlorine (Table 8).

Table 8 Effluent grab samples 2013-2014 (site SWG002002)

Parameter	Unit	Date		
		19-Dec-13	4-Mar-14	5-Jun-14
Faecal coliform	cfu/100 ml	24	20	50
Enterococci	cfu/100ml	5	6	9
Total available chlorine	g/m^3	0.2	0.4	0.4
Free available chlorine	g/m^3	<0.1	<0.2	<0.1

The results of these grab samples show that the consent condition (which requires the total available chlorine level in the final effluent to be maintained at a level not less than 0.3 g/m^3) was met on two of the three sampling occasions.

Relatively low counts of both faecal coliforms and enterococci were recorded in the final effluent on all three occasions.

3.1.2.2 Inter-laboratory comparison

Two grab samples of the final effluent (24 hour composite samples) were collected and split in order to perform an inter-laboratory comparison. The samples were analysed for: cadmium, chromium, copper, nickel, lead and zinc (all acid soluble), cyanide, mercury (total) and phenols (Table 9).

Table 9 Inter-laboratory effluent grab samples 2013-2014

Parameter	Unit	4 March 2014			5 June 2014			Consent limit
		TRC	NPWWTP	Agree	TRC	NPWWTP	Agree	
Cadmium	g/m³	< 0.005	< 0.002	√	<0.005	< 0.002	√	0.04
Chromium	g/m³	< 0.03	<0.02	√	<0.03	<0.02	√	0.15
Copper	g/m³	<0.01	<0.02	√	<0.01	<0.02	√	0.1
Cyanide	g/m³	0.003	<0.02	√	0.01	0.03	**	0.1
Mercury	g/m³	<0.0002	< 0.001	√	0.0003	< 0.001	√	0.002
Nickel	g/m³	< 0.02	< 0.008	√	<0.02	< 0.008	√	0.15
Lead	g/m³	< 0.05	< 0.03	√	<0.05	< 0.03	√	0.1
Phenol	g/m³	<0.02	<0.05	√	<0.02	<0.05	√	1.0
Zinc	g/m³	0.03	0.07	**	0.03	0.05	**	0.2

√ = satisfactory agreement
* = result within 10 -25 % of the mean
** = result > 25 % from mean

The results of the inter-laboratory comparison show that, apart from cyanide and zinc, the values obtained were mostly in good agreement, and all results were within levels prescribed by consent conditions. The majority of metals were below detection limits.

3.1.3 NPDC self monitoring

3.1.3.1 Effluent monitoring

A summary of the results of effluent monitoring (composite samples), from July 2013 to June 2014 by NPDC, is presented in Table 10, along with a summary of previous results since July 1990. Raw data for the period under review can be found in Appendix II. Results from 1990 onwards are plotted in Appendix III.

The results of all parameters were within the consent limits.

Table 10 Summary results of effluent composite samples collected by NPDC

Parameter	Unit	Consent limit	2013-2014			1990-2013		
			Median	Range	Number	Median	Range	Number
pH			7.4	7.1 – 7.7	12	7.60	7.0 – 8.1	271
NH_3	g/m³		0.16	<0.1 - 20	12	0.8	0.05 – 21.8	271
COD	g/m³		32	20 - 181	12	22	10 – 380	265
NOx	g/m³		4.3	0.7 – 6.4	12	6.75	<0.1 – 19	264
Phosphorus	g/m³		0.41	0.1 – 2.1	12	2.17	0.16 – 6.8	262
Cyanide	g/m³	**0.1**	0.02	<0.02 – 0.08	12	<0.05	<0.02 – 0.1	262
Phenols	g/m³	**1.0**	<0.05	<0.05 – 0.08	12	<0.05	< 0.05 – 0.11	259
Zinc	g/m³	**0.2**	<0.05	<0.04 – 0.07	12	0.03	< 0.02 – 0.15	267
Copper	g/m³	**0.1**	<0.02	<0.02	12	<0.01	< 0.01 – 0.05	267
Chromium	g/m³	**0.15**	<0.02	<0.02	12	<0.05	<0.05	267
Nickel	g/m³	**0.15**	<0.008	<0.008	12	<0.02	<0.008 – 0.07	267
Cadmium	g/m³	**0.04**	<0.002	<0.002	12	<0.008	<0.008	267
Lead	g/m³	**0.1**	<0.03	<0.03	12	<0.02	< 0.02 – 0.04	267
Mercury	g/m³	**0.002**	<0.001	<0.001	12	<0.001	< 0.001	256

NPDC also provided Council with a monthly summary of plant performance (influent and effluent grab samples). Treatment of influent at the wastewater treatment plant resulted in a reduction in pH, suspended solids, alkalinity, BOD, COD, ammonia, and faecal coliforms (Table 11). Nitrate generally increased as the ammonia was converted to nitrate through nitrification.

The level of suspended solids in the final effluent was generally below the 25 g/m^3 limit prescribed by consent conditions. The elevated level of 49 g/m^3 in July 2013 is covered by the increased allowable concentration of 110 g/m^3 in condition 5 of the consent. The result of 132 g/m^3 in August 2013 exceeded the consent condition.

BOD of the effluent was elevated during July and August 2013, however, given upgrade work carried out at the plant during this time, the BOD was within the 130 g/m^3 limit allowed by condition 5 of consent 0882-4.

Table 11 Monthly summary of plant performance (mean values) – comparison of influent and effluent grabs 2013-2014. Data in black are influent values, data in blue are effluent values

Parameter	pH	SS g/m^3	Alkalinity g/m^3	BOD g/m^3	COD g/m^3	NH3 g/m^3	NNN g/m^3	FC g/m^3
July 2013	7.4	510	189	381	656	29	0.05	1.4x10^7
	7.5	49	122	38	52	9	0.71	27
August 2013	7.4	447	189	330	706	32	0.08	7.0x10^6
	7.4	132	*	60	181	11	2.9	45
September 2013	7.4	330	183	210	479	28	0.2	2.0x10^6
	7.3	18	*	7	71	4	2.0	41
October 2013	7.4	234	166	178	393	25	0.55	4.2x10^6
	7.3	16	64	7	43	13	6.1	5
November 2013	7.4	293	199	182	454	28	0.8	4.6x10^6
	7.5	7	70	5	31	0.18	6.9	30
December 2013	7.4	292	173	169	449	23	0.8	5.2x10^6
	7.3	8	64	3	31	0.17	5.6	4
January 2014	7.4	331	187	201	454	26	0.03	8.6x10^6
	7.2	7	*	3	26	0.2	8.2	10
February 2014	7.6	379	232	229	558	34	0.24	2.9x10^7
	7.3	7	*	3	30	0.14	4.7	7
March 2014	7.5	370	239	260	514	35	0.08	7.2x10^6
	7.5	3	*	2	22	0.08	4.3	6
April 2014	7.4	346	201	216	480	33	0.08	3.0x10^6
	7.4	5	*	4	31	0.13	4.0	5
May 2014	7.4	297	181	200	438	29	0.3	9.8x10^6
	7.3	3	*	3	24	0.05	3.8	3
June 2014	7.4	385	188	225	474	27	0.08	2.5x10^6
	7.1	6	*	4	44	0.14	6.1	6

* = results not available

Condition 10 of consent 0882-4 requires that total available chlorine in the effluent shall be no less than 0.3 g/m^3. NPDC collected regular grab samples of the effluent to assess this condition. The results are presented in Table 12.

Table 12 Total Available Chlorine (TAC) in effluent grab samples

Min TAC	Normal operation		One basin offline		Total	
	Samples	Compliance	Samples	Compliance	Samples	Compliance
0.3 g/m^3	136	100%	114	96%	250	98%

There was generally a high level of compliance with total available chlorine maintained at acceptable levels most of the time. There was some difficulty in sustaining the 0.3 g/m^3 minimum while one of the aeration basins was offline, section 5 discusses these incidents in more detail.

3.1.3.2 Sludge lagoon monitoring

The results of sludge lagoon monitoring, undertaken once a month by NPDC, are summarised in Table 13, along with a summary of previous results from 1990 to July 2013. The full results of the 2013-2014 period are presented in Appendix IV. The location of the sampling sites in relation to the lagoon are shown in Figure 2, section 2.1.3.2.

Minor changes in pH within all three groundwater bores occurred during the monitoring period. Surface waters within the drain adjacent to the sludge lagoon were generally within the relatively narrow pH range of 6.6 to 6.8.

The process of decomposition of nitrogenous fractions within the sludge biomass generates ammonia. Similar to the previous monitoring period, levels in all three bores during the period under review were relatively low. Levels of ammonia at the open drain sites were also similar to historical results.

Table 13 Summary results of sludge lagoon monitoring 2013-2014 (black) and 1990-2013 (blue)

Site	2013 - 2014 1990 - 2012	pH	NH_3 g/m^3	Faecal coliforms cfu/100ml	TDP g/m^3	NOx g/m^3	COD g/m^3
Bore 1	Number	12	12	12	12	12	12
	Range	5.5 - 6.8	<0.1 – 13	<5 – 80	<0.05 – 0.21	<0.15 – 9.9	13 – 48
	Median	6.3	3.7	<10	<0.05	0.5	21
	Number	249	249	246	248	249	248
	Range	4.9 – 7.1	<0.1 - 100	<5 – 2,300	<0.01 – 3.3	<0.05– 18.3	1 - 44
	Median	6.2	2.4	<10	<0.05	0.3	11
Bore 2	Number	12	12	12	12	12	12
	Range	5.7 – 6.5	<0.1 – 28	<5 – 301	<0.05 – 0.16	<0.15 –0.48	23 – 73
	Median	5.9	0.15	10	<0.05	0.09	35
	Number	249	248	248	248	249	248
	Range	4.9 – 7.4	<0.1 – 25	<5 – 10,000	<0.01 - 0.36	<0.1 - 40	6 - 181
	Median	6.2	2.5	<10	<0.05	0.13	15
Bore 3	Number	12	12	12	12	12	12
	Range	5.7 – 6.5	<0.1 – 1.9	<5 - >5,000	<0.05 – 0.21	<0.15 – 0.9	29 – 200

Site	2013 - 2014 1990 - 2012	pH	NH_3 g/m^3	Faecal coliforms cfu/100ml	TDP g/m^3	NOx g/m^3	COD g/m^3
	Median	6.2	0.3	70	<0.05	0.1	79
	Number	242	242	242	239	240	241
	Range	5.0 – 7.3	<0.1 – 198	<10 – 72,000	<0.05 - 1	<0.15 – 64	1 - 740
	Median	6.3	0.7	<10	<0.05	0.2	16
Open drain point 2	Number	12	12	12			
	Range	6.6 – 6.8	0.35 – 1.1	20 - 620			
	Median	6.6	0.67	150			
	Number	244	244	243			
	Range	6.0 – 6.9	<0.1 – 7.5	<10 – 5,000			
	Median	6.6	0.5	70			
Open drain point 3	Number	12	12	12			
	Range	6.6 – 6.8	1.8 – 20.8	50 – 630			
	Median	6.7	4.1	193			
	Number	243	244	243			
	Range	6.4 – 7.1	0.13 – 27	<10 – 1,970			
	Median	6.7	6.2	100			

The median faecal coliform counts recorded at Bores 1 and 2 were generally low, with medians of <10 and 10 cfu/100 ml respectively. Bore 3 had a higher median of 70 cfu/100 ml. High counts of >900 cfu/100 ml were recorded on four occasions at Bore 3. The two open drain sites had generally higher levels of faecal coliforms than the bores, with variation in faecal coliform numbers in the surface waters of the drain affected to a greater extent by fluctuations in drain flow and access by stock and wildlife.

Soluble phosphate is released from the sludge biomass under anaerobic conditions and therefore is the major contributor to dissolved phosphorus levels. Levels at all three bores were low. The generally low levels of total dissolved phosphorus at the bore sites indicate that soluble phosphorus might have been absorbed into the ash and clay substrate.

Oxidised nitrogen levels in the groundwater bores generally remained low throughout the monitoring period.

Levels of COD increased from Bore 1, to Bore 2 to Bore 3 with levels in all three wells above the historical median. These elevated COD levels indicate that seepage from the lagoon was occurring. The construction of the lagoon was so that the sludge would be forced by hydraulic pressure into the fine river silts and ash which underline the lagoon, thus blinding and sealing the bottom of the lagoon. This has in the most part been achieved, although minimal leakage still occurs as indicated by the monitoring results of groundwater and surface waters in the vicinity of the lagoon.

3.1.4 Marine ecological surveys

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, ecological surveys were conducted in January 2014 at five

sites (Figure 3 in section 2.1.4). These surveys included three potential impact sites named (site codes in brackets):

- 500m SW (SEA902015)
- 300m NE (SEA902010)
- Mangati Reef (SEA902005)

The two control sites were:

- Turangi Reef (SEA901007)
- Greenwood Road (SEA903070)

It is probable that any adverse effects of the NPWWTP outfall discharge on the intertidal communities would have been evident as a significant decline in species richness and diversity at the potential impact sites relative to the control sites.

A full copy of the marine ecological survey reports, including a comprehensive analysis and interpretation of results, are provided in Appendix V. In summary, both number of species and Shannon-Weiner index were greater at the potential impact site closest to the outfall relative to the two control sites (Figures 5 and 6). In addition, over the long term record, there has been no obvious decline in number of species and Shannon-Weiner index at the potential impact sites relative to the control sites. The results indicate that the outfall discharge was not having detectable adverse effects on the intertidal reef communities of north Taranaki. Natural environmental factors, in particular sand cover, substrate type and substrate mobility, appeared to be the dominant drivers of species diversity at the sites surveyed.

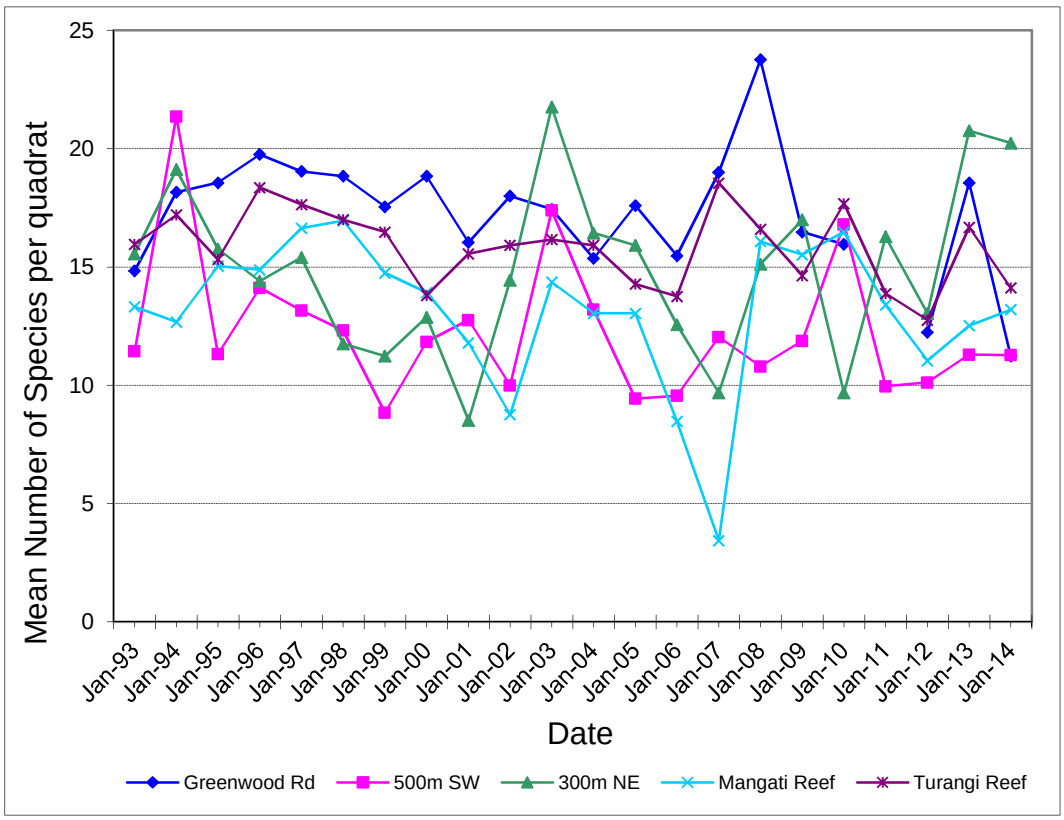

Figure 5 Mean number of total species per quadrat from 1993 to 2014

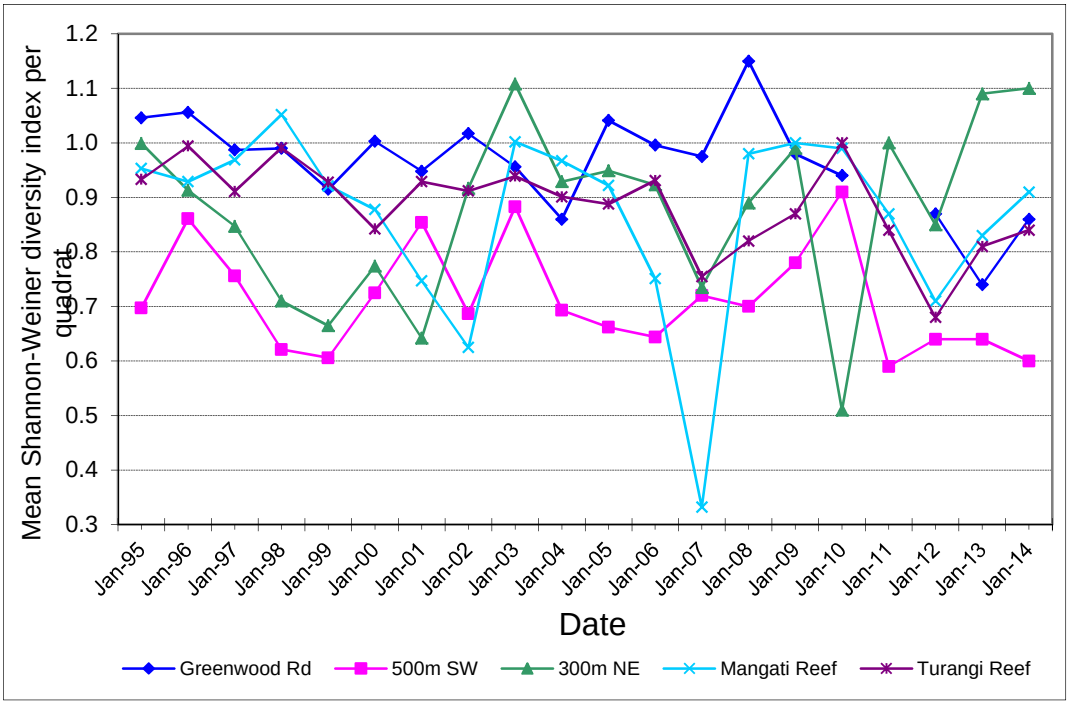

Figure 6 Mean Shannon-Weiner index per quadrat from 1995 to 2014

3.1.5 Metals in mussel tissue

Mussels can accumulate contaminants in their tissues over time. As a consequence, they can be used as bio-monitors to assess the contaminant load at a particular site. Naturally occurring green lipped mussel were collected from three low shore sites. In order of influence from the NPWWTP outfall discharge the sites sampled were: the Waiwhakaiho Reef, Bell Block and Arakaitai Reef. All sites consisted of scattered mussel populations.

Each sample was depurated (mussels were placed in filtered seawater for a period of time to allow the elimination of waste products from the gut). The results of heavy metal analysis in mussel tissue are presented in Table 14.

Table 14 Heavy metal contaminants in green lipped mussel flesh and guideline maximum limits

Parameter	Units	Site			Shellfish guideline maximum limit*
		Arakaitai Reef	Waiwhakaiho Reef	Bell Block	
Silver	mg/kg	<0.01	<0.01	<0.01	-
Cadmium	mg/kg	0.027	0.025	0.029	2
Chromium	mg/kg	<0.10	<0.10	<0.10	-
Copper	mg/kg	0.55	1.01	0.69	-
Mercury	mg/kg	<0.01	<0.01	0.012	0.5
Nickel	mg/kg	0.15	0.23	0.25	-
Lead	mg/kg	0.025	0.127	0.031	2
Zinc	mg/kg	7.2	7.8	8.3	-

**Australia New Zealand Food Standards Code, 2008*

For those metals which have standards (mercury, cadmium and lead), concentrations in mussel flesh from all three sites (Table 14) were well below Australia New Zealand Food Standards Code guidelines (2008).

There were only minor variations in metal concentration between sites (Table 14). Both lead and copper were elevated at the Waiwhakaiho Reef site relative to the other reef sites. However these concentrations were well within the range of concentrations recorded in mussel flesh around the Taranaki region (between 2008 and 2014 copper 0.44 to 1.96 mg/kg and lead 0.03 to 0.31 mg/kg) and were of no cause for concern.

The results collected since 1993 (Appendix VII) indicate that, over the long term, metal concentrations in mussel flesh are comparable between all three sites.

The mussel survey is scheduled to occur every two years and will be next completed as part of the 2015-2016 monitoring period.

3.2 Air

3.2.1 Inspections

Air inspections were undertaken in conjunction with scheduled site inspections on 19 December 2013 and 5 June 2014. An assessment of the odour performance of the milliscreen and sludge filter buildings was made during each visit.

Moderate odours were detected down wind of the sludge processing area and adjacent to the rear sludge storage lagoon (behind the milliscreen building).

4. Upgrade monitoring

Over the duration of the aeration basin upgrade (December 2012 to August 2013), additional monitoring was undertaken in the receiving environment by the Council and of the effluent by NPDC.

4.1 Receiving environment monitoring

4.1.1 Shellfish microbiology

In waters affected by discharges from wastewater treatment plants the relationship between indicators and pathogens can be altered by the wastewater treatment process. Currently, it is norovirus that are believed to pose the greatest health risk in seawater containing treated wastewater. Norovirus are the main cause of gastroenteritis associated with shellfish consumption and only low concentrations are required to pose a high risk of infections in humans. Mussels and other filter feeding molluscs are efficient at concentrating norovirus which can be retained in their flesh for up to 8-10 weeks.

As a requirement of condition 13, consent 0882-4, a Quantitative Microbial Risk Assessment (QMRA) was completed which assesses the human health effects associated with norovirus in wastewater discharges from the NPWWTP (McBride, 2012).

In conjunction with the QMRA and as a requirement of condition 14, consent 0882-4, monitoring of microbial contamination within shellfish was implemented within the consent compliance monitoring for the NPWWTP. Mussel flesh was monitored for norovirus (GI and GII) and faecal coliforms at two potential impact sites (Waiwhakaiho Reef and Bell Block) and one control site (Oakura) before, during and after the NPWWTP upgrade works. Norovirus (GI and GII) concentrations were also measured within the NPWWTP influent and effluent.

Results of norovirus monitoring of influent and effluent support predictions made in the QMRA regarding a reduction of disinfection during the upgrade period (Table 15). During the upgrade, norovirus numbers were reduced less than an order of magnitude by the treatment process (reduction GI x4.3, GII x8.6 on 31 July 2013). Following the upgrade, when both aeration basins were back online, disinfection was much improved with over a two order of magnitude decrease in norovirus numbers as a result of treatment (reduction GI x335, GII x209 on 9 June 2014).

Table 15 Norovirus concentration in the effluent and influent from the NPWWTP

Operation	Date	Influent norovirus (genome copies/L)		Effluent norovirus (genome copies/L)	
		GI	GII	GI	GII
Upgrade	31 July 2013	35000	1200000	8200	140000
Post-upgrade	9 June 2014	67000	480000	200	2300

This difference in norovirus disinfection between upgrade and normal operation of the NPWWTP was reflected in the mussel flesh norovirus results (Table 16). During normal operation of the plant prior to the upgrade (on 5 October 2012) norovirus levels in mussel flesh were either below detection limits or low. Towards the end of the upgrade (20 August 2013) levels of norovirus GII were extremely high in mussel flesh from the Waiwhakaiho Reef (closest site to the outfall discharge) and moderate

in mussel flesh from Bell Block. Since completion of the upgrade norovirus levels in mussel flesh have dropped back to low or below detection levels (on 15 June 2014). However, due to the highly infectious nature of norovirus, with only low concentrations posing a high risk of illness, shellfish warning signs remain in place at the Waiwhakaiho area and Bell Block (Photograph 3).

Table 16 Mussel flesh microbiology results before, during and after the NPWWTP upgrade

Operation	Date	Site	Mussel flesh norovirus		Faecal coliforms	
			GI	GII	Mussel flesh (MPN/100 g)	Receiving water (MPN/100 ml)
Normal: Pre-upgrade	5 Oct 2012	Waiwhakaiho Reef	Negative	Negative	9000	90
		Bell Block	Negative	Low	1300	80
		Oakura	Negative	Negative	300	17
Upgrade: Aeration basin bypass	20 Aug 2013	Waiwhakaiho Reef	Moderate	Extremely high	460	7
		Bell Block	Low	Moderate	68	130
		Oakura	Negative	Low	20	2
Normal: Post-upgrade	15 June 2014	Waiwhakaiho Reef	Low	Negative	-	-
		Bell Block	Negative	Low	-	-

Concentrations of faecal coliforms in mussel flesh did not closely correlate with norovirus levels (Table 16). While norovirus provides an indication of contamination from human faecaes, faecal coliforms are indicative of faecal contamination from a range of different animal sources, potentially including livestock (cows and sheep) and wildlife (mainly birds). Both are relevant when considering health risks.

Photograph 3 Shellfish health warning sign at the Waiwhakaiho River mouth

Photograph 4 Green lipped mussels at Bell Block

4.1.2 Additional shoreline bacteriological water monitoring

Condition 9 of consent 0882-4 required signs to be erected at Fitzroy Beach and Bell Block Beach during periods the aeration basins were offline (December 2012 to December 2013) advising the public of potential health risks associated with partially treated sewage. Results from the QMRA were used to asses the potential magnitude of health risks during the bypass period. It was decided that while health risks from contact recreation were likely to be acceptably low (individual illness risk at Fitzroy Beach <0.5%), the risks from consuming raw shellfish were notably higher (individual illness risk at Fitzroy Beach >5%). Taking these results into consideration, the signs included a recommendation not to collect shellfish (Photograph 5). In order to check water quality for contact recreation, three coastal sites (named Fitzroy Beach, Bell Block and 300 m NE) were monitored on a weekly basis under all weather conditions during the bypass period. A site in the Waiwhakaiho River was also monitored in order to determine any potential contamination of the coastal site from the river (noting that this river site would not have been affected by discharges from the NPWWTP). Any decisions regarding contact recreation signage were made by the Taranaki District Health Board based on the monitoring results in relation to the MfE *Guidelines for Recreational Water Quality* (refer to Appendix VI for an explanation of MfE guidelines).

The location of the four sites sampled during the upgrade period are shown in Table 17. The data for the sites are presented in Figure 7 and Appendix VIII with a statistical summary provided in Table 18.

Photograph 5 NPWWTP Upgrade sign at Fitzroy

Table 17 Location of sampling sites

Site Name	Location	GPS	Site code
Bell Block	West of Mangati Stream	2609210E-6242224N	SEA902001
300 m NE	300 m NE NPWWTP outfall	1696721E-5679002N	SEA902010
Fitzroy Beach	Opposite surf lifesaving club	1694948E-5677598N	SEA902025
Waiwhakaiho River	Downstream of Lake Rotomanu	1696587E-5678336N	WKH000950

Table 18 Faecal indicator bacteria summary statistics

Site	Enterococci (cfu/100ml)			*E. coli* (cfu/100ml)			Faecal coliforms (cfu/100ml)			Conductivity @ 20°C (mS/m)		
	Median	Max	Min	Median	Max	Min	Median	Max	Min	Median	Max	Min
Fitzroy Beach	4	140	<1	3	170	<1	3	170	<1	4690	4790	3830
300 m NE	13	740	<1	8	340	<1	12	360	<1	4620	4790	2970
Bell Block	19	1800	<1	11	750	<1	11	750	<1	4600	4790	3550
Waiwhakaiho River	620	8700	8	665.0	5000	63	730	5500	66	11.5	1100	1.8

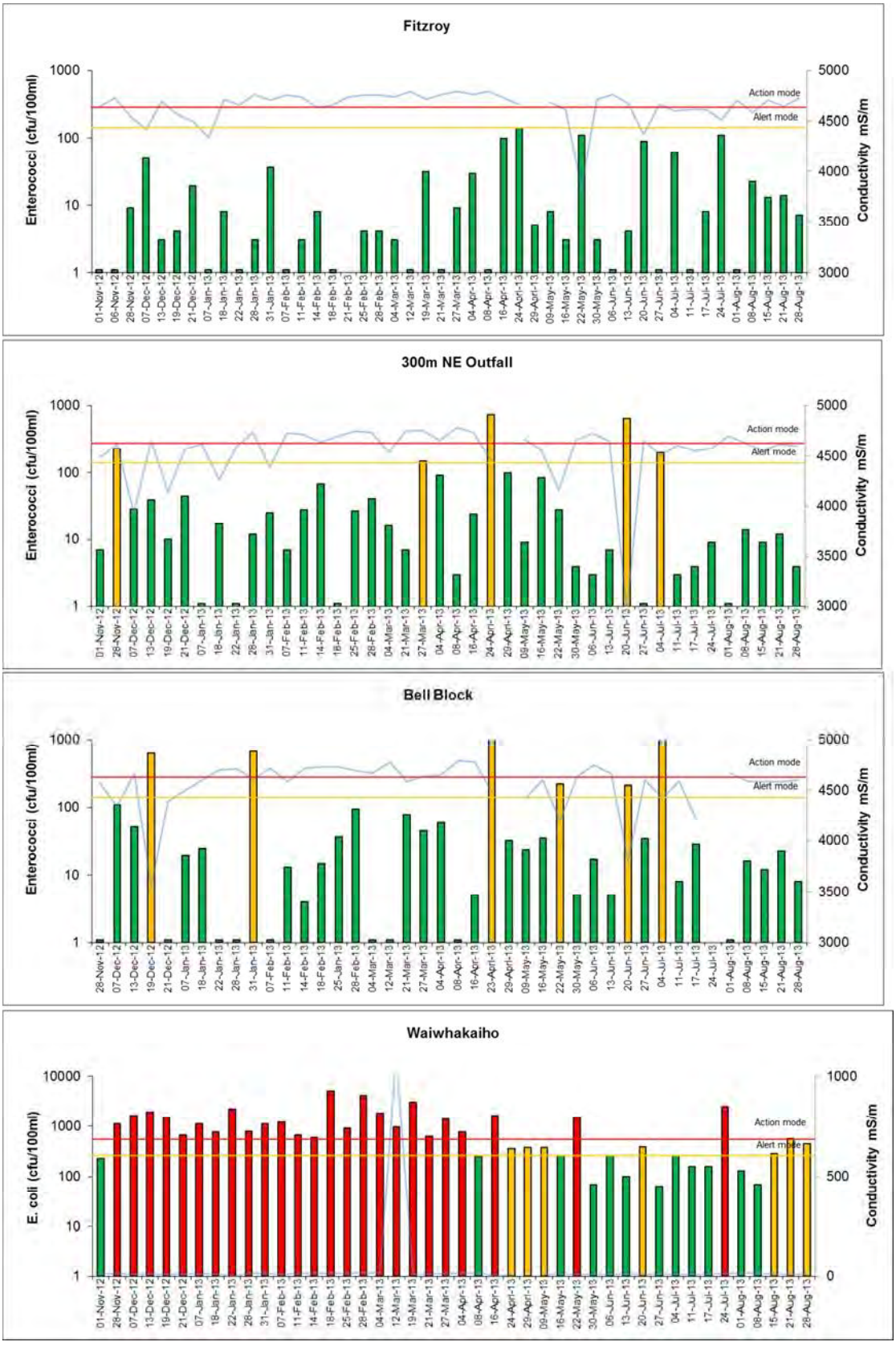

Figure 7 Faecal indicator bacteria counts at three coastal sites and one river site during all weather conditions over the NPWWTP upgrade period

Green bars = MfE 'Surveillance' mode, orange bars = MfE 'Alert mode', red bars = MfE 'Action' mode, blue line = conductivity

Bacteriological water quality at Fitzroy Beach remained high throughout the upgrade period with a low median enterococci count (4 cfu/100 ml) and all samples remaining in 'Surveillance' mode (Table 18, Figure 7). This site was relatively resilient to wet weather and freshwater input with the highest conductivity median and maximum of the three coastal sites (Table 18, Figure 7). At this site, there was no detectable influence from the NPWWTP discharges during the upgrade period monitored.

Being the closest site to the outfall discharge plume, water quality at the 300 m NE site was the most likely to be effected by reduced disinfection of effluent during the upgrade. Despite this, water quality was generally good at this site with a relatively low median enterococci count (13 cfu/100 ml) and 37 out of 42 samples (88%) remaining in 'Surveillance' mode (Table 18, Figure 7). However, the occasional high count was recorded, with five samples (12%) entering 'Alert' mode i.e. >140 cfu/100 ml (noting that although two samples exceeded 280 cfu/100 ml they remained in 'Alert' mode because they were not recorded consecutively, see guideline explanation Appendix VI). For all but one of the 'Alert' mode samples (27 March 2013), it had rained prior to sampling. This site was more susceptible to freshwater input from local run off and the Waiwhakaiho River, with a lower median and minimum conductivity than Fitzroy (Table 18). For the high enterococci count recorded on 20 June 2013 (660 cfu/100 ml) it is not possible to rule out potential influence from an unauthorised sewage discharge from NPWWTP on the 17 June 2013. However, there had been extremely heavy rain over this period, as indicated by the low conductivity (2970 mS/m at 20^{o}C), indicating that the Waiwhakaiho River and freshwater run off had effected water quality on that date.

The Bell Block site had the poorest water quality, with the highest median and maximum enterococci counts of the three coastal sites (19 and 1800 cfu/100 ml respectively, Table 18). This site is often influenced by the Mangati Stream following rainfall. The Mangati Stream is known to have poor water quality, with faecal contamination from a range of different animal sources (faecal source tracking result show ruminant, bird and human faecal contamination). Although samples generally obtained 'Surveillance' mode during dry weather conditions (82% of samples), high counts were obtained following heavy rain (Figure 7). Overall, the results indicate that the Mangati Stream had a greater influence on bacteriological water quality at Bell Block than discharges from the NPWWTP over the upgrade period.

At the Waiwhakaiho River site, median and maximum counts of all faecal indicator bacteria were very high (Table 18), indicating poor water quality at this site. Only 27% of the 44 samples obtained 'Surveillance' mode, with 13% 'Alert' mode and 59% 'Action' mode samples (Figure 7). Faecal source tracking results indicate that gulls are the main source of contamination. Interestingly, from April to August 2013, fewer gulls were observed directly upstream of the sample site coinciding with a drop in *E. coli* counts (Figure 7). It is possible, following heavy rainfall, faecal contamination in the river influenced water quality at the coastal site 300 m NE, as indicated by low conductivity.

In summary, weekly monitoring of faecal indicator bacteria at three coastal sites was used to guide whether signage was required in relation to contact recreation as a result of reduced disinfection of wastewater discharges from the NPWWTP during the upgrade of the aeration basins. No samples taken from the three coastal sites

during the upgrade period obtained 'Action' mode, therefore contact recreation signs were not erected at Fitzroy or Bell Block as a result of the additional monitoring undertaken. Water quality at Fitzroy Beach remained high with all samples remaining in 'Surveillance' mode. Following heavy rain, water quality at Bell Block was, on occasions, effected by the Mangati Stream. Occasional high enterococci counts were also obtained at the 300 m NE site following heavy rainfall. These high counts were most likely a result of freshwater influence from the Waiwhakaiho River and localised run off, although it was not always possible to totally discount influence from NPWWTP discharges.

4.1.3 Additional effluent monitoring

During upgrade of the aeration basins NPDC undertook additional monitoring of effluent suspended solids and BOD in relation to the variation to the limits defined in consent 0882-4, condition 5 (Table 19).

Table 19 Additional effluent monitoring undertaken by NPDC during 2012-2013

Constituent	Consent limit (g/m^3)	Sample type	Number of samples	% compliance
Suspended solids	110	Effluent grab	12	42%
		Effluent composite	81	65%
BOD	130	Effluent grab	4	100%
		Effluent composite	69	97%

There were 28 non complying suspended solids composite results between 9 December 2012 and 19 May 2013. The maximum was 318 g/m^3 with an average of 100 g/m^3.

There were seven non complying suspended solids grab samples between 28 December 2012 and 2 April 2013. The maximum was 463 g/m^3 on 19 March with an average of 185 g/m^3.

Two BOD composite samples, taken on 11 December and 19 March, were non compliant. In both samples the BOD concentration was 160 g/m^3.

Table 20 Additional effluent monitoring undertaken by NPDC during 2013-2014

Constituent	Consent limit (g/m^3)	Sample type	Number of samples	% compliance
Suspended solids	110	Effluent composite	88	97%
BOD	130	Effluent composite	70	99%

There were 3 non complying suspended solids composite results between 7 July 2013 and 10 October 2013. The maximum was 152 g/m^3 on 24 July 2013.

One BOD composite samples, also taken on 24 July 2013, was non compliant (140 g/m^3).

During the upgrade of the first aeration basin the weather conditions were dry for an extended period of time. As a result the influent flows were lower than usual and the concentration of influent was high. Given the treatment capacity limitation, with only the second aeration basin in service, the bypassed influent was of a higher concentration than anticipated by NPDC and when blended with treated effluent the limits of condition 5, consent 0882-4 were not consistently met. As a result, NPDC were issued an abatement notice (further details provided in Section 5.1).

5. Investigations, interventions, and incidents

The monitoring programme was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. Matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual courses of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register includes events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified company is indeed the source of the incident (or that the allegation cannot be proven).

5.1 Incidents 2012-2013

There were 18 incidents associated with the NPWWTP during the 2012-2013 monitoring year. Eleven of these were associated with discharges from sewage pump stations while seven were related to non-compliance with consent conditions. These are discussed below and summarised in Table 21.

On 5 July 2012 NPDC notified Council of an overwash at the NPWWTP. The incident was due to an electrical fault in a pump from Clarifier 2 to the aeration basin, which caused the clarifier to overwash. The pump system fault was checked and reset and normal operations resumed.

On 16 and 17 July 2012 overwashes occurred at the NPWWTP due to extreme rainfall. Measures were taken to reduce suspended solids and samples of the effluent were collected. The Council was notified.

A further overwash occurred at the NPWWTP on 10 August 2012 due to operational problems with the thermal drying facility (TDF). Clarifier 2 was returned to service and electrical problems with the TDF were corrected. The Council was notified and no further action was taken.

On 9 November 2012 NPDC staff advised Council that chlorine levels had dropped to less than 0.2 g/m^3 in the plant. On 17 November 2012 there was an unauthorised discharge due to jams on the milliscreen associated with high flows. A letter of explanation was received regarding the two incidents and it was established that both breaches of consent were due to unforeseeable and unpreventable mechanical failures. Therefore a defence under the RMA was established and no further action was taken. It was considered that adequate measures had been put in place to prevent a reoccurrence.

Table 21 Summary of incidents related to the NPWWTP during 2012-2013

Date	Incident	Action	Outcome
5 July 2012	Overwash due to electrical fault	System checked and reset	No further action taken
16 July 2012	Overwashes due to extreme rainfall	Measures taken to reduce suspended solids in effluent	No further action taken
17 July 2012			
10 August 2012	Overwash due to mechanical failure	Fault fixed	No further action taken
9 Nov 2012	Chlorine <0.2g/m^3	Letter of explanation received, both incidents due to unpreventable mechanical failures	Measures put in place to prevent reoccurrence
17 Nov 2012	Unauthorised discharge		
9 Dec 2012	Ongoing suspended solids limits breached	Proportion of by-passing effluent reduced	No further action taken
11 Dec 2012			
27 Jan 2013-May 2013		Meeting held to discuss options	**Abatement notice** issued
22 Mar 2013	Low chlorine levels	Letter of explanation received detailing steps put in place to avoid reoccurrence	**Infringement notice** issued
6 Mar 2013	Low chlorine levels	Letter of explanation received detailing steps put in place to avoid reoccurrence	**Abatement notice** issued
17 Mar 2013			
19 Mar 2013	Overwash due to flooding, including breach of suspended solids levels	Water samples collected form beach – within bathing standard limits. Report provided by NPDC detailing corrective action to prevent reoccurrence	Suspended solids breach covered under abatement notice issued previously
6 May 2013	Effluent discharged	Improved SCADA alarms	Letter of explanation requested
17 May 2013	Overwash due to heavy rainfall	Chlorine dosing increased	Letter of explanation requested
22 May 2013	Power failure causing influent overflow to stormwater	Mains supply reset	No further action
4 June 2013	Overwash due to high rainfall	Flow split altered and chlorine dosing increased	No further action
17 June2013	Overflow and discharge to stormwater due to high rainfall	Pump inflow reduced to prevent overtopping	No further action

On 9 and 11 December 2012, the suspended solids limit was breached, respective values of 141 and 318 g/m^3 being recorded. The proportion of by-passing effluent was reduced in order to bring the effluent suspended solids level under control. No action was taken by Council, other than to maintain close monitoring.

Self notification was received concerning suspended solids measurements which had consistently exceeded the consent limit of 110 g/m^3, by factors of up to 27% since 27 January 2013. NPDC commenced an upgrade of the first of two aeration basins at NPWWTP on 3 December 2012, and the limit on suspended solids (and on BOD) in the plant effluent was increased temporarily, from 25 to 110 g/m^3 under condition 5(a) on consent 0882-4. This was to provide for by-passing of screened-only influent around the affected basin. Chlorination was increased to ensure disinfection. Monitoring frequency was increased, for both effluent (by NPDC) and receiving water (by the Council). A meeting initiated by NPDC was held at Stratford on Thursday 21 February to discuss reasons for the breaches and remedial options. An abatement notice was issued.

On 26 February 2013, self-notification was received concerning a breach in chlorine levels at the NPWWTP on 22 February 2013. Investigation found that the decrease in chlorine levels was due to a combination of human and equipment error. A report was received from NPDC outlining the issues and steps that had been put in place to prevent reoccurrence. An infringement notice (fine) was issued.

Self-notification was received concerning a breach in chlorine levels at the NPWWTP on 6 March 2013. Investigation found that the decrease in chlorine levels was due to unforeseen equipment error. A report was received from NPDC, outlining the issues and steps that have been put in place to prevent reoccurrence. A further notification was received from NPDC advising of a further breach in chlorine levels on 17 March 2013. This was also due to unforeseen equipment error. An abatement notice was issued requiring condition 10 of the resource consent to be complied with at all times.

An inspection was conducted at the NPWWTP and receiving waters on 19 March 2013 following self notification received from NPDC regarding an overwash event. The overwash commenced at 09:30 and ceased at 16:00 on 19 March 2013. The cause of the overwash and the potential for consent breaches was discussed with staff onsite. The overwash event had occurred as a result of two flash flood events during the previous 24 hours (following an extensive dry period), combined with the plant upgrade work. Staff were taking preventative measures to ensure that the effluent was adequately disinfected. Following a site inspection at the NPWWTP, water samples were taken from Fitzroy Beach, the Waiwhakaiho River (at Rotomanu), and at the beach near the Waiwhakaiho groyne for bacteriological analysis. Despite high faecal indicator bacteria counts from the Waiwhakaiho River (typical of values post heavy rainfall), enterococci counts at Fitzroy remained below MfE guideline levels. Any negative impact from the discharge event on receiving waters was not evident from the bacteriological results.

Later results confirmed that there had been a breach (condition 5, consent 0882-4) of the suspended solids concentration (463 g/m^3) in the effluent during the overwash event. NPDC had until 17 May 2013 to comply with suspended solids levels, as required by an abatement notice discussed above. A completed Unauthorised Sewage Discharge Final Report was provided by NPDC on 2 April 2013 outlining the cause of the overwash event and corrective action taken to prevent reoccurrence.

On 6 May 2013 the trim pump blocked and treated effluent discharged. Improved SCADA alarms were implemented. The Council was notified and requested a letter of explanation.

An overwash from Clarifier 1 to the outfall occurred on 17 May 2013 after heavy rainfall and constant flow greater than 600 L/s to the plant. Chlorine dosing was increased. The Council was notified and a letter of explanation was requested.

On 22 May 2013 a power failure caused influent to overflow to a stormwater drain. The mains supply was reset and recycled water, TDF and dewatering were shut down to reduce flows. The Council was notified and no further action was taken.

On 4 June 2013 there was an overwash from Clarifier 1 caused by heavy rainfall. The flow split was altered and increased chlorine dosing was undertaken. The Council was notified and no further action was considered necessary.

On 17 June 2013 an extreme weather event resulted in flows into the plant exceeding 1000 L/s, causing the channel prior to the aeration basin to overflow and discharge via the stormwater system to the stream beside NPWWTP. Pump flow was reduced at Te Henui to prevent the overflow. Council was notified and no further action was taken.

5.2 Incidents 2013-2014

In the 2013-2014 period, there were 15 recorded incidents associated with the NPWWTP and the municipal sewerage system. Twelve of these related to non-compliance with consent conditions and three were unauthorised discharges from the NPWWTP and Sewage Pump Stations. These are discussed in more detail below and summarised in Table 22.

Self notification was received from NPDC on 22 July 2013 regarding non-compliance of chlorine, suspended solids and BOD levels in the effluent. These events were related to the commencement of bypassing as part of the upgrade of the second aeration basin. Chlorine dosing was increased immediately once the problem was detected, resulting in concentrations below the required level for six minutes. Suspended solids and BOD began to exceed consent limits between 22 and 26 July 2013, with investigation finding that the proportion of wastewater bypassing treatment was greater than intended. Flows were adjusted and the levels of suspended solids and BOD were brought back within allowable limits. Council requested and received a letter of explanation from NPDC and no further action was taken.

NPDC notified Council that suspended solids had exceeded the allowable level on both 14 and 20 August 2013. These incidents were both of short duration, occurring during upgrade construction and as such no further action was taken.

Notification was received from NPDC on 26 September 2013 regarding an overflow of effluent to the Waiwhakaiho River. Investigation found that contractors had disabled pumps for a sump and this had overflowed causing the discharge. Signs were erected at the river mouth to warn the public. An inspection, carried out later in the day by Council staff, found no evidence of effluent in the river.

Self notification was received from NPDC on 23 October 2013 and 11 November 2013 regarding short (10-15 minutes) chlorine level breaches (low chlorine). NPDC provided a written explanation, and no further action was taken.

Self notification was received from NPDC on 11 November 2013 regarding discharge of treated scum into the stormwater system and into the stream beside the plant. An inspection of the receiving waters by Council staff did not identify any adverse effects caused by the discharge. A letter of explanation was received from NPDC and no further action was taken.

Table 22 Summary of incidents related to the NPWWTP during 2013-1014

Date	Incident	Action	Outcome
22 Jul 2013	Chlorine below 0.3 g/m^3	Chlorine dosing increased. Letter of explanation received	No further action
22 Jul 2013	Elevated SS and BOD	Proportion of by-passing effluent reduced. Letter of explanation received	No further action
14 Aug 2013	Elevated SS	Actions taken by NPDC to prevent reoccurrence	No further action
20 Aug 2013		Actions taken by NPDC to prevent reoccurrence	No further action
26 Sep 2013	Discharge to stream	Signs erected to warn public. Inspection of river found no evidence of any effects	No further action
23 Oct 2013	Chlorine below 0.3 g/m^3	Letter of explanation received	No further action
11 Nov 2013		Letter of explanation received	No further action
11 Nov 2013	Discharge to stream	Spill cleaned up. Inspection of stream found no evidence of any effects. Letter of explanation received	No further action
28 Nov 2013	Chlorine below 0.3 g/m^3		No further action
29 Nov 2013	Discharge to stream	NPDC undertook measures to ensure scenario does not reoccur	No further action
21 Dec 2013	Chlorine below 0.3 g/m^3		No further action
31 Jan 2014		Letter of explanation received. A number of measures undertaken by NPDC to prevent reoccurrence	**Infringement notice**
13 Feb 2014			No further action
5 Mar 2014		Letter of explanation received	No further action
16 Jun 2014		Additional low level alarm installed to prevent reoccurrence.	No further action

On 28 November 2013 a peak flow test (creating a high flow into the plant to see how it responded) adversely affected the control of the chlorine concentration in the chlorine contact tank resulting in a drop below 0.3 g/m^3. The test identified that the chlorine system was on automatic control and would not respond quickly enough.

On 29 November there was an overflow into the stream beside the plant due to an obstruction preventing a valve from closing. NPDC undertook measures to ensure the scenario did not reoccur. No further action was taken.

On 21 December a power cut occurred in the CBD and at the Te Henui Pump Station and the restoration of power caused a sudden change in flow to the plant. Chlorine dropped below 0.3 g/m^3 in chlorine contact tank. A technician manually started the backup pump to increase chlorine levels in the tank. A review of disinfection procedures was conducted. No further action was taken.

Self notification was received from NPDC regarding chlorine levels lower than the limit of 0.3 g/m^3 allowed by condition 10 of consent 0882-4 on 31 January 2014. Council received a letter of explanation from NPDC regarding a number of corrective actions to prevent a similar situation happening again. An infringement notice (fine) was issued.

On 13 February 2014 a gate failure at the Te Henui pump station caused a sudden change in flow resulting in chlorine dropping below 0.3 g/m^3 in the chlorine contact tank. The backup pump was switched on and the dose rate was increased. Council was notified and no further action was taken.

On 5 March 2014 a power failure occurred and the generator failed to start. The trim pump faulted resulting in the chlorine level dropping below 0.3 g/m^3. The trim pump was reset to enable the system to operate as normal. A letter of explanation was received from NPDC and no further action was taken.

Chlorine levels dropped below the 0.3 g/m^3 required in the effluent on 16 June 2014. The low chlorine alarm was responded to immediately and chlorine dosing was resumed. An additional alarm has been installed as a result of the incident so that the operator is notified prior to the chlorine tank being empty.

6. Discussion

6.1 Discussion of plant performance

Major construction works were carried out at the plant during the 2012-2014 period. A number of non-compliances with consent conditions occurred directly as a result of the works undertaken. It is expected that, as normal operations are resumed in the 2014-2015 period, that compliance with consent conditions will improve.

NPDC publicly notified its intention to exercise condition 5(a) of consent 0882-4 at least five working days prior to taking the aeration basin off-line as per condition 6 of the consent. Council staff were notified of the intended dates that the aeration basin would be offline in order for an upgrade to occur as per condition 8 of consent 0882-4. Signs were erected at Fitzroy and Bell Block beaches as required by condition 9 of the consent.

A Quantitative Microbiological Risk Assessment (QMRA) of the discharge (focusing primarily on bypass discharges) was submitted in December 2012 as per condition 13 of consent 0882-4. Condition 14 required a Monitoring Plan to be submitted within six months of receipt of the QMRA. This was received in June 2013, after steps required by conditions 15 to 17 were followed, and a final version was approved by Council in October 2013.

Condition 20 of consent 0882-4 requires that NPDC provide an annual report to the Council by 31 July each year. The report is to detail progress made towards reducing inflow and infiltration reduction; NPDC's target for reduction of inflow and infiltration; and works proposed to meet that target over the coming year. Reports covering the 2012-2013 and 2013-2014 monitoring periods were received.

Updated contingency plans, as required by condition 21 of the same consent, were provided for the site in August 2012 and August 2013.

An annual meeting with representatives of the Council, Ngati Tawhirikura Hapu, and interested submitters is required by condition 22 of consent 0882-4. These meetings were held in December 2012 and 2013. In both instances the invitation for the meeting was extended to interested parties (including those specified in consents) for both New Plymouth and Waitara wastewater treatment plant consents. An update on the Waitara to New Plymouth pipeline and NPWWTP upgrade works was provided along with a summary of the monitoring undertaken in relation to all consents.

6.2 Environmental effects of exercise of consents

6.2.1 Effluent discharge to Tasman Sea

Two consents cover the discharge of treated wastewater from the plant to the Tasman Sea via the marine outfall. Consent 0882-4 allows the discharge of the wastewater through the marine outfall and consent 4593-2 licenses the presence of the outfall structure in the coastal marine area.

Monitoring of the wastewater discharge to the Tasman Sea during the 2012-2014 monitoring period consisted of both monitoring of the final wastewater composition prior to discharge, and monitoring of the effects of the discharge on the receiving environment.

Monitoring of the final wastewater prior to discharge was primarily undertaken by NPDC in the form of regular grab samples and monthly 24-hour composite samples. Inter-laboratory comparisons and checks of compliance with consent conditions were also undertaken by the Council. There was 100% compliance regarding contaminants as per condition 3 of consent 0882-4. During normal operation of the plant there were a couple of suspended solid breaches (condition 4) associated with high rainfall. During upgrade of the plant there were numerous occasion suspended solids and BOD exceeded consent condition 5 despite the increased concentration allowed while upgrade works were in progress. Chlorine concentrations were below the consent limit (condition 10) on a number of occasions and NPDC received an infringement notice (fines) during both 2012-2013 and 2013-2014 as a consequence.

Monitoring of effects on the receiving environment consisted of an intertidal marine ecological survey of potentially affected reefs, assessment of shoreline bacteriological water quality, analysis of metals in mussel tissue and analysis of norovirus in mussel tissue. Elevated norovirus levels were detected in mussel flesh towards the end of the upgrade works. There were no other significant detectable effects in the receiving environment resulting from wastewater discharges from the plant during the 2012-2014 monitoring period.

6.2.2 Sludge lagoon and sludge disposal monitoring

NPDC also hold two consents in relation to the management of activated sludge and bio solids. Consent 2982-4 allows the discharge of leachate from the sludge stabilisation lagoon to groundwater and consent 3989-2 allows the discharge of waste activated sludge and/or bio solids from the treatment plant onto land.

Monitoring of the sludge lagoon facility during the 2012-2014 monitoring period consisted of monthly testing of groundwater bores and nearby surface water in an open drain by NPDC, and inspections by the Council.

The groundwater results from the three bores, along with results from the surface water in the two drains indicated that seepage from the lagoon to groundwater and the drainage channel was occurring. The distance travelled before the surface water reaches the Waiwhakaiho River and the dilution that occurs at the river meant the level of contamination in the drainage channel adjacent to the lagoon was not at a level to cause concern. There were no other problems identified in relation to the sludge lagoon.

Consent 3989-2 was maintained as a contingency and no disposal to land was to occur unless the Council was notified. In April, May and June 2012 the consent was used in order to dispose of thermally dried activated sludge (in April and May) and to manage sludge during a plant failure incident (in June). The consent holder supplied the results of three-monthly sampling to Council in accordance with conditions on the consent. Inspections and samples from the site showed consent conditions were complied with.

Consent 3989-2 expired in June 2014 and NPDC requested that they be released from their responsibility of management of the site. Samples collected on 14 December 2013 showed that the site complied with soil guideline limits as required by condition 14 of the consent. Bore and surface water samples showed no rise in levels of nutrients, faecal counts or metal contamination. The site has been reinstated into pasture and observations of soil samples showed organic matter in the soil had improved, as had its overall fertility. As per condition 17, in January 2014 18 months had elapsed since the final application of sludge at the site and therefore the land was able to be removed from quarantine. Council approved NPDC's request to surrender the consent and the land has since been returned to the owners.

6.2.3 Air discharge

NPDC holds consent 4740-2 that allows the discharge of contaminants into the air from sludge processing activities. NPDC have provided documentation on the design specifications, operation and maintenance of the biofilter intended for abatement of discharges to air from the sludge management processing facilities.

Assessments of the odour performance of the milliscreen and sludge filter buildings made during inspections at the NPWWTP site noted slight to moderate odours during every inspection in the vicinity of the sludge thickening/drying buildings. Strong odours were noted during one inspection, however no odours were noted beyond the plant boundary on any occasion.

6.3 Evaluation of performance

A summary of NPDC's compliance record for the period under review is provided in Tables 23-28.

Table 23 Summary of performance for Consent 0882-4 to discharge wastewater to the Tasman Sea

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder to adopt best practicable option to minimise environmental effects	Inspections, sampling, ecological surveys	Yes
2. Maintenance of multiport diffuser system	Site inspections	Yes
3. Concentration limits upon potential contaminants in discharge	Samples collected by both Council and consent holder	Yes
4. Concentration limits upon suspended solids (SS) and BOD	Samples collected by both Council and consent holder	**No** **Two SS non-compliances associated with heavy rain**

5. Concentration limits upon SS and BOD when aeration basins off-line	Samples collected by both Council and consent holder	**No** **Numerous SS non-compliances associated with upgrade works** **Abatement notice issued**
6. Public notification prior to taking aeration basin off-line	Public notices in newspaper November 2012 and June 2013	Yes
7. Minimum duration off-line to achieve purpose	Inspections, consultation with consent holder	Yes
8. Notification to Council prior to taking aeration basins off-line	Notification received	Yes
9. Consent holder to erect signage during off-line periods	Signs erected at Fitzroy Beach (two locations), Waiwhakaiho and Bell Block	Yes
10. Total available chlorine at least 0.3 gm^{-3} in effluent	Presence of chlorine in samples collected by both Council and consent holder	**No** **Numerous chlorine non-compliances associated with upgrade works** **Abatement notice** **Infringement notice x2 issued**
11. Effluent through 3 mm screen	6 mm screen used during maintenance of milliscreens in 2012-2013 as per condition	Yes
12. Consent holder to undertake monitoring	Monitoring undertaken and results supplied	Yes
13. Consent holder to submit a QMRA	Received December 2012	Yes
14. Consent holder to submit a monitoring plan	Received June 2013	Yes
15. Preparation of draft monitoring plan for consultation	Draft issued, consultation undertaken in April and June 2013	Yes
16. Peer review of monitoring plan	Received May 2013	Yes
17. Consent holder to provide comments received during consultation and peer review to Council	Received June 2013	Yes
18. Results of peer review of monitoring programme in 2017, 2022, 2027, 2032 and 2037	Due March 2017	N/A
19. Provide Technology Report in March 2027 and 2037	Due March 2027	N/A
20. Provide Annual Report by 31 July	Reports received for 2012-2013 and 2013-2014	Yes
21. Maintain Contingency Plan	Plan updated during 2012-2013 and 2013-2014	Yes

22. Annual meeting with Council, iwi and others	Meetings held in December 2012 and 2013	Yes
23. Meeting to include future management of wastewater	Next scheduled in 2027	N/A
24. Review of consent	Next scheduled in June 2017, if required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Poor**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 24 Summary of performance for Consent 1826-2 to erect, place and maintain a culvert

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Structure maintained to meet consent conditions	Inspections	Yes
2. Instream maintenance work between November and April	No maintenance required	N/A
3. Notification prior to maintenance work	No maintenance required	N/A
4. Best practicable option during maintenance to avoid adverse effects on environments	No maintenance required	N/A
5. Area and volume of streambed disturbance minimised during maintenance	No maintenance required	N/A
6. No obstruction of fish passage	Inspections	Yes
7. Removal and reinstatement	N/A	N/A
8. Review of consent conditions	No further provision for review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Table 25 Summary of performance for Consent 2982-4 discharge of leachate from sludge stabilisation lagoon

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Monitoring of groundwater adjacent to lagoon	Monitoring undertaken by consent holder	Yes
2. Monitoring of unnamed tributary of the Waiwhakaiho	Monitoring undertaken by consent holder	Yes
3. No direct discharge of contaminants to surface water from sludge lagoons	Inspections and results of monitoring	Yes

4. No adverse effects upon ground or surface waters	Inspections and results of monitoring	Yes
5. Review of consent	Next review scheduled for June 2014 if required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Table 26 Summary of performance for Consent 3989-2 to discharge waste to land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. General duty under S 17 of RMA to avoid, remedy, or mitigate effects	Consent not exercised during period under review	N/A
2. Consent exercised only in event of emergency	Consent not exercised during period under review	N/A
3. Written notification prior to disposal	Consent not exercised during period under review	N/A
4. Report detailing disposal	Consent not exercised during period under review	N/A
5. Analysis of sludge/biosolid sample	Consent not exercised during period under review	N/A
6. Analysis of soil sample	Consent not exercised during period under review	N/A
7. Preparation of management plan	Consent not exercised during period under review	N/A
8. Management plan to form part of conditions	Consent not exercised during period under review	N/A
9. Consent exercised for site which management plan addresses	Consent not exercised during period under review	N/A
10. No disposal within 150 m of property boundary	Consent not exercised during period under review	N/A
11. No dried solids to be discharged within 10 m of property boundary	Consent not exercised during period under review	N/A
12. No ponding of surface water on contact with sludge	Consent not exercised during period under review	N/A
13. Analyses of surface and ground waters within disposal area	Consent not exercised during period under review	N/A
14. Compliance with heavy metal guidelines	Samples collected on 14 December 2013 comply	Yes
15. Further analyses of soils contaminated with heavy metals	Samples comply	N/A
16. Consent holder responsible for site if contaminated by heavy metals	Samples comply	N/A
17. Access restrictions to disposal site	Access restrictions lapsed in January 2014	Yes
18. Access restrictions to disposal site	Access restrictions lapsed	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
19. Access restrictions to disposal site	Access restrictions lapsed	Yes
20. Review of consent conditions	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Table 27 Summary of performance for Consent 4593-2 to erect, place, maintain and use a marine outfall

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Structures maintained	Inspections	Yes
2. Notification prior to maintenance	No maintenance undertaken	N/A
3. Measures to prevent disturbance	No maintenance undertaken	N/A
4. Removal of structures when no longer required	N/A	N/A
5. Review of consent conditions	No further provision for review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 28 Summary of performance for Consent 4740-2 to discharge contaminants to the air

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option to prevent or minimise adverse effects	Inspections	Yes
2. Operation and maintenance of sludge management processes	Inspections	Yes
3. No odours beyond property boundary	Inspections	Yes
4. Statement of how biofilters are maintained	Information received	Yes
5. Preparation of contingency plan	Information received	Yes
6. Plan and notification prior to removal of sludge from No. 2 lagoon	Not yet undertaken	N/A
7. Review of consent	Next scheduled for June 2020 if required	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

During the year, NPDC demonstrated an improvement required level of environmental and high level of administrative performance with the resource consents as defined in Section 1.1.4. There were 32 recorded incidents, two abatement notices and two infringement notices issued during the two year period. These incidents related to a mixture of unauthorised incidents (generally wastewater discharges to water) and non-compliance with consent conditions (mostly elevated suspended solids or BOD, or low chlorine levels). Elevated norovirus levels were detected in mussel flesh towards the end of the upgrade works. There were no other significant detectable effects in the receiving environment resulting from discharges from the plant. It is anticipated that compliance with consent conditions will be achieved in the next monitoring period now that upgrade work is complete.

6.4 Recommendations from the 2011-2012 Annual Report

In the 2011-2012 Annual Report, it was recommended:

1. THAT the monitoring programme for the NPWWTP in the 2012-2013 year remains unchanged from that of 2011-2012.

2. THAT shoreline bacteriological water quality monitoring at five sites is included in the 2012-2013 monitoring programme.

3. THAT the monitoring programme is reviewed during the 2012-2013 period in accordance with consent 0882-4, condition 14. The revised programme will be implemented during the 2013-2014 monitoring period.

These recommendations were implemented.

6.5 Alterations to monitoring programmes for 2013-2014 and 2014-2015

In designing and implementing the monitoring programmes for air and water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, the obligations of the RMA in terms of monitoring emissions and discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere and discharging to the environment.

The NPWWTP's programme for 2012-2013 was unaltered from that for 2011-2012.

The monitoring programme was reviewed during the 2012-2013 period in accordance with consent 0882-4, condition 14. The revised programme was to be

implemented during the 2013-2014 monitoring period. The monitoring programme now includes a shellfish norovirus component in accordance with condition 14 (e) of consent 0882-4.

Bacteriological shoreline water quality monitoring at five sites will be next included in the 2014-2015 programme. Monitoring of metals in mussel tissue at three sites will be included in the 2015-2016 programme. A recommendation to this effect is attached to this report.

6.6 Exercise of optional review of consent

Conditions of consents 1826-2, 2982-4 and 4740-2 allow for an optional review of the consent in June 2014.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier compliance monitoring reports, it was considered that there were no grounds that required a review to be pursued.

A recommendation to this effect is presented in Section 7 of this report.

7. Recommendations

1. THAT the monitoring programme for the NPWWTP in the 2014-2015 year remains unchanged from that of 2013-2014.

2. THAT bacteriological shoreline water quality monitoring at five sites is included in the 2014-2015 monitoring programme.

3. THAT the Council notes the optional review of consents 1826-2, 2982-4 and 4740-2, in June 2014 were not considered necessary, on the grounds that current conditions are adequate for the protection of the environment.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
Bund	A wall around a tank to contain its contents in the case of a leak.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Enterococci	An indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units (CFU) per 100 millilitre of sample.
FAC	Free available chlorine.
Faecal coliforms	An indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units (CFU) per 100 millilitre sample.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
IR	Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
L/s	Litres per second.
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NOx	Oxidised nitrogen.

pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
RDP	Reactive dissolved phosphorous.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	Resource Management Act 1991 and subsequent amendments.

For further information on analytical methods, contact the Council's laboratory.

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Appendix I
Resource consents held by
New Plymouth District Council

Coastal Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH 4342
Decision Date:	15 November 2011
Commencement Date:	13 December 2011

Conditions of Consent

Consent Granted:	To discharge treated municipal wastewater from the New Plymouth wastewater treatment plant through a marine outfall structure into the Tasman Sea at or about (NZTM) 1696211E-5679248N
Expiry Date:	1 June 2041
Review Date(s):	June 2017, June 2022, June 2027, June 2032, June 2037 and/or within three months of the receipt of the Quantitative Microbial Risk Assessment required by condition 13
Site Location:	Waiwhakaiho Marine Outfall, [approximate 450 metres offshore]
Catchment:	Tasman Sea Waiwhakaiho

General condition

a. The consent holder shall pay to the Taranaki Regional Council [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

2. The discharge shall occur through a multiport diffuser system that ensures a minimum dilution of 13:1 at the sea surface at chart datum under dry weather discharge flow and calm sea conditions.

3. Constituents in the effluent discharged shall meet the standards shown in the table below.

Constituent	**Standard**
Zinc	Concentration not greater than 0.2 gm^{-3}
Chromium	Concentration not greater than 0.15 gm^{-3}
Cadmium	Concentration not greater than 0.04 gm^{-3}
Lead	Concentration not greater than 0.1 gm^{-3}
Nickel	Concentration not greater than 0.15 gm^{-3}
Copper	Concentration not greater than 0.1 gm^{-3}
Mercury	Concentration not greater than 0.002 gm^{-3}
Cyanide	Concentration not greater than 0.1 gm^{-3}
Phenols[including chlorinated phenols]	Concentration not greater than 1.0 gm^{-3}

4. Subject to condition 5 below, at least 95% of effluent discharge samples shall meet the standards shown in the table below.

Constituent	**Standard**
Suspended solids	Concentration not greater than 25 gm^{-3}
5-day Biochemical oxygen demand	Concentration not greater than 25 gm^{-3}

5. During:

   (a) two periods, occurring before 30 June 2015, during which one of the aeration basins is off-line while being upgraded; and

   (b) periods not exceeding 14 days, occurring no more than once per year, when one of the aeration basins is off-line for planned maintenance purposes;

Condition 4 shall not apply and samples shall instead meet the following standards:

Constituent	**Standard**
Suspended solids	Concentration not greater than 110 gm^{-3}
5-day Biochemical oxygen demand	Concentration not greater than 130 gm^{-3}

6. The consent holder shall publicly notify its intention to exercise condition 5(a) at least five working days prior to taking an aeration basin off-line. The public notice shall detail the health and safety risks, reasons why the basin is being taken off line, and associated potential effects.

7. Notwithstanding any duration specified in condition 5 above, the periods when aeration basins are off-line shall be of the minimum duration necessary to achieve the purpose.

8. The consent holder shall give at least 30 working days notice to the Chief Executive, Taranaki Regional Council of the intention to take an aeration basin off-line. Notice shall be given by email to worknotification@trc.govt.nz and shall include:

   (a) The intended dates that the aeration basin will be offline; and

   (b) Documentation demonstrating the off-line period complies with the requirement to be the minimum necessary.

9. The consent holder shall erect and maintain signs for a period beginning on the date that an aeration basin goes off-line, as described in condition 5(a), and ending 14 days after the date that the off-line period ends. The signs shall advise the public of the discharge of sewage that has not been fully treated and inform them of the potential health risks, and are to be placed in a prominent location at:

   - Fitzroy Beach; and
   - Bell Block Beach.

10. The total available chlorine in the effluent, prior to entering the outfall pipe, shall be no less than 0.3 gm^{-3}.

11. All effluent discharged shall have passed through a screen with an aperture no more than 3 mm, except that during periods when the milli-screen is non-operational for maintenance purposes, effluent may pass through a screen with an aperture no more than 6 mm.

12. The consent holder shall undertake sampling and testing necessary to:

   (a) Determine compliance with the conditions of this consent; and

   (b) Characterise the effluent to the extent necessary to identify the nature and scale of its effects on the environment, during normal operation and at times when all the effluent is not being fully treated. In particular, monitoring must occur at times when an aeration basin is off-line, and be discussed at the annual meeting required by special condition 22.

Until the Monitoring Plan required by condition 14 is submitted to Taranaki Regional Council, monitoring will continue in accordance with the existing monitoring plan prepared under consent 0882-3.

13. Within one year of the commencement of this consent, the consent holder shall submit to the Chief Executive, Taranaki Regional Council a Quantitative Microbial Risk Assessment (QMRA) of the discharge under this consent (focusing primarily on bypass discharges).

14. Within six months of the provision of the QMRA under condition 13, the consent holder shall prepare, and submit to the Chief Executive, Taranaki Regional Council for certification, a 'Monitoring Plan' detailing the sampling, testing and measuring that will be undertaken to achieve compliance with condition 12. The Plan shall include, but not necessarily be limited to:

    (a) Details of the measuring and sampling to be undertaken including: sampling location, frequency and methodology; and

    (b) Documentation of how the measuring and sampling described in 14(a) above, adequately characterises the effluent at all times.

    As a minimum, the Monitoring Plan will require:

    (c) Monitoring of the effluent to determine compliance with conditions 3, 4 and 5;

    (d) Monitoring of ecology in the intertidal zone approximately adjacent to the point of discharge, with appropriate control sites; and

    (e) Monitoring of microbiological contamination within shellfish.

15. In preparing the Monitoring Plan, the consent holder shall issue a draft Monitoring Plan and then carry out reasonable consultation with the Department of Conservation, Ngati Tawhirikura Hapu and interested community groups, allowing at least one month for a response from those groups on the draft Plan.

16. Before submitting the Monitoring Plan to Taranaki Regional Council for certification, the consent holder shall have the Monitoring Plan peer reviewed by an independent, suitably qualified expert.

17. The consent holder shall provide any comments received from the Department of Conservation, Ngati Tawhirikura Hapu and interested community groups under condition 15, and the peer review under condition 16, to the Chief Executive, Taranaki Regional Council, at the time the final Monitoring Plan is submitted for certification under condition 14. In the event that the consent holder declines to adopt any recommendations provided by the peer reviewer under condition 16, the consent holder shall also provide, at the same time, its written reasons for declining to follow those recommendations.

18. By 31 March in the years 2017, 2022, 2027, 2032 and 2037, the consent holder shall provide to the Chief Executive, Taranaki Regional Council the results of a peer review of the Monitoring Plan by an independent, suitably qualified expert to ensure that the monitoring programme is still appropriate. The results of the peer review shall also be made publicly available. In the event that the consent holder declines to adopt any recommendations provided by the peer reviewer under this condition, the consent holder shall also provide, at the same time, its written reasons for declining to follow those recommendations.

19. By 31 March in the years 2027 and 2037, the consent holder shall provide to the Chief Executive, Taranaki Regional Council a Technology Report covering:

    (a) A summary of any improvements made to the reticulation, treatment or disposal system since the granting of this consent;

    (b) An outline of technological changes and advances in relation to wastewater management, treatment, disposal and technologies which may be available to address any residual adverse effects; and

    (c) An assessment of whether any such options or combination of options represent the Best Practicable Option to minimise the effects of the discharge and whether the consent holder intends to incorporate such changes.

    The Technology Report shall also be made publicly available. The Regional Council may obtain an independent peer review of the Technology Report, and may charge the consent holder for the actual and reasonable cost of obtaining this peer review.

20. By 31 July each year, the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report covering:

    (a) details of the progress made towards reducing inflow and infiltration reduction over the past year;

    (b) the consent holder's target for reduction of inflow and infiltration in the coming year; and

    (c) details of the works proposed in order to meet that target.

21. The consent holder shall maintain a Contingency Plan for the wastewater treatment plant site that shall be adhered to in the event of a spill or emergency. The Plan shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity and shall detail measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

22. At least once every year, the consent holder shall convene a meeting with representatives of the Taranaki Regional Council, Ngati Tawhirikura Hapu, and interested submitters on application 6803, to discuss any matter relating to the operation or monitoring of this consent.[1]

23. In the years 2027 and 2037, the consent holder shall use the meeting required by condition 22 as a means of collaborating with the community and stakeholders about the strategy for the future management of wastewater in New Plymouth district.

24. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within three months of the receipt of the QMRA required by condition 13 and/or during the month of June 2017 and/or June 2022 and/or June 2027 and/or June 2032 and/or June 2037 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time. Reviews may also be undertaken at the dates listed above to enable the Taranaki Regional Council to deal with the consequences of the consent holder declining to accept the Peer Reviewer's recommendations under condition 18.

    Advice note: The consent holder intends to establish a collaborative approach with Maori to investigate a trial of land-based disposal of treated wastewater. The commencement of such a trial will be subject to the consent holder being satisfied that:

    (a) the owner(s) of land which has been offered for that purpose consent to its use for effluent disposal over the period of the trial and appropriate arrangements for its use are able to be satisfactorily resolved; and

    (b) the disposal is technically, economically and environmentally feasible (including addressing relevant RMA requirements).

Signed at Stratford on 13 December 2011

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

[1] For the avoidance of doubt, this meeting can be combined with the annual meetings required under consents 7861-1 and 3397-2.

Consent 2982-4

TARANAKI REGIONAL COUNCIL

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Please quote our file number on all correspondence

Discharge Permit

Pursuant to the Resource Management Act 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH
Consent Granted Date:	17 October 2002

Conditions of Consent

Consent Granted:	To discharge up to 60 cubic metres/day of leachate from a sludge stabilisation lagoon to groundwater in the vicinity of the Waiwhakaiho River at or about GR: P19:070-402
Expiry Date:	1 June 2020
Review Date(s):	June 2008, June 2014
Site Location:	New Plymouth Wastewater Treatment Plant, Rifle Range Road, New Plymouth
Legal Description:	Pt Sec 224 SO 11937 Hua Dist Blk II Paritiutu SD
Catchment:	Waiwhakaiho

For General, Standard and Special conditions pertaining to this consent please see reverse side of this document

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The consent holder, in conjunction with the Taranaki Regional Council, shall monitor the groundwater adjacent to the lagoon. The number of monitoring sites, the parameters to be monitored and the frequency of the monitoring shall be to the satisfaction of the Chief Executive, Taranaki Regional Council.

2. The consent holder, in conjunction with the Taranaki Regional Council, shall monitor the surface water in the small open drain [an unnamed tributary of the Waiwhakaiho River] located adjacent to the northern and eastern boundary of the lagoon. The number of sites, the parameters to be monitored and the frequency of the monitoring shall be to the satisfaction of the Chief executive, Taranaki Regional Council.

3. The exercise of this consent shall not lead to a direct discharge of contaminants from the sludge stabilisation lagoon to any other surface water body.

4. That the exercise of this consent shall not result in any adverse impacts to groundwaters and surface waters such that the suitability of those waters for any use is changed as determined by the Chief Executive, Taranaki Regional Council.

5. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2008 and/or June 2014, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 17 October 2002

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 3989-2

SURRENDERED
30-4-2014

TARANAKI REGIONAL COUNCIL

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Discharge Permit

Pursuant to the Resource Management Act 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH
Consent Granted Date:	18 October 2002

Conditions of Consent

Consent Granted:	To discharge up to 85 cubic metres/day of waste dewatered activated sludge or equivalent dry weight of thermally dried activated sludge from the New Plymouth wastewater treatment plant onto land at the New Plymouth Airport at or about GR: Q19:124-442
Expiry Date:	1 June 2014
Review Date(s):	within six months of exercise of consent, June 2008
Site Location:	New Plymouth Airport, Mahoetahi Road, Waitara
Legal Description:	Parts Puketapu C1, D & E being part of land in certificate of title B3/369
Catchment:	Waiongana

For General, Standard and Special conditions pertaining to this consent please see reverse side of this document

SURRENDERED

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. Nothing in this consent shall remove from the consent holder the obligations, responsibilities, duties and/or liabilities specified in section 17 of the Resource Management Act 1991, or in any other part of that Act, nor shall compliance with the special conditions of this consent be held to sufficiently discharge such obligations, responsibilities, duties and/or liabilities.

2. This consent shall only be used in the event of an emergency. The event which will justify the disposal of sludge/biosolid to land is defined as:

   a) a problem with the operation of the thermal drying facility and excess sludge is needed to be disposed to land; or

   b) a problem with the produced biosolid rendering the product unusable;

   or any other event as agreed between the consent holder and the Chief Executive, Taranaki Regional Council.

3. The consent holder shall provide written advice to the Chief Executive, Taranaki Regional Council, of the intention to exercise the consent and the circumstances applying.

4. The consent holder shall, within 3 months of any exercise of this consent, provide a written report to the Chief Executive, Taranaki Regional Council, detailing the circumstances necessitating the exercise of this consent, the duration of exercise of consent, what was disposed to land, and the volume disposed. The report should also include results of analyses undertaken in accordance with special conditions 5 and 6.

5. The consent holder shall provide an analysis of a representative sample of dewatered sludge and/or biosolid prior to the exercise of this consent to the satisfaction of the Chief Executive, Taranaki Regional Council. Analyses shall be conducted for the total concentrations of copper, chromium, nickel, lead, mercury and zinc, for moisture content, for ash, and for such other characteristics and constituents as may from time to time be agreed between the Chief Executive, Taranaki Regional Council, and the consent holder. Methods of analysis shall be as agreed between the Chief Executive, Taranaki Regional Council, and the consent holder.

6. The consent holder shall provide analyses of one or more representative samples of soil from each application site to the satisfaction of the Chief Executive, Taranaki Regional Council, and as agreed between the consent holder, the Taranaki Regional Council, and any owner or occupier of any sludge application site. Such analyses shall be provided prior to the use of any site for the land application of sludge, and also within twelve months after any such use, when requested by any owner or occupier of any sludge application site or as agreed between the Chief Executive, Taranaki Regional Council, and the consent holder.

SURRENDERED

7. The consent holder shall prepare to the satisfaction of the Chief Executive, Taranaki Regional Council, a management plan for the site of sludge/biosolid application.

8. Once prepared to the satisfaction of the Chief Executive, Taranaki Regional Council, the management plan shall form part of the conditions of this consent, except that in the case of conflict between any requirement within a management plan and these special conditions, the latter shall prevail.

9. This consent shall be exercised only in respect of site notified to the Taranaki Regional Council and for which a management plan has been prepared in accordance with special conditions 7 and 8.

10. Dewatered sludge shall not be discharged or applied within 150 metres of any property boundary, except when sludge is incorporated into soil during the day of discharge or with the prior written permission of all owners and occupiers of any property located within 150 metres of any site of discharge or application.

11. Dried solids [from the thermal drying facility] shall not be discharged within 10 metres of any property boundary.

12. If at any site sludge is not incorporated into soil during the day of discharge, it shall instead be spread to a depth of no more than 150 millimetres and in such a manner that surface water will not pond in contact with sludge.

13. The consent holder shall provide analyses of any surface waters within, or flowing through, any sludge/biosolid application site, and of any groundwaters, on a three monthly basis upon exercise of consent and for a period as determined by agreement between the consent holder and the Taranaki Regional Council. Analyses shall be conducted for nutrients, microbiological indicators, metals, and such other constituents as agreed prior to use of the site between the consent holder and the Taranaki Regional Council.

14. The consent holder shall comply with the limits upon `heavy metal' concentrations in soil and application rates and loadings specified in Table C of `Public health guidelines for the safe use of sewage effluent and sewage sludge on land' [Department of Health, 1992] [or more recent guidelines]. Should representative soil analyses show that an increased sludge application rate will not result in the limit values allowable in soil for any element listed [based on incorporation into the top 200 millimetres of soil] being exceeded, then such increased application shall be permitted. Soil analyses as described in special condition 7 shall be completed prior to any subsequent sludge application to the same site.

15. Should the analytical results of soil samples from a site show any heavy metal concentrations to be in excess of the limit values allowable in soil specified in Table C of `Public health guidelines for the safe use of sewage effluent and sewage sludge on land' [Department of Health, 1992] [or more recent guidelines], then further analyses shall be provided by the consent holder three years after the last use of the site.

16. Should analyses show that any heavy metal concentration is in excess of its limit value as specified in special conditions 15 and/or 16, the consent holder shall remain responsible for the control and use of the site to the satisfaction of the Chief Executive, Taranaki Regional Council, until such time as the limit value or values have been satisfied.

17. Subject to special condition 17, use of, and public access to, each site shall be restricted for a period of eighteen months after the last application of dewatered sludge. This period may, however, be taken to include any period of segregated storage of sludge within the wastewater treatment plant prior to land deposition and, in the case of hay, silage or other animal fodder crop harvested from the site, any storage period between harvesting and utilisation.

SURRENDERED

18. Subject to special condition 17, access to sites where dried solids [from the thermal drying facility] have been applied at rates of greater than 4,000 kg ha^{-1} $year^{-1}$ and incorporated into the soil shall be restricted until pasture cover has been re-established for 70 days.

19. Subject to special condition 17, access to sites where dried solids [from the thermal drying facility] have been applied at rates of 4,000 kg ha^{-1} $year^{-1}$ or less shall be restricted for the greater of either a period of 10 days or until the discharged solids have been predominantly incorporated into the soil.

20. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within six months of the exercise of this consent, and/or in June 2008, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 18 October 2002

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TRK954740

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COUNCIL

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DISCHARGE PERMIT

Pursuant to the RESOURCE MANAGEMENT ACT 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of Consent Holder:	NEW PLYMOUTH DISTRICT COUNCIL PRIVATE BAG 2025 NEW PLYMOUTH
Consent Granted Date:	12 July 1995

CONDITIONS OF CONSENT

Consent Granted:	TO DISCHARGE CONTAMINANTS INTO THE AIR FROM SLUDGE PROCESSING ACTIVITIES AT THE NEW PLYMOUTH WASTEWATER TREATMENT PLANT AT OR ABOUT GR: P19:070-402
Expiry Date:	1 June 2008
Review Date[s]:	June 1996 and June 2002
Site Location:	NEW PLYMOUTH WASTEWATER TREATMENT PLANT, RIFLE RANGE ROAD NEW PLYMOUTH
Legal Description:	PT SEC 224 HUA DIST BLK II PARITUTU SD

For General, Standard and Special Conditions pertaining to this consent please see reverse side of this document.

TRK954740

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GENERAL CONDITIONS

(a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

(b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

(c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

(i) the administration, monitoring and supervision of this consent;
(ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii) charges authorised by regulations.

SPECIAL CONDITIONS

1) THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment associated with the discharges into air from sludge management processing activities and facilities on the site. 'Best practicable option' shall be determined by the Taranaki Regional Council, taking into account the information supplied by the consent holder under condition 3 of this consent, and/or following review as set out under condition 8 of this consent.

2) THAT the consent holder shall at all times operate, maintain, supervise, monitor and control all sludge management processes so that discharges authorised by this consent are maintained at a practicable minimum.

3) THAT the consent holder shall provide to the satisfaction of the General Manager, Taranaki Regional Council, documentation on the design specifications and the operations and maintenance of the biofilter intended for abatement of discharges to air from the sludge management processing facilities, by 29 February 1996.

4) THAT following the approval of the General Manager, Taranaki Regional Council, of the documentation described in condition 3, the biofilter shall thereafter be operated and maintained in compliance with that information.

5) THAT prior to undertaking any alteration to the plant, processes, or operations as specified in the application and supporting documentation [including that described in condition 3] lodged with the Taranaki Regional Council for this consent, which may significantly change the nature or quantity of contaminants discharged from the site, the consent holder shall consult with the General Manager, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.

6) THAT the discharges authorised by this consent shall not give rise to any direct significant adverse ecological effect on any off-site ecosystems, including but not limited to habitats, plants, animals, microflora and microfauna.

7) THAT the discharges authorised by this consent shall not give rise to any odours that are offensive or objectionable at or beyond any boundaries of the property.

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8) THAT the Taranaki Regional Council may, in accordance with section 128(1) of the Resource Management Act 1991, review any or all of the conditions of this consent by giving notice of review in June 1996 and/or June 2002, for the purpose of:

(a) dealing with any significant adverse effect on the environment arising from the exercise of this consent; or

(b) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising from the exercise of this consent; or

(c) adding, altering, or deleting any limit on discharge or ambient concentrations of any contaminant or contaminants.

Signed at Stratford on 12 July 1995

For and on behalf of
TARANAKI REGIONAL COUNCIL

OPERATIONS MANAGER

EXPIRED
01-06-2008

TRK995480

TARANAKI REGIONAL COUNCIL

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DISCHARGE PERMIT

Pursuant to the RESOURCE MANAGEMENT ACT 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of Consent Holder:	NEW PLYMOUTH DISTRICT COUNCIL PRIVATE BAG 2025 NEW PLYMOUTH
Consent Granted Date:	31 May 1999

CONDITIONS OF CONSENT

Consent Granted:	TO DISCHARGE CONTAMINANTS INTO THE AIR FROM SLUDGE DRYING PROCESSES AT THE NEW PLYMOUTH WASTEWATER TREATMENT PLANT AT OR ABOUT GR: P19:070-402
Expiry Date:	1 June 2008
Review Date[s]:	June 2000 and June 2002
Site Location:	NEW PLYMOUTH WASTEWATER TREATMENT PLANT, RIFLE RANGE ROAD, NEW PLYMOUTH
Legal Description:	PT SEC 224 HUA DIST BLK II PARITUTU SD

For General, Standard and Special Conditions pertaining to this consent please see reverse side of this document.

EXPIRED
01-06-2008

TRK995480

General conditions

a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment associated with the discharges into air from sludge management processing activities and facilities on the site. 'Best practicable option' shall be determined by the Taranaki Regional Council, taking into account the information supplied by the consent holder under condition 3 of this consent, and/or following review as set out under condition 8 of this consent.

2. THAT the consent holder shall at all times operate, maintain, supervise, monitor and control all sludge management processes so that discharges authorised by this consent are maintained at a practicable minimum.

3. THAT the consent holder shall provide to the satisfaction of the General Manager, Taranaki Regional Council, documentation on the 'as built' design specifications and the operations and maintenance of the biofilter intended for abatement of discharges to air from the sludge drying facilities, within 6 months of the granting of this consent.

4. THAT following the approval of the General Manager, Taranaki Regional Council, of the documentation described in condition 3, the biofilter shall thereafter be operated and maintained in compliance with that information.

5. THAT prior to undertaking any alteration to the plant, processes, or operations as specified in the application and supporting documentation [including that described in condition 3] lodged with the Taranaki Regional Council for this consent, which may significantly change the nature or quantity of contaminants discharged from the site, the consent holder shall consult with the General Manger, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.

6. THAT the discharges authorised by this consent shall not give rise to any direct significant adverse ecological effect on any off-site ecosystems, including but not limited to habitats, plants, animals, microflora and microfauna.

7. THAT the discharges authorised by this consent shall not give rise to any odours that are offensive or objectionable at or beyond any boundaries of the property.

EXPIRED
01-06-2008

TRK995480

8. THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2000 and/or June 2002, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the discharge on the environment arising from the exercise of this consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 31 May 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

DIRECTOR—RESOURCE MANAGEMENT

Discharge Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH 4342
Consent Granted Date:	29 May 2008

Conditions of Consent

Consent Granted:	To discharge contaminants into the air from sludge drying and processing activities at the New Plymouth Wastewater Treatment Plant at or about (NZTM) 1697041E-5678313N
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020
Site Location:	Rifle Range Road, New Plymouth
Legal Description:	Secs 5-6 So 314271 Pt Sec 224 Hua Dist Blk II Paritutu SD

For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. Notwithstanding any other condition of this consent, the consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharges into air from sludge management processing activities and facilities on the site.

2. That the consent holder shall at all times operate, maintain, supervise, monitor and control all sludge management processes (including but not limited to associated emission treatment processes) so that discharges authorised by this consent are maintained at a practicable minimum.

3. That the discharges authorised by this consent shall not give rise to any odours that are offensive or objectionable at or beyond any boundaries of the property.

4. Without restricting the generality of condition 1, the consent holder shall supply a statement of how the biofilters are maintained, operated, and monitored, to give effect to condition 1. This statement shall be provided to the Chief Executive, Taranaki Regional Council, within six months of the granting of the consent.

5. The consent holder shall prepare a contingency plan addressing events at the New Plymouth Waste Water Treatment Plant that could give rise to abnormal odour release potential, and the procedures the consent holder would adopt to deal with any such event. This contingency plan shall be provided to the Chief Executive, Taranaki Regional Council, within six months of the granting of the consent. The contingency plan shall subsequently be reviewed at intervals not exceeding two years.

6. Prior to undertaking processing of, including removal of, sludge from No. 2 lagoon, the consent holder shall submit a plan, for approval by the Chief Executive, Taranaki Regional Council [such approval not to be unreasonably withheld], describing the methodology proposed for sludge recovery from the lagoon and measures proposed for mitigation of odours and any off-site effects of odours, during the recovery activity, demonstrating the capability to satisfy the conditions of this consent. The consent holder shall notify the Council at least 72 hours prior to any processing/removal activity, including associated recovery of sludge, before undertaking removal. Notification shall be emailed to worknotification@trc.govt.nz.

7. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2014 and/or June 2020, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 29 May 2008

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

TRK964593

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TARANAKI REGIONAL COUNCIL

PRIVATE BAG 713
47 CLOTON ROAD
STRATFORD
NEW ZEALAND
PHONE 0-6-765 7127
FAX 0-6-765 5097

COASTAL PERMIT

Pursuant to the RESOURCE MANAGEMENT ACT 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of Consent Holder:	NEW PLYMOUTH DISTRICT COUNCIL PRIVATE BAG 2025 NEW PLYMOUTH
Renewal Granted Date:	24 July 1996

CONDITIONS OF CONSENT

Consent Granted:	TO ERECT, PLACE, MAINTAIN AND USE A MARINE OUTFALL WITHIN THE COASTAL MARINE AREA AS PART OF THE NEW PLYMOUTH WASTEWATER TREATMENT SYSTEM AT OR ABOUT GR: P19:063-410
Expiry Date:	1 June 2014
Review Date[s]:	June 2002 and June 2008
Site Location:	450 METRES OFFSHORE FROM THE WAIWHAKAIHO RIVER MOUTH
Legal Description:	450 METRES OFFSHORE FROM THE WAIWHAKAIHO RIVER MOUTH
Catchment:	TASMAN SEA 902.000

For General, Standard and Special Conditions pertaining to this consent please see reverse side of this document.

TRK964593

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GENERAL CONDITIONS

(a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

(b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

(c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

(i) the administration, monitoring and supervision of this consent;
(ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii) charges authorised by regulations.

SPECIAL CONDITIONS

1. THAT the consent holder shall maintain the structures to the satisfaction of the General Manager, Taranaki Regional Council.

2. THAT the consent holder shall notify the Taranaki Regional Council at least seven days prior to undertaking any programmed maintenance works.

3. THAT the consent holder shall ensure that all practicable measures are undertaken to prevent undue disturbance of intertidal reefs and marine life in the area during maintenance of the structures licensed by this consent, to the satisfaction of the General Manager, Taranaki Regional Council.

4. THAT the consent holder shall remove structures licensed by this consent, to the satisfaction of the General Manager, Taranaki Regional Council, when these structures become no longer necessary.

5. THAT the Taranaki Regional Council may review any or all of the conditions of this consent, by giving notice of review during June 2002 and/or June 2008 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this consent.

Signed at Stratford on 24 July 1996

For and on behalf of
TARANAKI REGIONAL COUNCIL

OPERATIONS MANAGER

Consent 1826-2

TARANAKI
REGIONAL
COUNCIL

PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 0-6-765 7127
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Land Use Consent

Pursuant to the Resource Management Act 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH
Consent Granted Date:	16 January 2002

Conditions of Consent

Consent Granted:	To erect, place, use and maintain a twin box culvert on the Mangaone Stream for road access purposes at or about GR: P19:069-400
Expiry Date:	1 June 2020
Review Date(s):	June 2008, June 2014
Site Location:	Mangaone Stream, Rifle Range Road, New Plymouth
Legal Description:	Pt Sec 161,138 & Lot 1 DP 12331 Hua Dist
Catchment:	Waiwhakaiho
Tributary:	Mangaone

For General, Standard and Special conditions pertaining to this consent please see reverse side of this document

General conditions

a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The structure[s] authorised by this consent shall be maintained to ensure the conditions of this consent are met.

2. Any instream maintenance works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.

3. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to and upon completion of any maintenance works which would involve disturbance of or deposition to the streambed or discharges to water.

4. During any maintenance of the structure[s] authorised by this consent, the consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the streambed and to avoid or minimise the disturbance of the streambed and any adverse effects on water quality.

5. During any maintenance of the structure[s] authorised by this consent, the consent holder shall ensure that the area and volume of streambed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

6. The structure[s], which are the subject of this consent, shall not obstruct fish passage.

7. The structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.

8. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2008 and/or June 2014, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 16 January 2002

For and on behalf of
Taranaki Regional Council

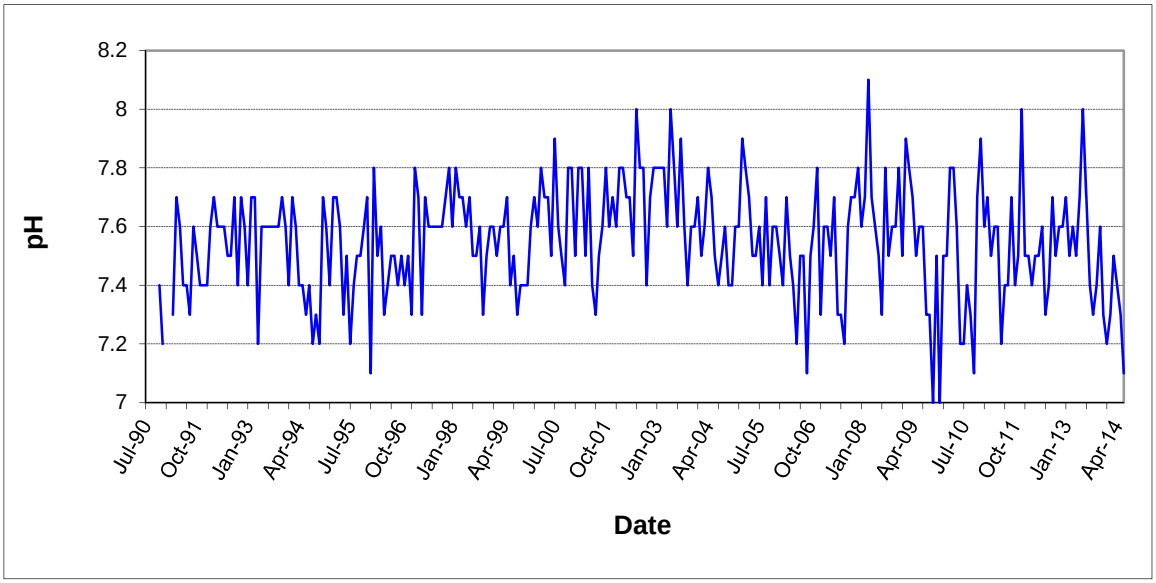
Director-Resource Management

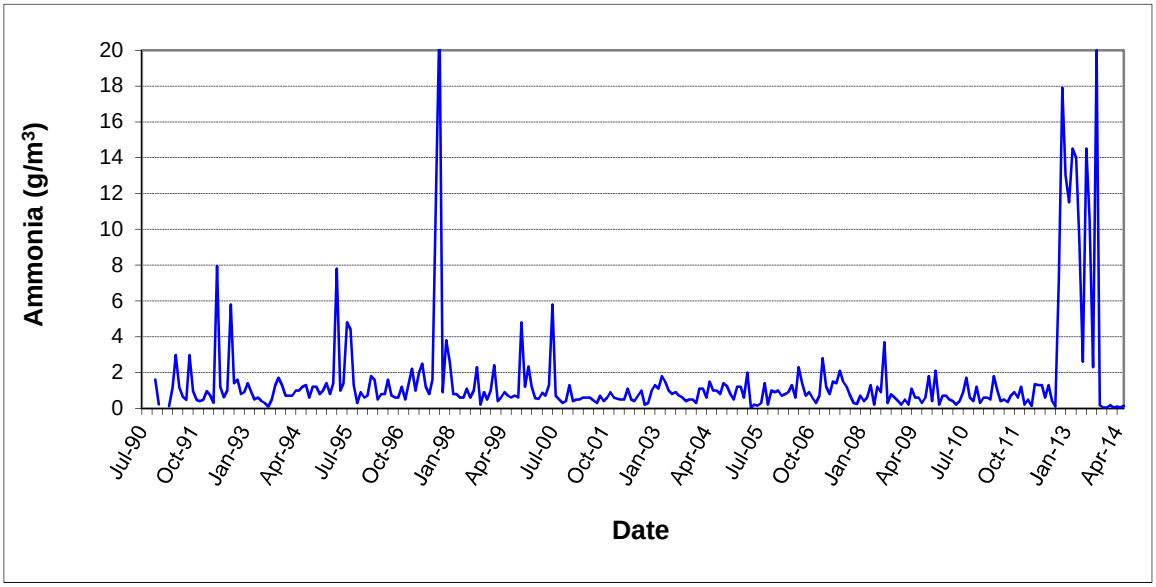
Appendix II
Results of monthly composite effluent monitoring 2012-2013 and 2013-2014

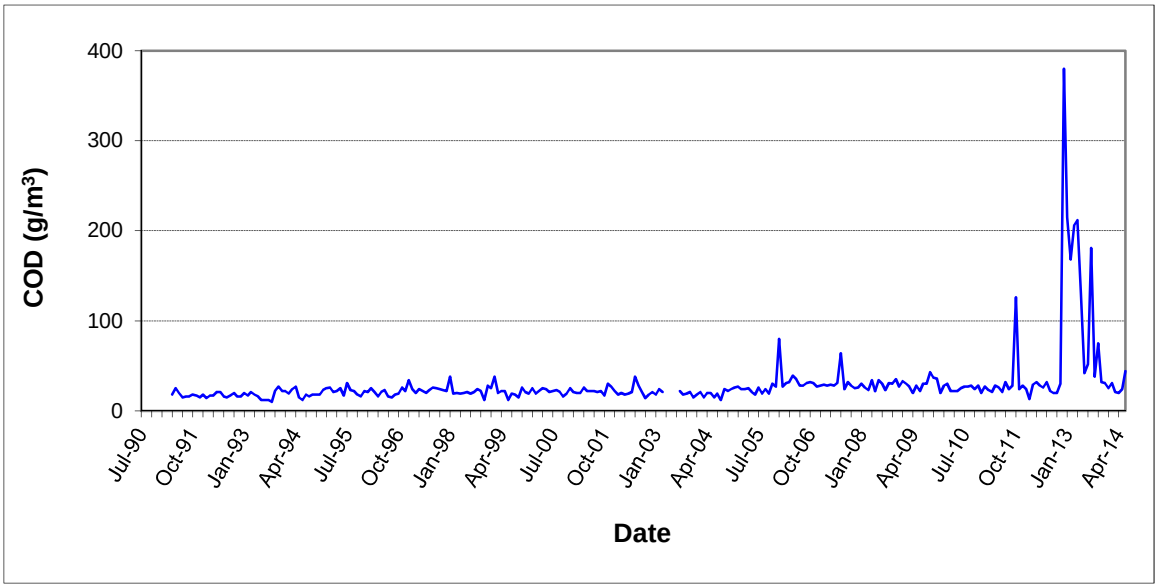
Parameter	Month (2012-2013)											
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June
pH	7.3	7.4	7.7	7.5	7.6	7.6	7.7	7.5	7.6	7.5	7.7	8.0
NH_3	0.6	1.3	0.4	0.1	7.2	17.9	13	11.5	14.5	14	9.4	2.6
SS	17	<5	<5	<5	8	318	103	126	114	129	70	10
COD	32	22	20	20	30	380	215	168	206	212	130	42
Faecal coli.	1	5000	<2	<2	<2	1000	110	2300	7200	1167	1133	8
NOx	6.07	4.52	7.1	5.2	6	<0.1	0.45	1.3	<0.1	9.4	0.49	2.9
phosphorus	1.2	1.06	1.7	2	2.2	2.5	1.6	2.3	1.55	2.4	2.4	0.48
Free chlorine	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total chlorine	0.3	<0.2	0.5	0.4	0.3	<0.2	0.7	<0.2	<0.2	<0.2	<0.2	0.2
Cyanide	0.04	0.02	0.01	0.02	0.02	0.07	0.1	0.07	0.1	0.1	0.03	0.02
Phenols	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.09	0.11	0.09	<0.05	<0.05
Zinc	0.04	<0.02	0.03	<0.02	<0.02	0.15	0.09	0.06	0.05	0.08	0.08	<0.04
Copper	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	0.02	<0.02	<0.02	0.02	0.02	<0.02
Chromium	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.02	<0.008	<0.008
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Iron	0.16	0.07	0.025	0.03	0.06	1.96	1.3	0.32	0.31	0.45	0.38	0.15
Manganese	0.09	0.05	0.05	0.03	0.09	0.15	0.15	0.04	0.06	0.06	0.06	0.09
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

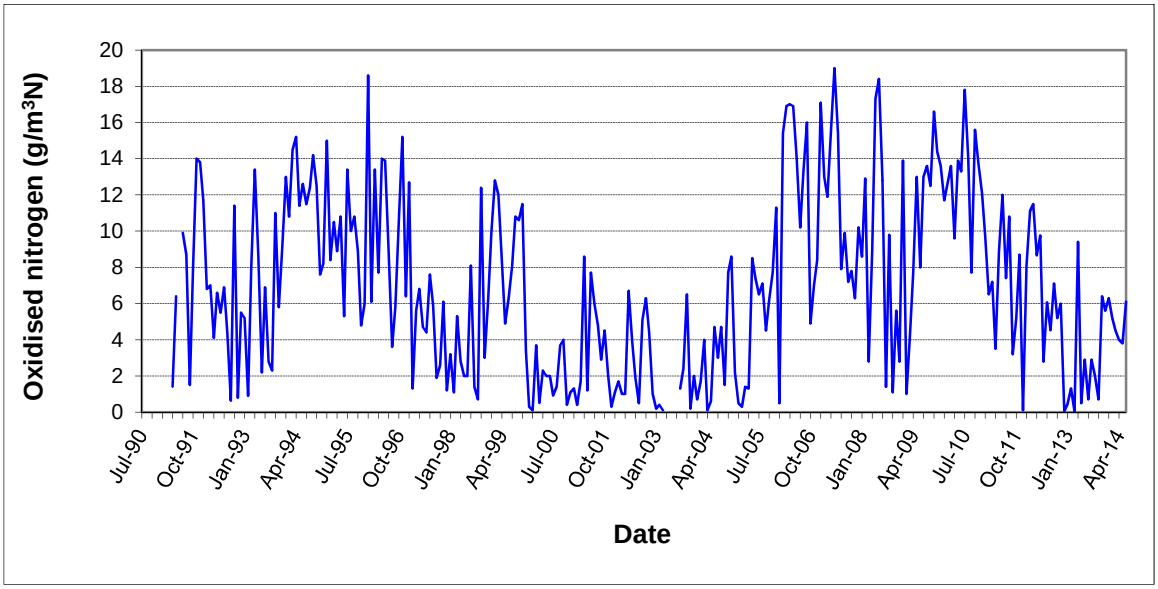
Parameter	Month (2013-2014)											
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June
pH	7.7	7.4	7.3	7.4	7.6	7.3	7.2	7.3	7.5	7.4	7.3	7.1
NH_3	14.5	10.6	2.3	20	0.17	0.05	0.05	0.19	0.05	0.1	0.05	0.14
COD	52	181	38	75	32	31	25	31	21	20	24	44
NOx	0.71	2.9	2	0.7	6.4	5.6	6.3	5.2	4.5	4	3.8	6.1
phosphorus	0.36	1.08	0.42	0.4	0.1	1	2.1	1.7	1.7	0.13	0.17	0.2
Cyanide	<0.05	0.08	<005	<0.05	0.02	<0.02	<0.02	<0.05	<0.02	0.02	<0.02	0.03
Phenols	0.07	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	<0.04	0.04	<0.04	0.05	<0.04	0.07	<0.04	0.05	0.07	0.05	<0.04	0.05
Copper	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chromium	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

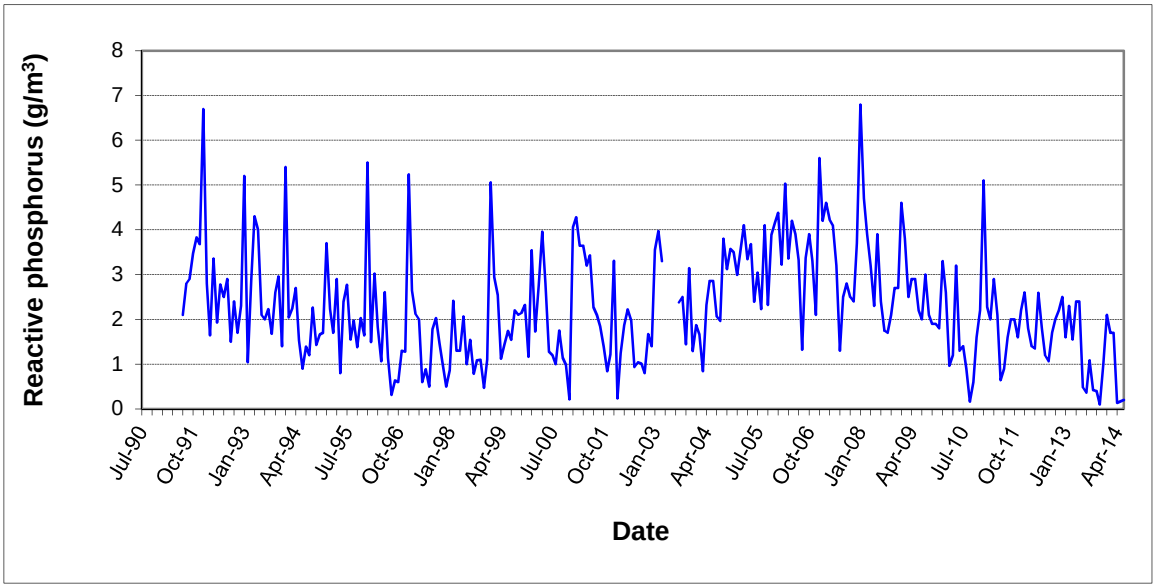
Appendix III
Graphical results of monthly composite effluent monitoring 1990-2014

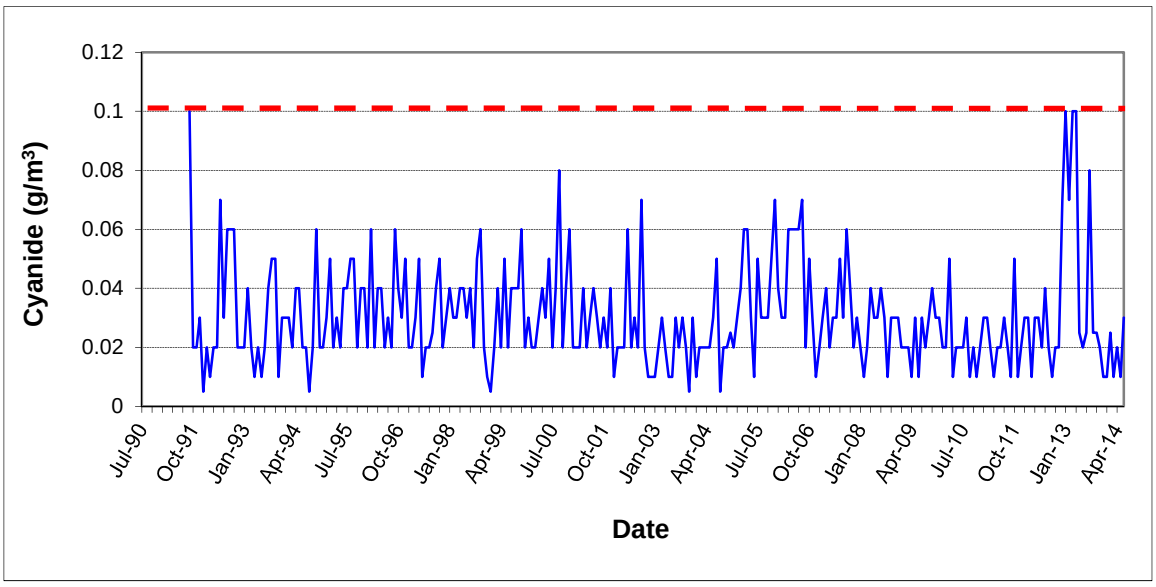

pH
8.2
8
7.8
7.6
7.4
7.2
7
Jul-90
Oct-91
Jan-93
Apr-94
Jul-95
Oct-96
Jan-98
Apr-99
Jul-00
Oct-01
Jan-03
Apr-04
Jul-05
Oct-06
Jan-08
Apr-09
Jul-10
Oct-11
Jan-13
Apr-14
Date


Ammonia (g/m³)
20
18
16
14
12
10
8
6
4
2
0
Jul-90
Oct-91
Jan-93
Apr-94
Jul-95
Oct-96
Jan-98
Apr-99
Jul-00
Oct-01
Jan-03
Apr-04
Jul-05
Oct-06
Jan-08
Apr-09
Jul-10
Oct-11
Jan-13
Apr-14
Date

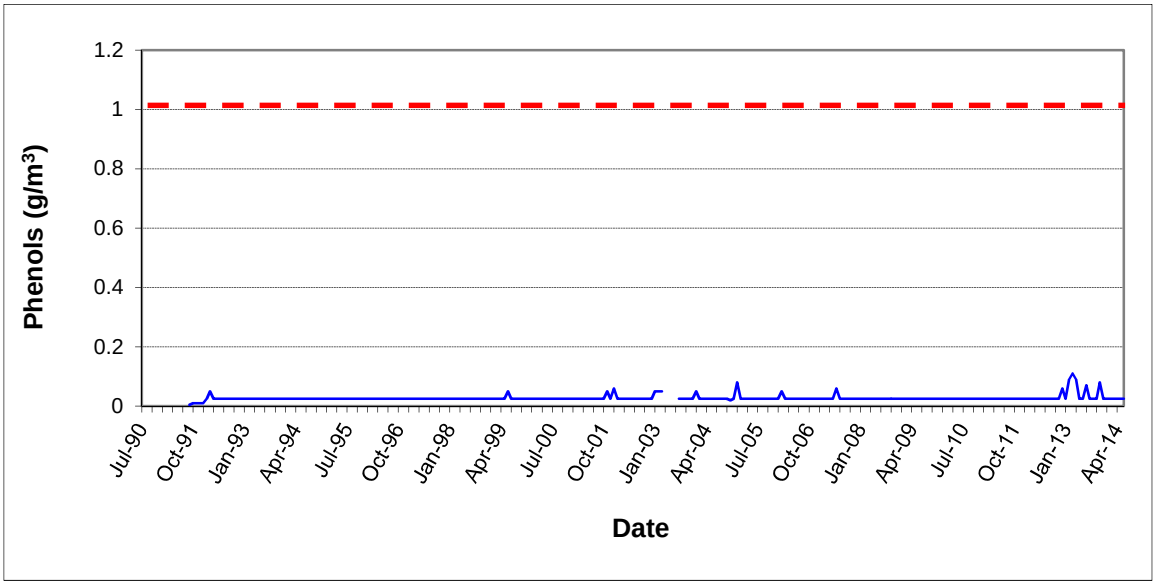

COD (g/m³)
400
300
200
100
0
Jul-90
Oct-91
Jan-93
Apr-94
Jul-95
Oct-96
Jan-98
Apr-99
Jul-00
Oct-01
Jan-03
Apr-04
Jul-05
Oct-06
Jan-08
Apr-09
Jul-10
Oct-11
Jan-13
Apr-14
Date



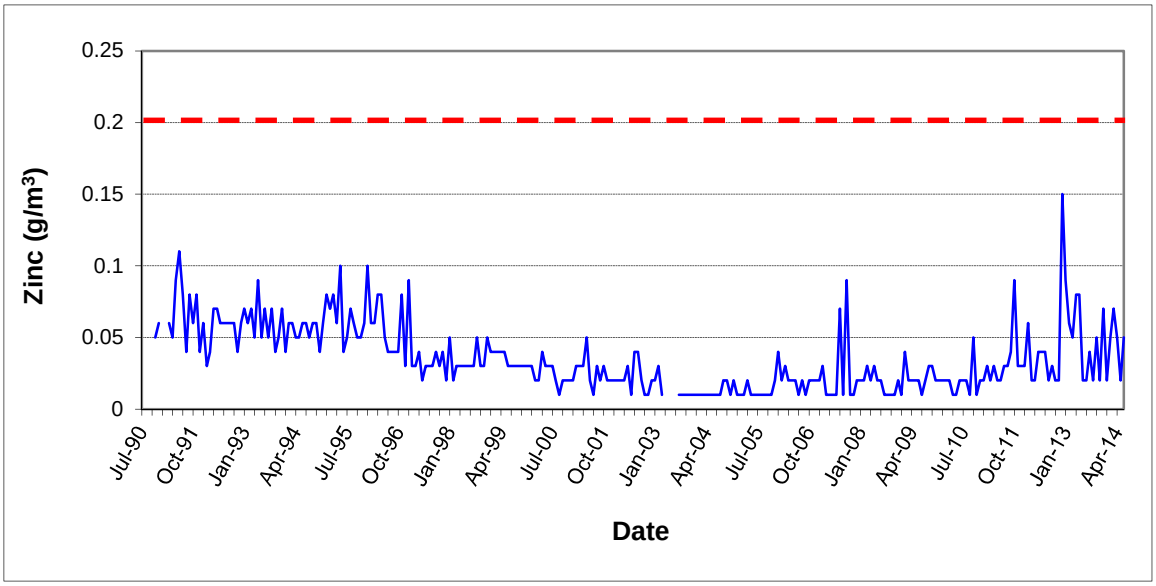




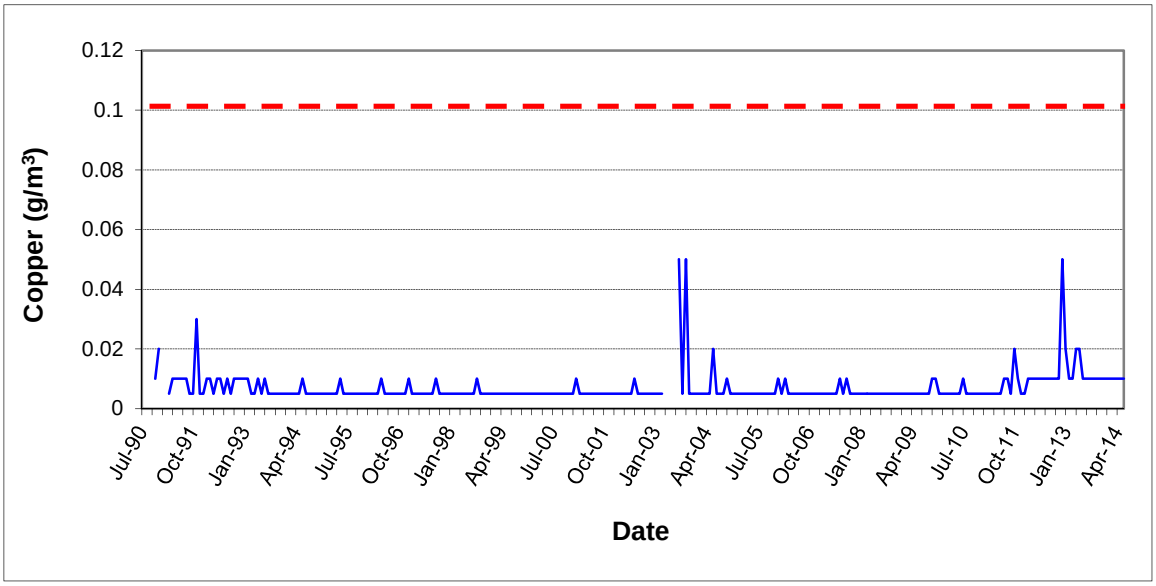
Note: Consent limit indicated by dashed red line



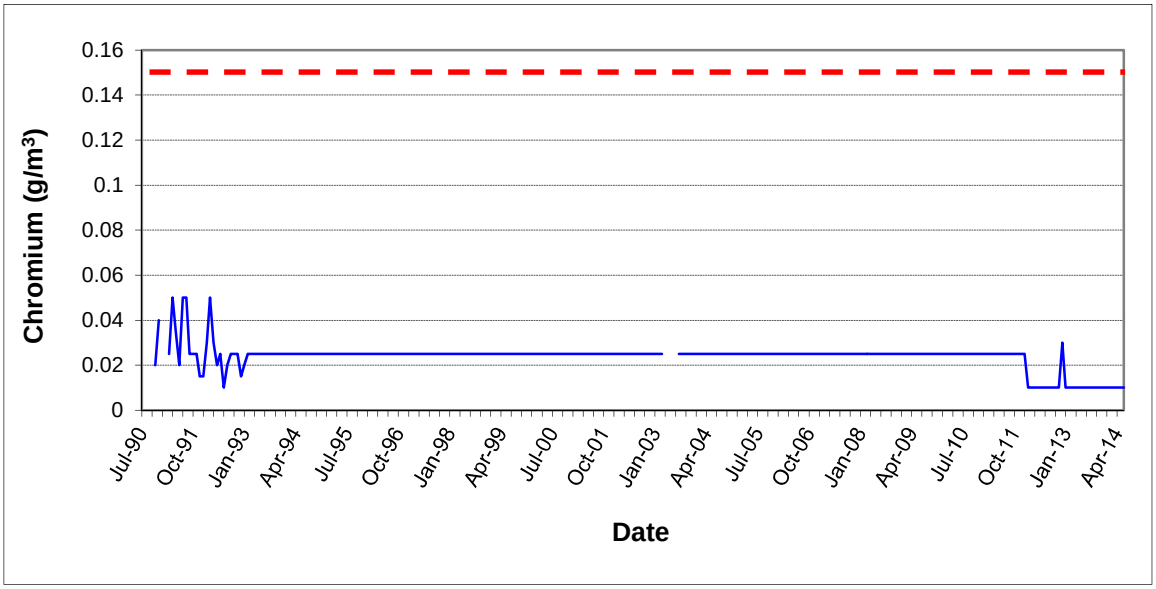
Note: Consent limit indicated by dashed red line



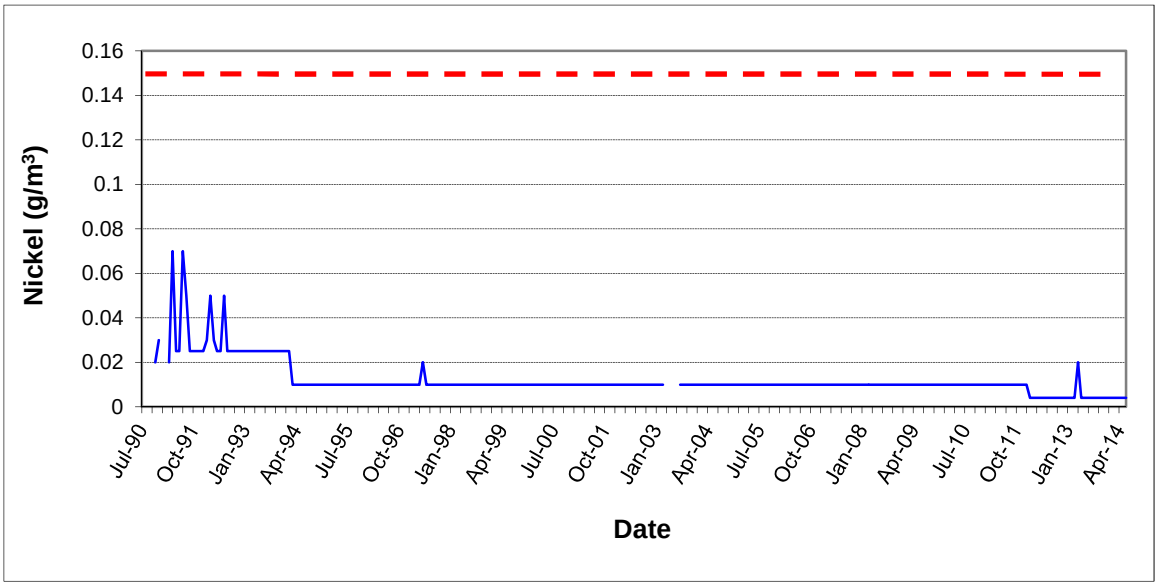
Note: Consent limit indicated by dashed red line



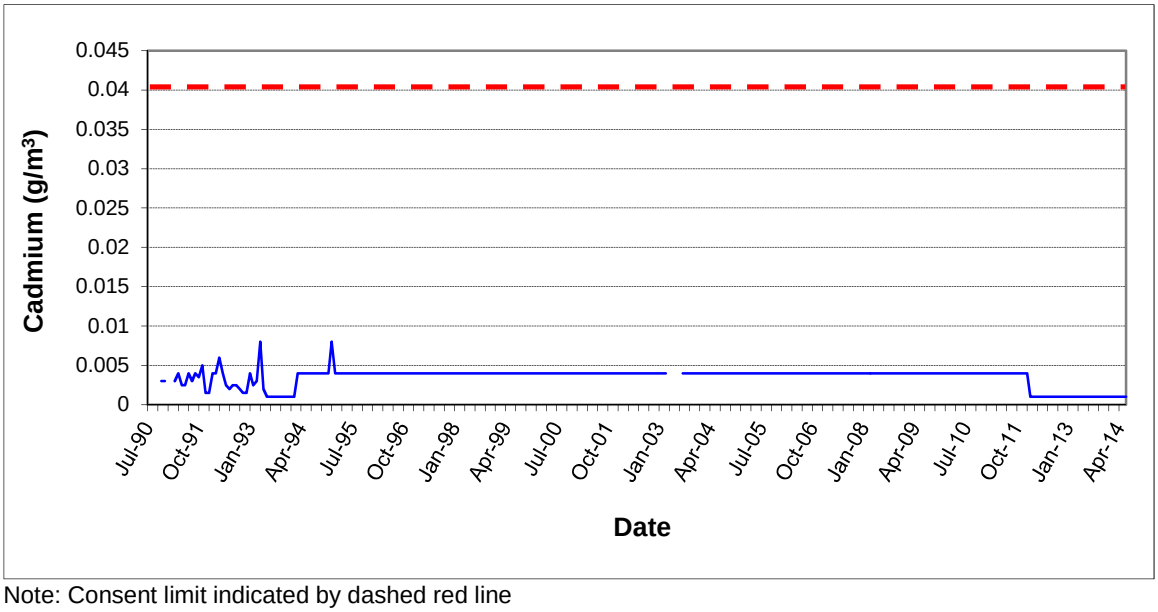
Note: Consent limit indicated by dashed red line



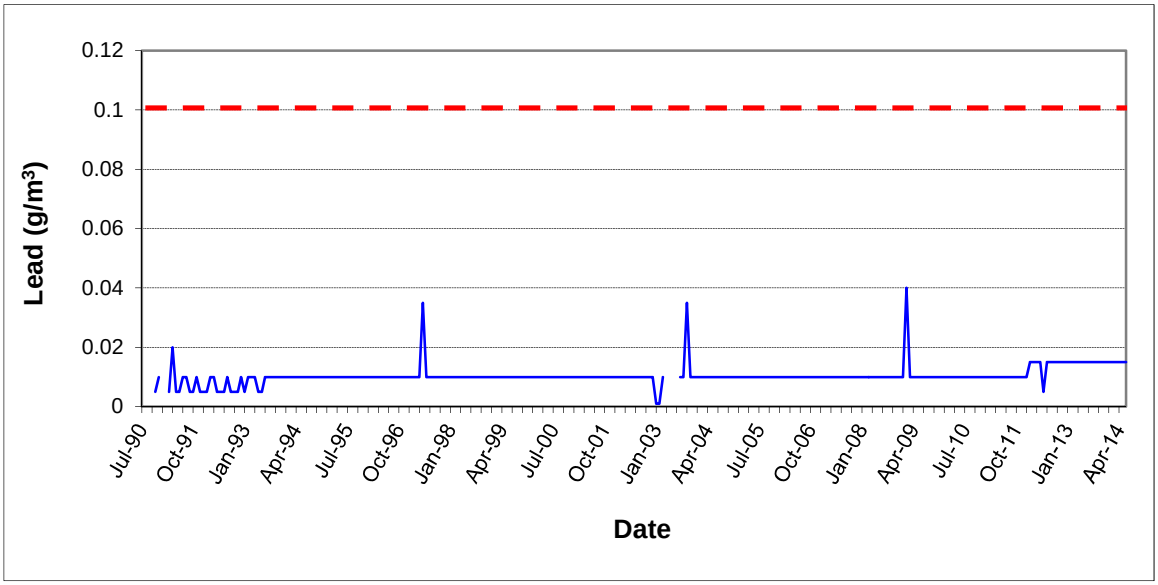
Note: Consent limit indicated by dashed red line



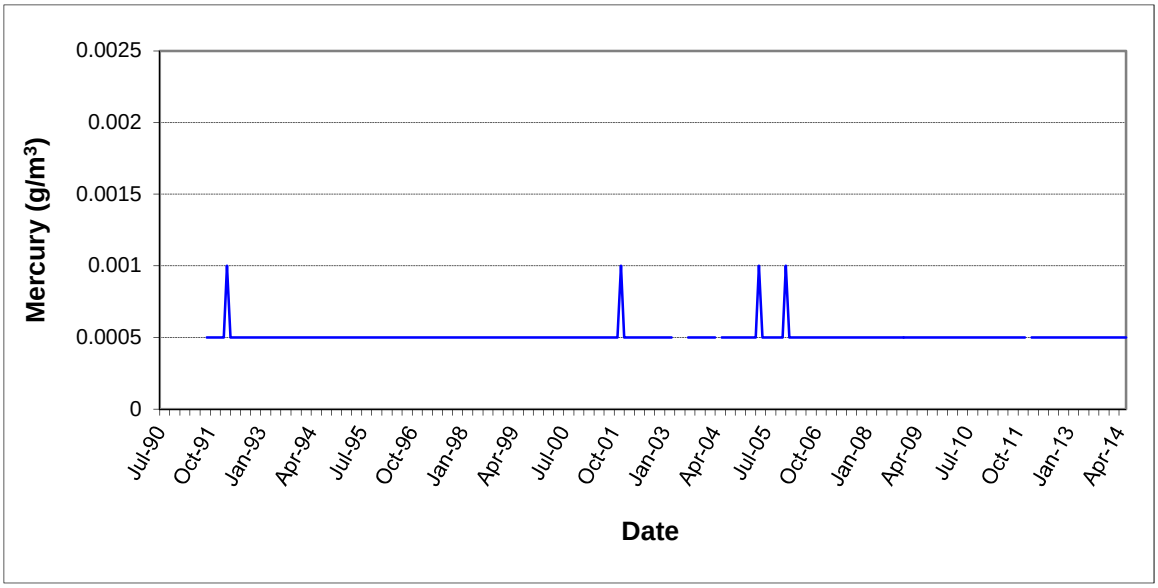
Note: Consent limit indicated by dashed red line



Note: Consent limit indicated by dashed red line



Note: Consent limit indicated by dashed red line



Appendix IV
Results of sludge lagoon monitoring
2012-2013 and 2013-2014

Site	Parameter					
Bore 1	**pH**	**NH_3 g/m³**	**Faecal coliforms No./100ml**	**TDP g/m³**	**NOx g/m³**	**COD g/m³**
July 2012	6.1	4.3	<10	<0.05	4.8	9
August 2012	5.7	0.5	<10	<0.05	9.1	23
September 2012	5.8	1.9	<10	<0.05	5.2	11
October 2012	6.1	0.65	<10	0.14	0.8	13
November 2012	6.3	4.1	<10	0.22	0.4	19
December 2012	6.4	5.2	<10	<0.05	0.14	14
January 2013	6.6	7	8	0.92	<0.05	14
February 2013	6.6	8.6	<10	0.24	<0.05	22
March 2013	6.6	8.4	<10	0.18	0.05	14
April 2013	6.7	5.2	<10	0.09	<0.05	21
May 2013	6.5	5.2	<10	0.13	<0.05	14
June 2013	5.5	<0.1	<10	<0.05	6.8	14
Bore 2	**pH**	**NH_3 g/m³**	**Faecal coliforms No./100ml**	**TDP g/m³**	**NOx g/m³**	**COD g/m³**
July 2012	5.8	0.1	<10	<0.05	0.03	38
August 2012	6.0	<0.1	<10	<0.05	<0.1	32
September 2012	5.9	<0.1	<10	<0.05	<0.1	26
October 2012	6.1	0.64	<10	<0.05	0.2	30
November 2012	6.0	0.12	<10	<0.05	0.2	24
December 2012	5.9	0.12	<10	<0.05	0.14	21
January 2013	5.9	0.17	40	<0.05	<0.1	24
February 2013	6.3	2.5	<10	<0.05	<0.1	43
March 2013	6.5	4.4	<10	<0.05	0.07	32
April 2013	5.8	<0.1	70	<0.05	<0.1	57
May 2013	5.7	0.13	100	<0.05	<0.1	25
June 2013	5.9	<0.1	10	<0.05	0.11	39
Bore 3	**pH**	**NH_3 g/m³**	**Faecal coliforms No./100ml**	**TDP g/m³**	**NOx g/m³**	**COD g/m³**
July 2012	5.9	0.5	<10	<0.05	0.47	56
August 2012	5.9	<0.1	70	0.08	2	109
September 2012	6.0	<0.1	<10	0.08	1.7	93
October 2012	6.0	0.17	<10	0.05	0.5	42
November 2012	5.9	0.14	<10	<0.05	0.4	85
December 2012	5.9	<0.1	20	0.06	0.18	66
January 2013	6.1	<0.1	118	0.23	<0.15	34
February 2013	6.5	1.3	<10	<0.05	<0.15	87
March 2013	-	-	-	-	-	-
April 2013	5.9	0.27	1200	0.05	<0.15	91
May 2013	5.7	<0.1	205	0.08	1.1	34
June 2013	5.9	<0.1	800	0.05	0.4	216

Open Drain	**pH**		**NH_3**		**Faecal coliforms**	
	Pt 2	**Pt 3**	**Pt 2**	**Pt 3**	**Pt 2**	**Pt 3**
July 2012	6.6	6.8	0.8	2.6	10	30
August 2012	6.7	6.7	2.1	0.75	30	20
September 2012	6.6	6.7	0.7	2.5	70	90
October 2012	6.6	6.7	0.58	3.2	70	120

November 2012	6.6	6.7	0.88	2.9	280	100
December 2012	6.6	6.6	0.66	1.9	230	70
January 2013	6.7	6.8	0.64	9.8	2230	540
February 2013	-	-	-	-	-	-
March 2013	6.6	6.6	0.96	1.4	580	1770
April 2013	6.7	6.7	0.58	0.7	3000	980
May 2013	6.6	6.6	0.63	1.1	1400	1800
June 2013	6.7	6.7	0.72	1.9	160	610

2013-2014

Site	**Parameter**					
Bore 1	**pH**	**NH_3 g/m³**	**Faecal coliforms No./100ml**	**TDP g/m³**	**NOx g/m³**	**COD g/m³**
July 2013	5.5	<0.1	<10	<0.05	2.6	15
August 2013	6.2	1.3	<5	<0.05	0.6	26
September 2013	6.0	<0.1	80	0.21	0.41	48
October 2013	5.7	0.1	74	0.07	9.9	13
November 2013	6.1	1.52	<10	<0.05	1.3	14
December 2013	6.0	1.9	<10	<0.05	5.4	21
January 2014	6.4	5.4	4	<0.05	0.7	23
February 2014	6.6	8.0	20	<0.05	<0.15	21
March 2014	6.7	11.6	<10	<0.05	<0.15	26
April 2014	6.8	13	20	<0.05	<0.15	34
May 2014	6.6	8.4	<10	0.05	0.4	17
June 2014	6.5	10	<10	<0.05	0.23	17
Bore 2	**pH**	**NH_3 g/m³**	**Faecal coliforms No./100ml**	**TDP g/m³**	**NOx g/m³**	**COD g/m³**
July 2013	5.7	<0.1	10	<0.05	0.2	25
August 2013	6.0	0.18	<5	<0.05	0.24	34
September 2013	5.9	<0.1	10	0.16	<0.15	40
October 2013	5.9	0.16	301	<0.05	<0.15	48
November 2013	6.0	0.14	<10	<0.05	0.48	31
December 2013	5.8	<0.1	160	<0.05	0.14	63
January 2014	5.8	0.14	30	<0.05	<0.1	73
February 2014	6.1	0.72	10	<0.05	<0.15	34
March 2014	6.1	1.9	<10	<0.05	<0.15	35
April 2014	6.5	2.8	10	<0.05	<0.15	37
May 2014	5.8	<0.1	30	<0.05	0.1	27
June 2014	5.7	0.19	<10	<0.05	0.3	23
Bore 3	**pH**	**NH_3 g/m³**	**Faecal coliforms No./100ml**	**TDP g/m³**	**NOx g/m³**	**COD g/m³**
July 2013	6.1	<0.1	100	0.06	0.9	200
August 2013	6.4	0.33	<5	0.06	0.33	184
September 2013	6.0	<0.1	80	0.21	0.41	48
October 2013	6.0	<0.1	3000	<0.05	0.9	180
November 2013	6.2	0.32	60	0.05	0.1	54
December 2013	6.2	0.13	5000	0.08	0.1	86
January 2014	6.0	0.29	930	<0.05	0.1	29
February 2014	6.2	1.1	45	<0.05	<0.15	72

March 2014	6.3	1.3	10	<0.05	<0.15	65
April 2014	6.5	1.9	<10	<0.05	<0.15	158
May 2014	5.7	0.11	1490	<0.05	0.9	59
June 2014	6.0	0.57	30	<0.05	0.1	138

Open Drain	**pH**		**NH_3**		**Faecal coliforms**	
	Pt 2	**Pt 3**	**Pt 2**	**Pt 3**	**Pt 2**	**Pt 3**
July 2013	6.6	6.6	1.1	4	170	215
August 2013	6.8	6.8	0.73	20.8	250	170
September 2013	6.6	6.8	0.71	4.1	70	110
October 2013	6.6	6.7	0.86	4.6	270	630
November 2013	6.6	6.7	0.54	4	80	50
December 2013	6.6	6.8	0.56	3.8	620	270
January 2014	6.6	6.7	0.54	4.8	170	120
February 2014	6.6	6.7	0.35	4.1	130	410
March 2014	6.6	6.8	0.67	4.3	110	130
April 2014	6.6	6.8	0.8	2.6	225	525
May 2014	6.6	6.7	0.58	2.3	20	125
June 2014	6.6	6.6	0.67	1.8	110	250

Appendix V
Marine ecological survey reports

Memorandum

To: Environmental Monitoring Manager, Keith Brodie
From: Scientific Officer, Emily Roberts
File: #1247533
Date: 9 September 2013

New Plymouth Wastewater Treatment Plant Marine Outfall - Marine Ecological Survey January 2013

1. Introduction

The New Plymouth District Council (NPDC) operates the New Plymouth Wastewater Treatment Plant (NPWWTP). At this facility municipal wastewater from the New Plymouth urban area is treated and thereafter discharges through a 450m long marine outfall offshore of the Waiwhakaiho River mouth. NPDC hold coastal permit 0882-4 to discharge treated effluent into the Tasman Sea. Special condition 1 of the consent requires that the consent holder prevents or minimises any adverse environmental effects. Accordingly, a survey at coastal sites in the vicinity of the outfall is undertaken each year to assess any adverse effects on intertidal communities.

The survey was carried out at five sites between 12 and 30 January 2013 as part of the 2012-2013 monitoring programme. The objective of the survey was to assess any change in intertidal diversity attributable to the wastewater discharge.

2. Methods

2.1 Field Work

The survey was conducted at three potential impact sites and 2 control sites (Photographs 1-5).

The potential impact sites were (site name and code in brackets):

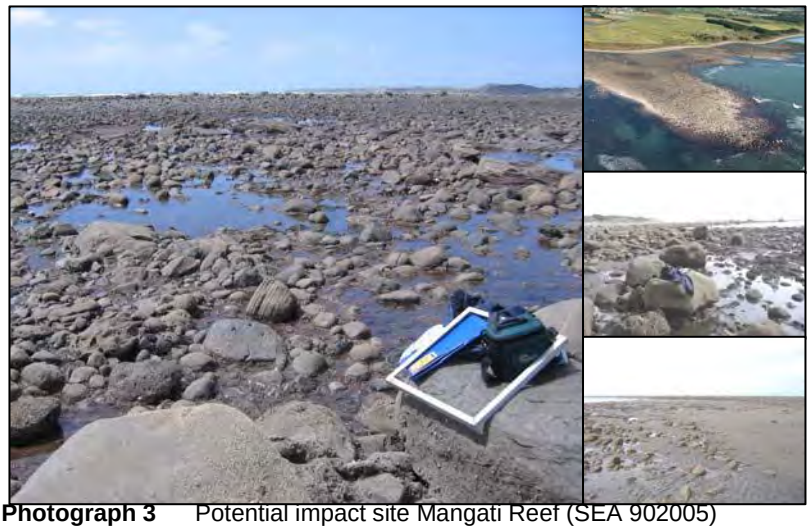
- 500m south west of the outfall on the Waiwhakaiho Reef (500m SW, SEA902015);
- 300m north east of the outfall on the Waiwhakaiho Reef (300m NE, SEA902010); and
- Mangati Reef approximately 2.2 km north east of the outfall (Mangati Reef, SEA902005).

The two control sites were:

- Turangi Reef approximately 16 km north east of the outfall (Turangi Reef, SEA901007); and
- Greenwood Road approximately 22 km south west of the outfall (Greenwood Road, SEA903070).

Photograph 1 Potential impact site 500m SW (SEA902015)

Photograph 2 Potential impact site 300m NE (SEA902010)



Photograph 3 Potential impact site Mangati Reef (SEA 902005)

Photograph 4 Control site Greenwood Road (SEA903070)

Photograph 5 Control site Turangi Reef (SEA901007)

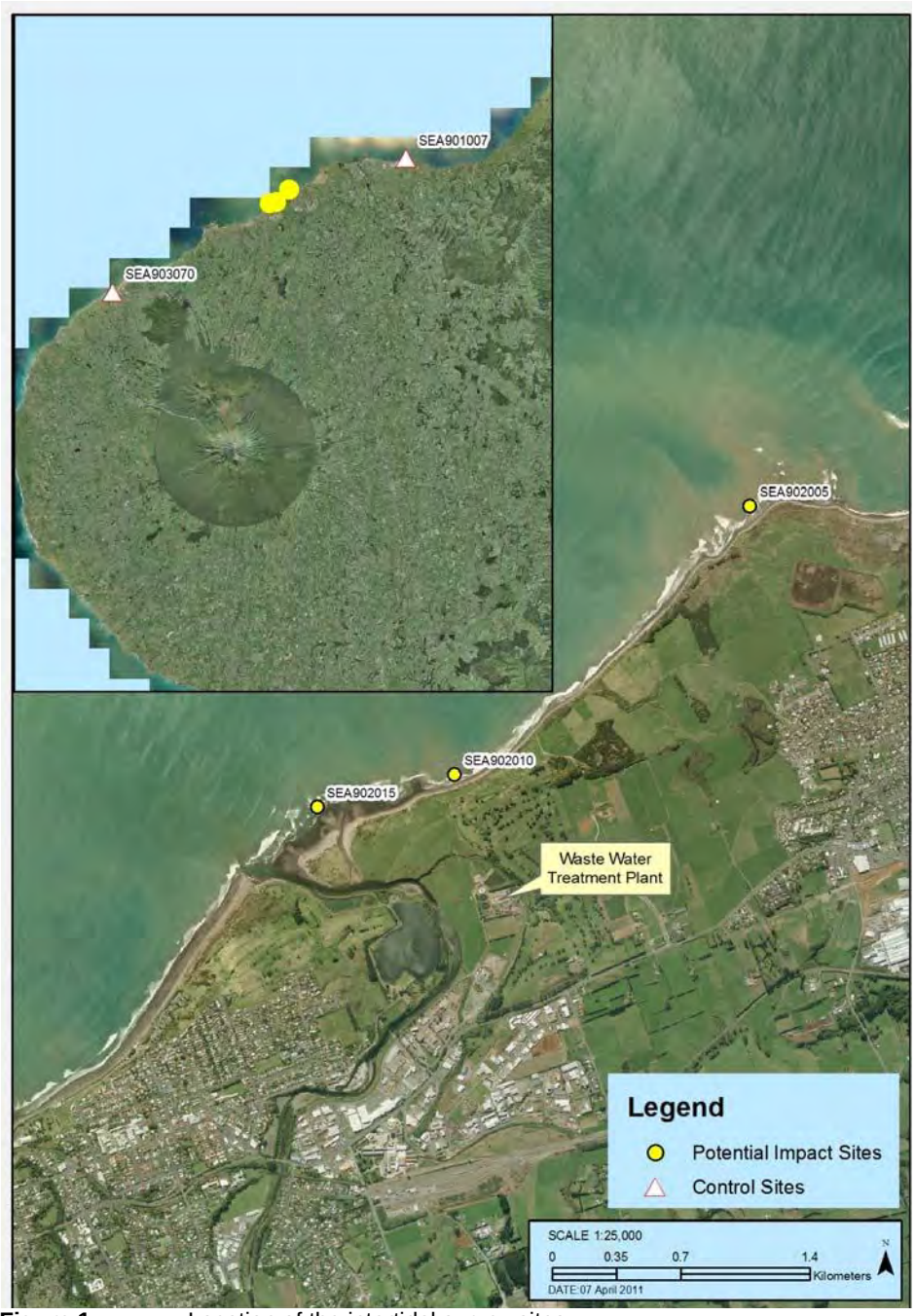


Figure 1 Location of the intertidal survey sites

At each site, a 50m transect was laid parallel to the shore, approximately 0.6 metres above chart datum. This transect was used to establish five 5m x 3m blocks. Within each block, 5 random 0.25 m² quadrats were laid giving a total of 25 random quadrats. For each quadrat the percentage cover of algae and encrusting animal species was estimated using a grid. For all other animal species, individuals larger than 3mm were counted. Under boulder biota was counted where rocks and cobbles were easily overturned.

3. Results

Summary statistics, including the number of species per quadrat and Shannon Weiner indices are presented in Table 1. The potential impact site 300m NE had the highest number of species, followed by the control sites at Greenwood Road and Turangi Road, then the potential impact sites at Mangati Reef and 500m SW. Diversity was highest at 300m NE, followed by Mangati Reef, Turangi Road, Greenwood Road and 500m SW.

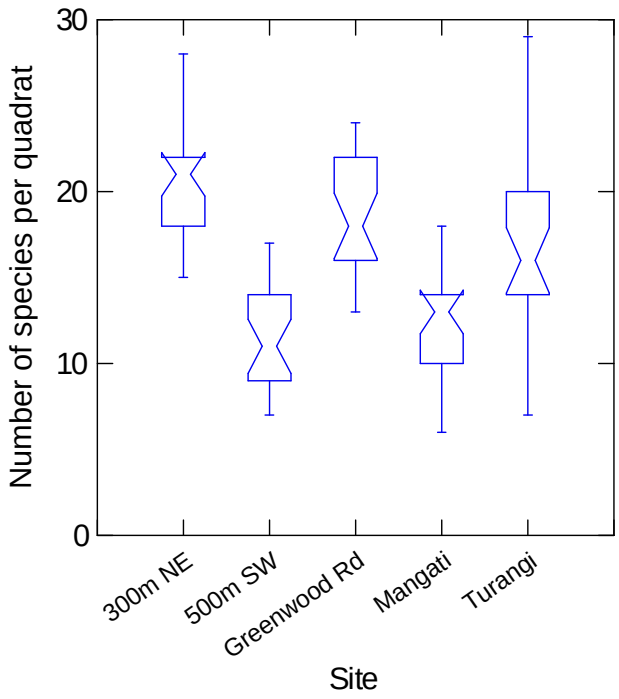
Table 1 Summary statistics – January 2013

Site	Number of quadrats	Mean number of species per quadrat			Mean Shannon-Weiner index per quadrat		
		Algae	Animals	Total Species	Algae	Animals	Total Species
500m SW	25	2.12	9.20	11.30	0.27	0.59	0.64
300m NE	25	5.68	15.08	20.76	0.64	0.96	1.09
Mangati Reef	25	4.04	8.48	12.52	0.34	0.71	0.83
Turangi Reef	25	5.00	11.68	16.68	0.49	0.66	0.81
Greenwood Road	25	9.50	9.08	18.56	0.80	0.48	0.74

3.1 Number of Species per Quadrat Data

Figure 1 shows the total number of species per quadrat at each site as a box and whisker plot. The notched area of the box represents the median plus and minus the 95% confidence interval. This form of graphical representation allows a quick comparison to be made between sites. Generally, if the notched areas of the boxes do not overlap you would expect to obtain a significantly different result with an analysis of variance statistical test (ANOVA).

Figure 2 Box and whisker plot of total number of species per quadrat



For all sites, there was no significant deviation from normal distribution at the 95% confidence level (Lilliefors test, n = 25, P >0.05). There was a significant difference in species number per quadrat between sites (ANOVA, n = 25, F = 32.717, P <0.001).

Significant differences between sites were determined using Tukey's multiple comparison test (Table 2). Number of species per quadrat was significantly greater at 300m NE, Greenwood Road and Turangi than 500m SW and Mangati (P<0.05).

Table 2 Tukey multiple comparison test of number of species per quadrat

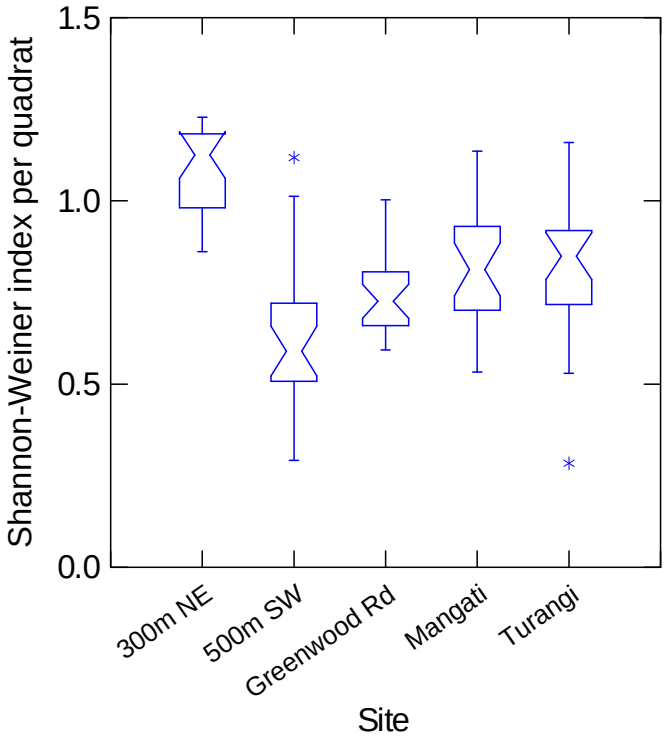
Site	Greenwood Road	500m SW	300m NE	Mangati Reef
500m SW	SIG			
300m NE	NS	SIG		
Mangati Reef	SIG	NS	SIG	
Turangi Reef	NS	SIG	SIG	SIG

Key: SIG = significant difference at 95% confidence level
NS = no significant difference

3.2 Shannon-Weiner Diversity Index Data

Figure 2 shows the Shannon-Weiner index per quadrat at each site as a box and whisker plot.

Figure 3 Box and whisker plots of Shannon-Weiner diversity indices



Only one site (300m NE) showed a significant deviation from a normal distribution at the 95% confidence level (Lilliefors test, n = 25, P = 0.012). There was a significant difference in the Shannon-Weiner index per quadrat between sites (ANOVA, n = 25, F = 27.791, P <0.001). Significant differences between sites were determined using Tukey's multiple comparison test (Table 3).

Table 3 Tukey's multiple comparison test of Shannon-Weiner diversity indices

Site	Greenwood Road	500m SW	300m NE	Mangati Reef
500m SW	NS			
300m NE	SIG	SIG		
Mangati Reef	NS	SIG	SIG	
Turangi Reef	NS	SIG	SIG	NS

Key: SIG = significant difference at 95% confidence level
NS = no significant difference

Shannon-Weiner index at 300m NE was significantly greater than that at all other sites (P<0.05). Shannon-Weiner index at 500m SW was significantly lower than that at all other sites with the exception of Greenwood Road.

3.3 Sand Cover

The percentage cover of sand was recorded (Table 4) because high sand levels can significantly impact marine communities.

Table 4 Mean percentage sand cover per quadrat at each site

Site	Mean coverage per quadrat (%)
500m SW	1
300m NE	15
Mangati Reef	47
Turangi Reef	15
Greenwood Road	8

Sand cover >30% can significantly impact marine communities

Relative to other sites, Mangati Reef had a high cover of sand (47%). This site has a history of being susceptible to sand accumulation (Refer to Figure 4 and Photograph 3 bottom right hand insert). Previous studies on intertidal reefs in Taranaki have demonstrated that at 30% cover, sand begins to negatively influence hard shore communities.

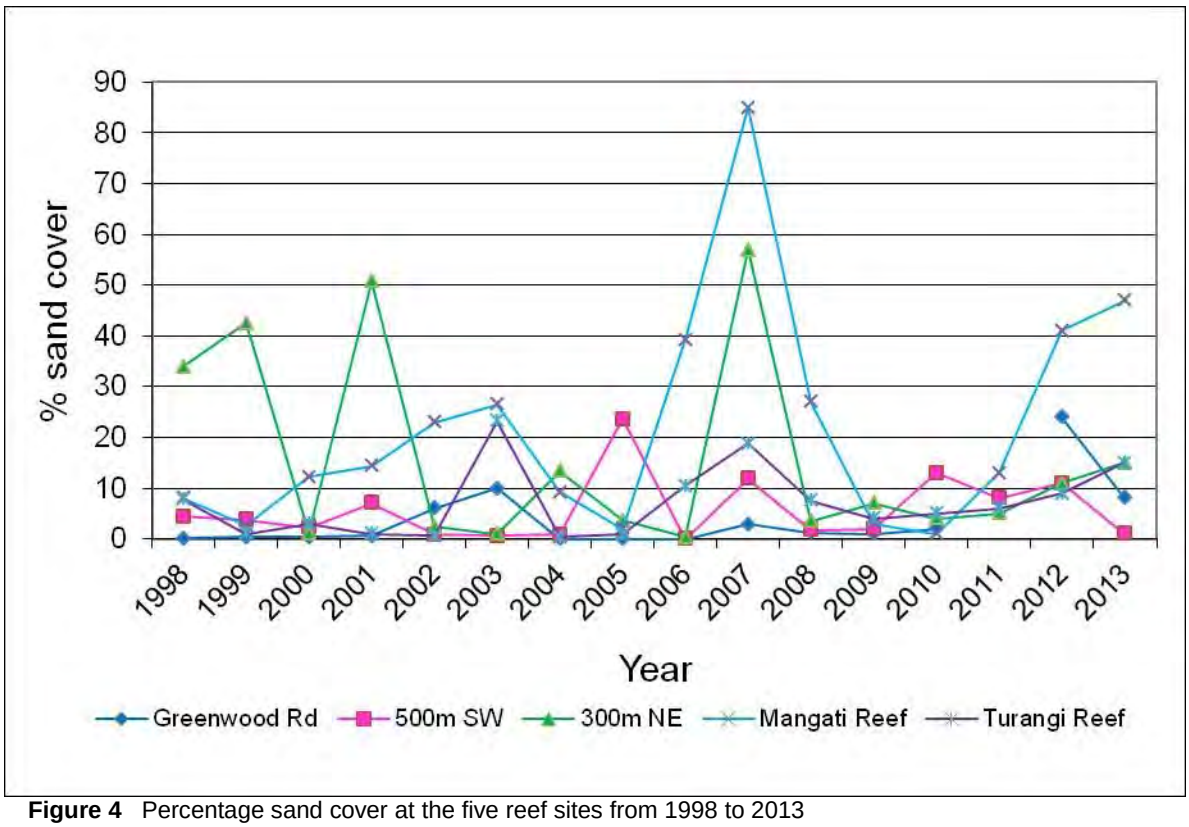


Figure 4 Percentage sand cover at the five reef sites from 1998 to 2013

3.4 Trends over time

Comparisons of the mean number of species per quadrat and the mean Shannon-Weiner index at the five sites surveyed from 1993 to 2013 are shown in Figures 5 and 6, respectively. Species abundance and diversity showed high interannual variability, with no obvious long term trends in diversity evident at the three impact sites over time (Figures 5 and 6). For the 2012-2013 season, while 300m NE was at the upper end of the range of values previously recorded, 500m SW and Mangati Reef were at the lower end of the range for both species abundance and Shannon-Weiner index (Figures 5 and 6). Although the number of species present at Greenwood Road had increased sharply from the previous year, the Shannon-Weiner index was the lowest recorded to date at this site. At the Turangi Reef site, both species abundance and Shannon-Weiner index had increased since the previous year.

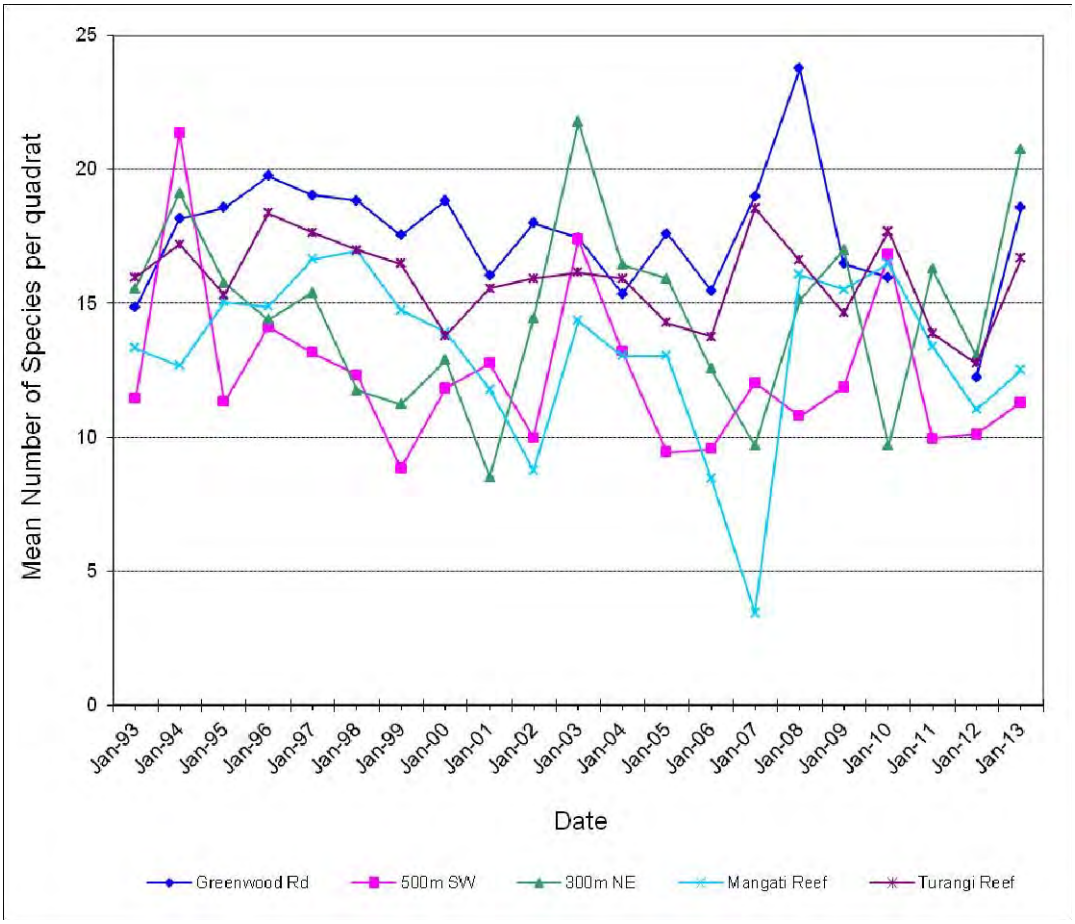


Figure 5 Mean number of total species per quadrat from 1993 to 2013

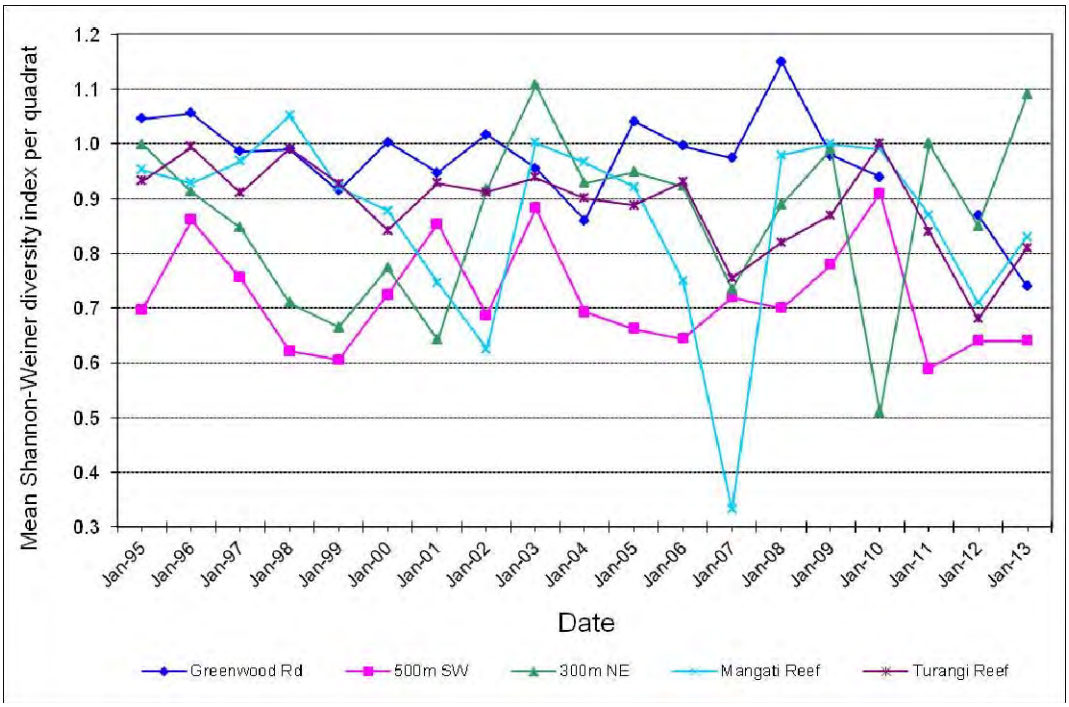


Figure 6 Mean Shannon-Weiner index per quadrat from 1995 to 2013

4. Discussion

An intertidal survey was conducted at five sites between 12 and 30 January 2013 as part of the 2012-2013 monitoring programme. Potential impact of the NPWWTP outfall discharge on the intertidal community was assessed through comparison of results from potential impact sites and control sites within the same year in addition to the analysis of trends over time. The data analysed in this report covers a twenty year record of species diversity from January 1993 to January 2013.

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2013 survey results. Both species number and Shannon-Weiner index were greater at the potential impact site closest to the outfall (300m NE) relative to the two control sites (Figure 2 and 3). In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative to the control sites (Figures 5 and 6).

Spatial and interannual variability in the intertidal communities surveyed could be largely attributed to natural changes in physical characteristics of the habitats. In particular sand cover, substrate type and substrate mobility were major drivers of diversity. For example, at the site 500m SW of the outfall, the reef was predominantly composed of relatively uniform, small, rounded rocks (Photograph 1, Figure 7). It has been previously noted that the movement of these rocks is influenced by the close proximity of the Waiwhakaiho River, with the formation of cobble banks which regularly shift and vary in height. The mobile nature of the substrate prevented many species, in particular macroalgae, from establishing (Table 1). The porcelain crab *Petrolisthes elongates* was one of the few animals able to thrive at this site (Figure 8). This highly mobile, small species of crab is well adapted to such harsh, transient environments, being able to scuttle and filter feed between the rounded rocks (Morton, 2004).

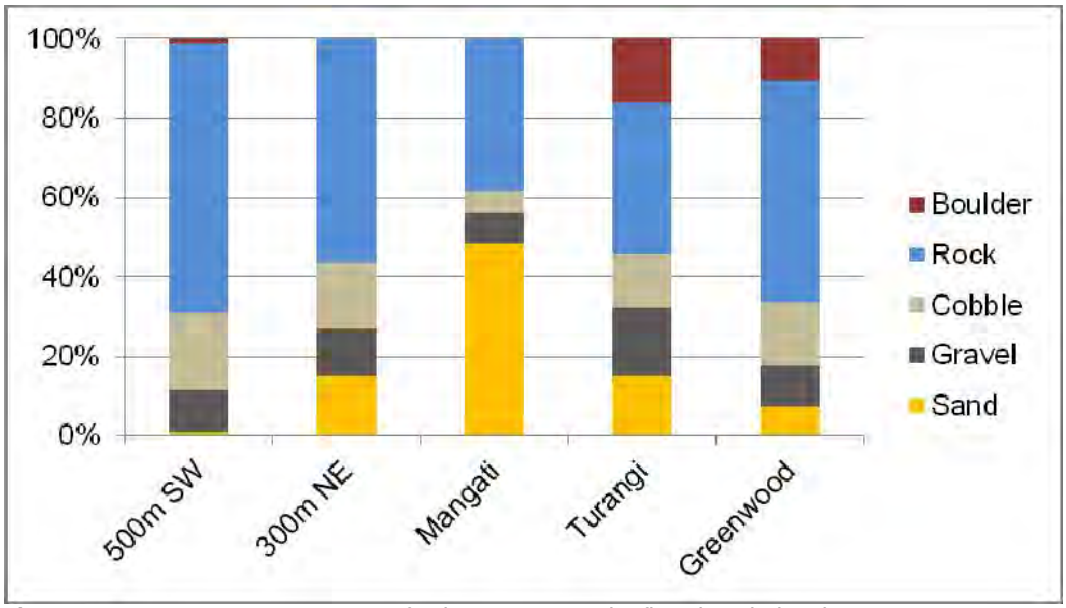


Figure 7 Percentage cover of substrate type at the five sites during the January 2013 survey

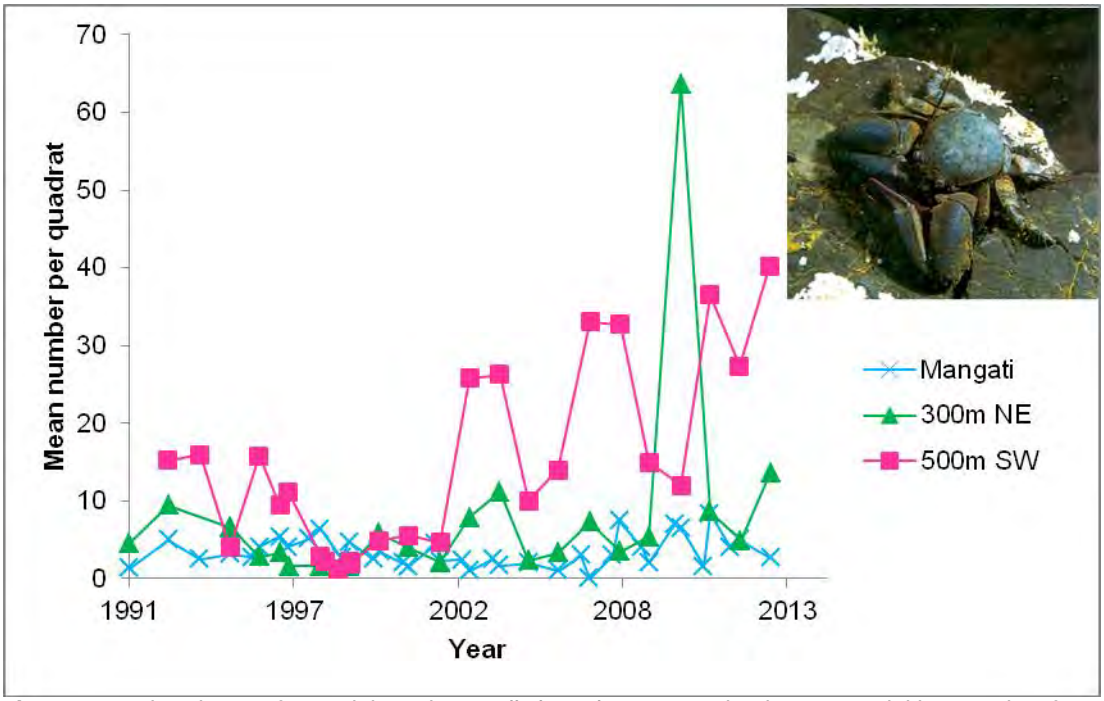


Figure 8 Abundance of Porcelain crab *Petrolisthes elongates* at the three potential impact sites from 1991 to 2013

Relative to the other potential impact sites, the Mangati Reef site was more prone to sand accumulation (Figure 4). Years of high sand accumulation at this site tend to be associated with low diversity (for example 2006, 2007, 2012 and 2013). This is not surprising given that sand deposition has been shown to have a profound effect on under-rock colonisation on intertidal hard-shore environments in Taranaki (Walsby, 1982). Sand cover can result in reduced diversity due to sand scour of the biota, reduced water movement between rocks and temporary sand burial. A combination of these three effects is likely to have resulted in the relatively low species number and Shannon-Weiner index recorded at the Mangati Reef during the 2013 survey.

Although high sand cover is likely to have caused an overall reduction in intertidal diversity at the Mangati Reef in 2013, the more sheltered conditions at this site, relative to the other two impact sites, favoured the growth of coralline turf (Figure 9). The relatively high percentage cover of coralline turf provided an ideal habitat for juvenile cat's-eyes *Turbo smaragdus* (Figure 10), which are known to feed on the small epiphytes present on the calcified surface of the coralline algae (Morton, 2004). Juvenile cat's-eyes are known to live for up to 18 months in the coralline turf, prior to moving further down-shore.

The 300m NE site provided an intermediate substrate cover relative to the two other potential impact sites (Figure 7), offering more shelter/stability than the 500m SW site and less sand accumulation than the Mangati Reef site. This, combined with the range of habitats/ecological niches provided by the substrate, resulted in a high number of species and Shannon Weiner Index at this site for the January 2013 survey.

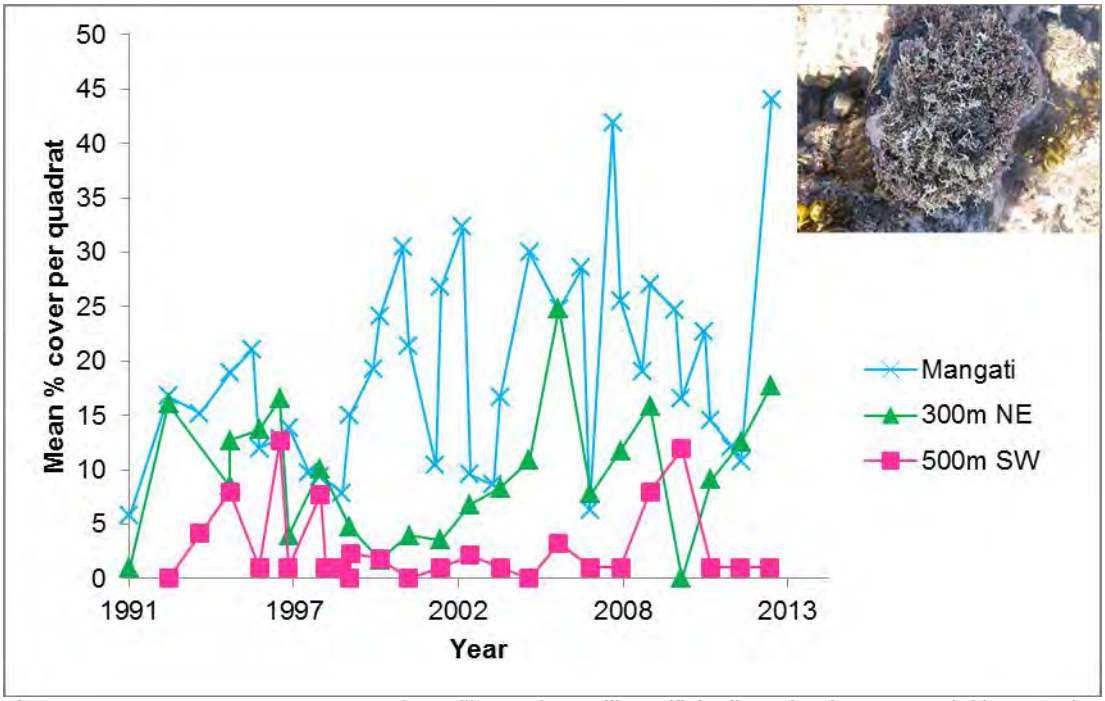


Figure 9 Percentage cover of coralline turf *Corallina officinalis* at the three potential impact sites from 1991 to 2013

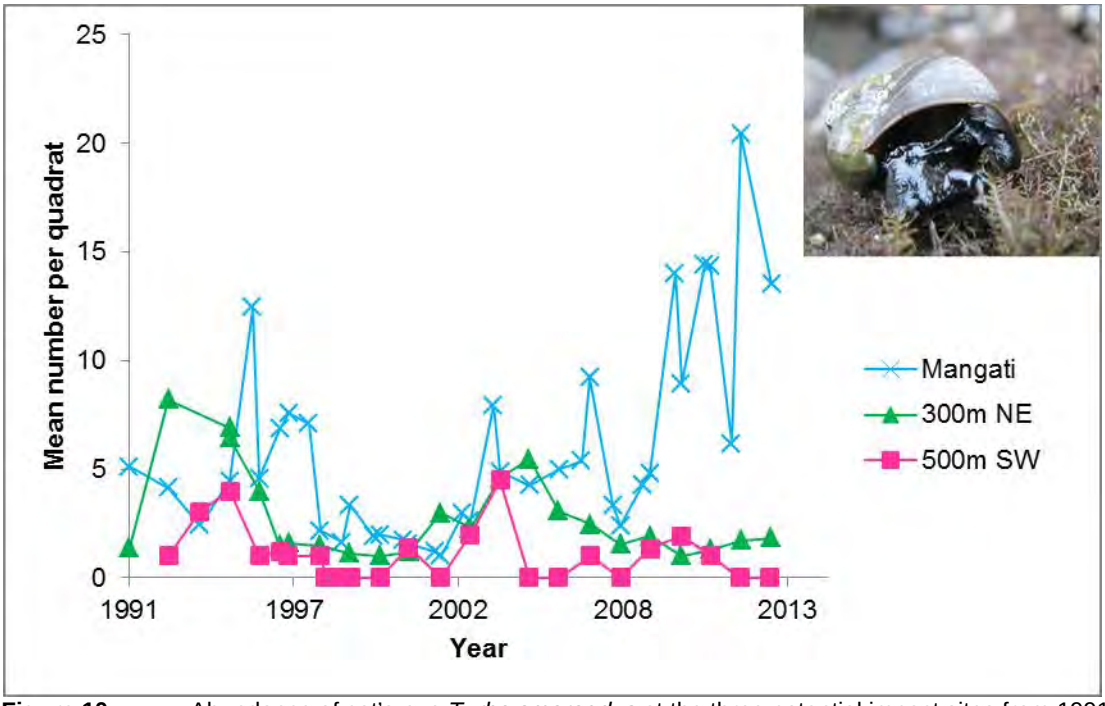


Figure 10 Abundance of cat's-eye *Turbo smaragdus* at the three potential impact sites from 1991 to 2013

The control sites at Turangi Reef and Greenwood Road have typically had a high level of species abundance and diversity. Variation at these sites (lower abundance and diversity) has previously been attributed to sand inundation. Species number and diversity have tended to recover quickly once the sand has been removed. Results from the January 2013 survey showed that despite a high number of species recorded at Greenwood Road, the Shannon-Weiner index was the lowest to date at this site. This discrepancy can be explained by taking into account the abundance of each species i.e.

in January 2013 two small gastropod species (*Cantharidella tesselata* and *Diloma nigerrima*) numerically dominated at this site, with other animal species being low in abundance in comparison.

Finally, it must be noted that the high energy receiving environment combined with the effects of suspended sediments from rivers and streams prevent the development of stable biological communities along the Taranaki coastline (Clark *et al*., 2012). Such conditions could potentially mask any subtle ecological effects from the NPWWTP outfall discharge. However, in spite of these limitations, intertidal surveys are useful in detecting more noticeable effects from wastewater, as clearly identified in the TRC Fonterra Whareroa Annual Report 2012-2013 (13-24).

5. Conclusions

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, surveys were conducted in January 2013 at five sites. These surveys included three potential impact sites and two control sites, either side of the outfall. It is expected that significant adverse effects of the NPWWTP outfall discharge on the intertidal communities would have been evident as a decline in species diversity at the potential impact sites relative to the control sites.

Both species number and Shannon-Weiner index were greater at the potential impact site closest to the outfall relative to the two control sites. In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative to the control sites. The results indicate that the outfall discharge was not having detectable adverse effects on the intertidal reef communities of north Taranaki. Natural environmental factors, in particular sand cover, substrate type and substrate mobility, appeared to be the dominant drivers of species diversity at the sites surveyed.

Emily Roberts
Scientific Officer – Marine Ecologist

References

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Walsby, J.R. (1982) Marine ecological baseline programme NZSFC Synthetic Petrol Plant Motunui.

Memorandum

To: Science Manager – Hydrology/Biology, Regan Phipps
From: Scientific Officer, Emily Roberts and Technical Officer, Abbie Bates
File: #1385172
Date: 14 August 2014

New Plymouth Wastewater Treatment Plant Marine Outfall - Marine Ecological Survey January/February 2014

1. Introduction

The New Plymouth District Council (NPDC) operates the New Plymouth Wastewater Treatment Plant (NPWWTP). At this facility municipal wastewater from the New Plymouth urban area is treated and thereafter discharges through a 450m long marine outfall offshore of the Waiwhakaiho River mouth. NPDC hold coastal permit 0882-4 to discharge treated effluent into the Tasman Sea. Special condition 1 of the consent requires that the consent holder prevents or minimises any adverse environmental effects. Accordingly, a survey at coastal sites in the vicinity of the outfall is undertaken each year to assess any adverse effects on intertidal communities.

The survey was carried out at five sites between 30 January and 3 February 2014 as part of the 2013-2014 monitoring programme. The objective of the survey was to assess any change in intertidal diversity attributable to the wastewater discharge.

2. Methods

2.1 Field Work

The survey was conducted at three potential impact sites and 2 control sites (Photographs 1-5).

The potential impact sites were (site name and code in brackets):

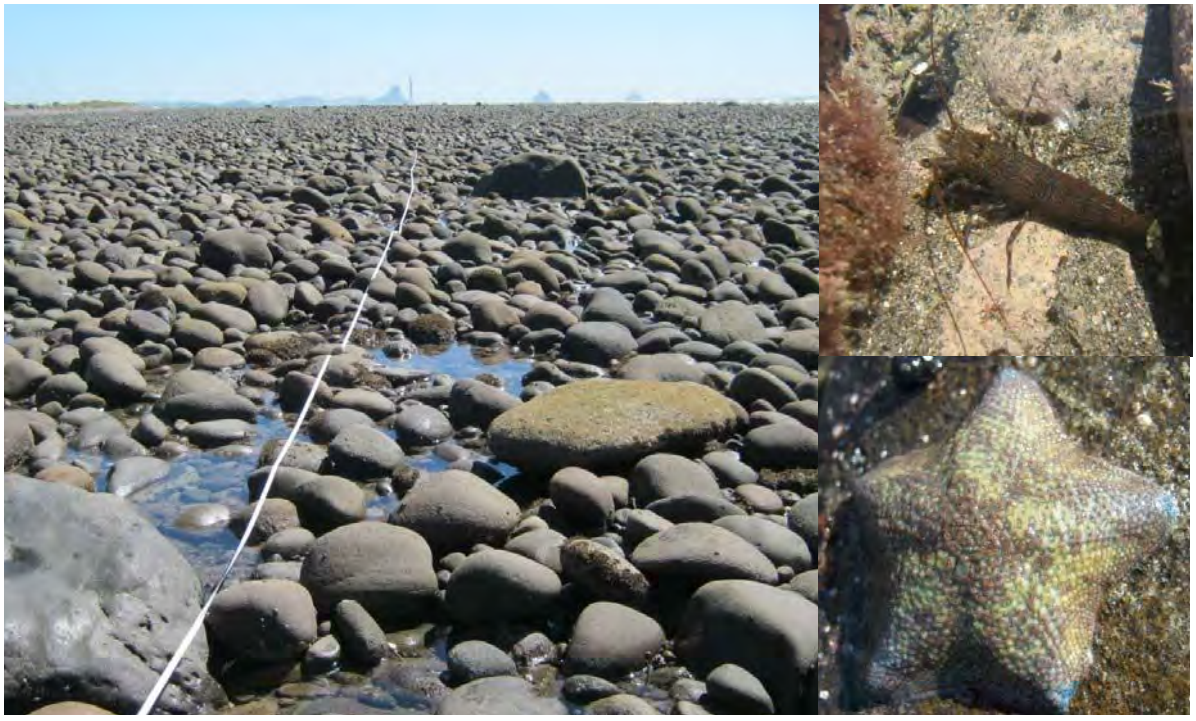
- 500m south west of the outfall on the Waiwhakaiho Reef (500m SW, SEA902015);
- 300m north east of the outfall on the Waiwhakaiho Reef (300m NE, SEA902010); and
- Mangati Reef approximately 2.2 km north east of the outfall (Mangati Reef, SEA902005).

The two control sites were:

- Turangi Reef approximately 16 km north east of the outfall (Turangi Reef, SEA901007); and

Greenwood Road approximately 22 km south west of the outfall (Greenwood Road, SEA903070).

Photograph 1 Potential impact site 500m SW (SEA902015)



Photograph 2 Potential impact site 300m NE (SEA902010)

Photograph 3 Potential impact site Mangati Reef (SEA 902005)

Photograph 4 Control site Greenwood Road (SEA903070)

Photograph 5 Control site Turangi Reef (SEA900095)

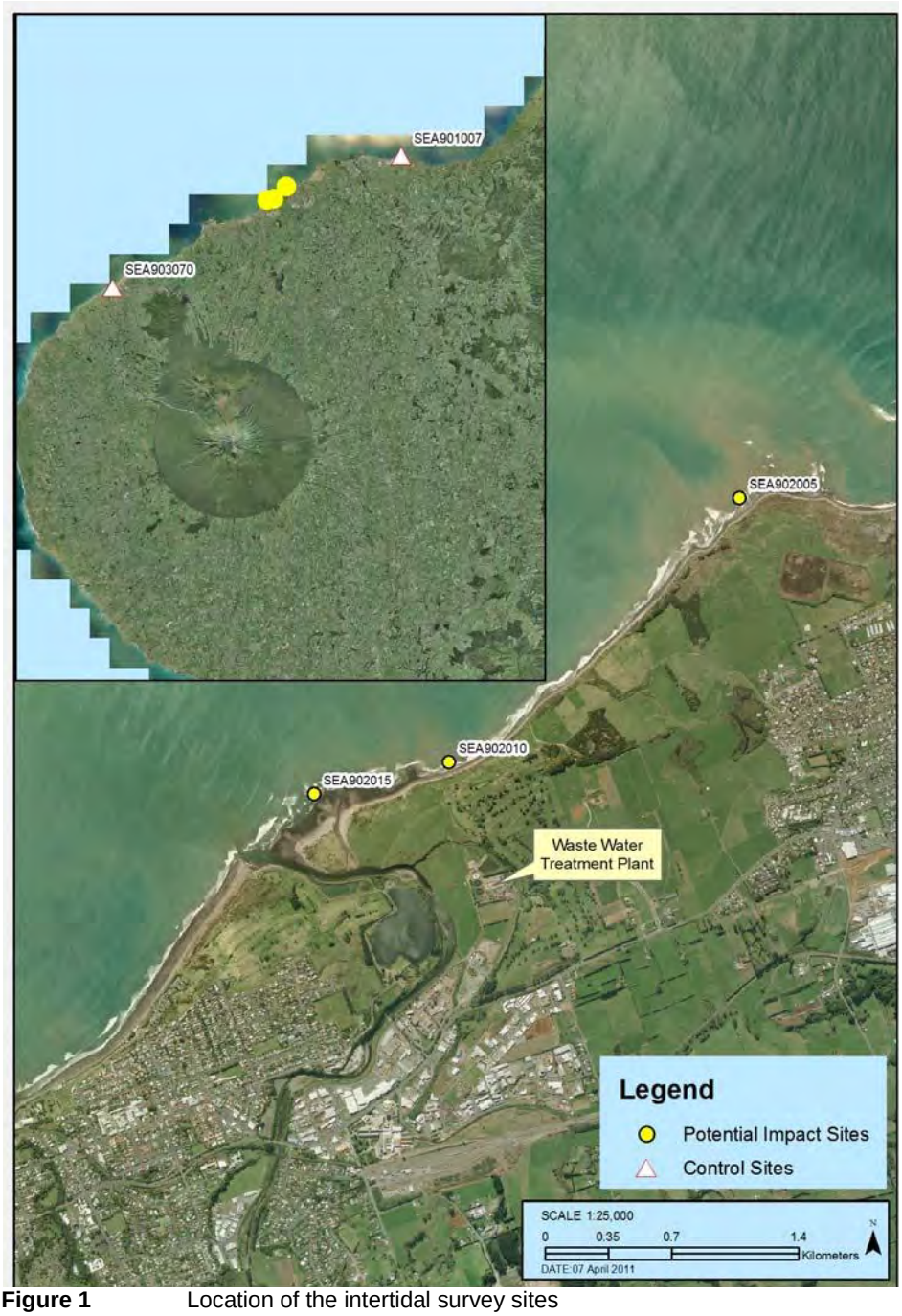


Figure 1 Location of the intertidal survey sites

At each site, a 50m transect was laid parallel to the shore, approximately 0.6 metres above chart datum. This transect was used to establish five 5m x 3m blocks. Within each block, 5 random 0.25 m² quadrats were laid giving a total of 25 random quadrats. For each quadrat the percentage cover of algae and encrusting animal species was estimated using a grid. For all other animal species, individuals larger than 3mm were counted. Under boulder biota was counted where rocks and cobbles were easily overturned.

3. Results

Summary statistics, including the number of species per quadrat and Shannon Weiner indices are presented in Table 1. The potential impact site 300m NE had the highest number of species, followed by the Turangi Reef, then the potential impact sites at Mangati Reef, 500m SW and then the control sites at Greenwood Road. Diversity was highest at 300m NE, followed by Mangati Reef, Greenwood Road, Turangi Reef, and 500m SW.

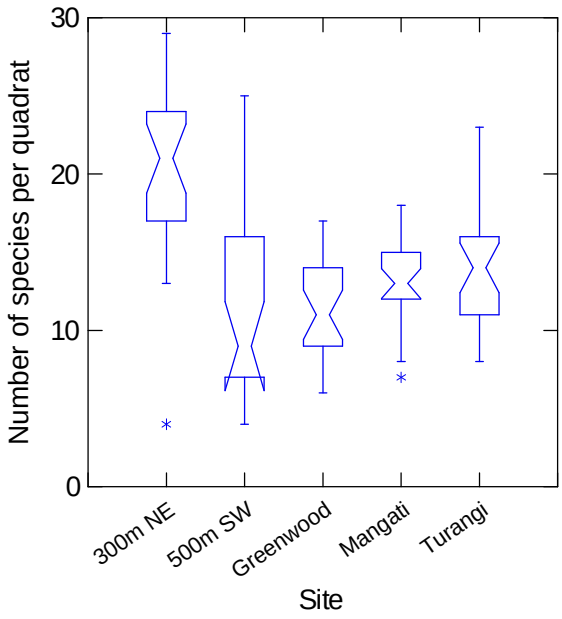
Table 1 Summary statistics – January/February 2014

Site	Number of quadrats	Mean number of species per quadrat			Mean Shannon-Weiner index per quadrat		
		Algae	Animals	Total Species	Algae	Animals	Total Species
500m SW	25	2.20	9.08	11.28	0.29	0.55	0.60
300m NE	25	6.08	14.16	20.24	0.67	0.95	1.10
Mangati Reef	25	4.84	8.36	13.20	0.52	0.71	0.91
Turangi Reef	25	4.84	9.28	14.12	0.59	0.66	0.84
Greenwood Road	25	5.48	5.76	11.24	0.69	0.57	0.86

3.1 Number of Species per Quadrat Data

Figure 1 shows the total number of species per quadrat at each site as a box and whisker plot. The notched area of the box represents the median plus and minus the 95% confidence interval. This form of graphical representation allows a quick comparison to be made between sites. Generally, if the notched areas of the boxes do not overlap you would expect to obtain a significantly different result with ANOVA.

Figure 2 Box and whisker plot of total number of species per quadrat



Two of the sites (Greenwood Road and 500m SW) showed a significant deviation from normal distribution at the 95% confidence level (Lilliefors test, n = 25, P >0.05).

There was a significant difference in species number per quadrat between sites (ANOVA, n = 25, F = 17.4, P <0.001).

Significant differences between sites were determined using Tukey's multiple comparison test (Table 2). Number of species per quadrat was significantly greater at 300m NE than Greenwood Road, Turangi 500m SW and Mangati (P<0.05).

Table 2 Tukey multiple comparison test of number of species per quadrat

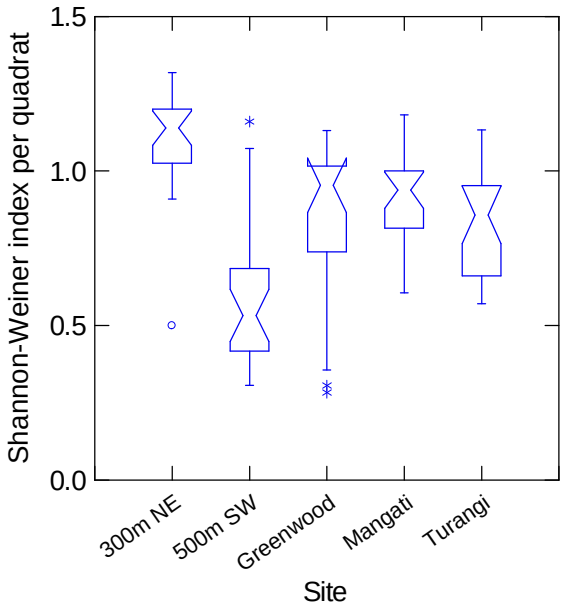
Site	Greenwood Road	500m SW	300m NE	Mangati Reef
500m SW	NS			
300m NE	SIG	SIG		
Mangati Reef	NS	NS	SIG	
Turangi Reef	NS	NS	SIG	NS

Key: SIG = significant difference at 95% confidence level
NS = no significant difference

3.2 Shannon-Weiner Diversity Index Data

Figure 2 shows the Shannon-Weiner index per quadrat at each site as a box and whisker plot.

Figure 3 Box and whisker plots of Shannon-Weiner diversity indices



Only one site (300m NE) showed a significant deviation from a normal distribution at the 95% confidence level (Lilliefors test, n = 25, P <0.05). There was a significant difference in the Shannon-Weiner index per quadrat between sites (ANOVA, n = 25, F = 20.7, P <0.001). Significant differences between sites were determined using Tukey's multiple comparison test (Table 3).

Table 3 Tukey's multiple comparison test of Shannon-Weiner diversity indices

Site	Greenwood Road	500m SW	300m NE	Mangati Reef
500m SW	SIG			
300m NE	SIG	SIG		
Mangati Reef	NS	SIG	SIG	
Turangi Reef	NS	SIG	SIG	NS

Key: SIG = significant difference at 95% confidence level
NS = no significant difference

Shannon-Weiner index at 300m NE was significantly greater than that at all other sites ($P<0.05$). Shannon-Weiner index at 500m SW was significantly greater than that at all other sites except 300m NE.

3.3 Sand Cover

The percentage cover of sand was recorded (Table 4) because high sand levels can significantly impact marine communities.

Table 4 Mean percentage sand cover per quadrat at each site

Site	Mean coverage per quadrat (%)
500m SW	1.8
300m NE	6.2
Mangati Reef	25.4
Turangi Reef	12.9
Greenwood Road	7.6

Sand cover >30% can significantly impact marine communities

Relative to other sites, Mangati Reef had a high cover of sand (25.4%). This site has a history of being susceptible to sand accumulation (Refer to Figure 4 and Photograph 3 bottom right hand insert). Previous studies on intertidal reefs in Taranaki have demonstrated that at 30% cover, sand begins to negatively influence hard shore communities.

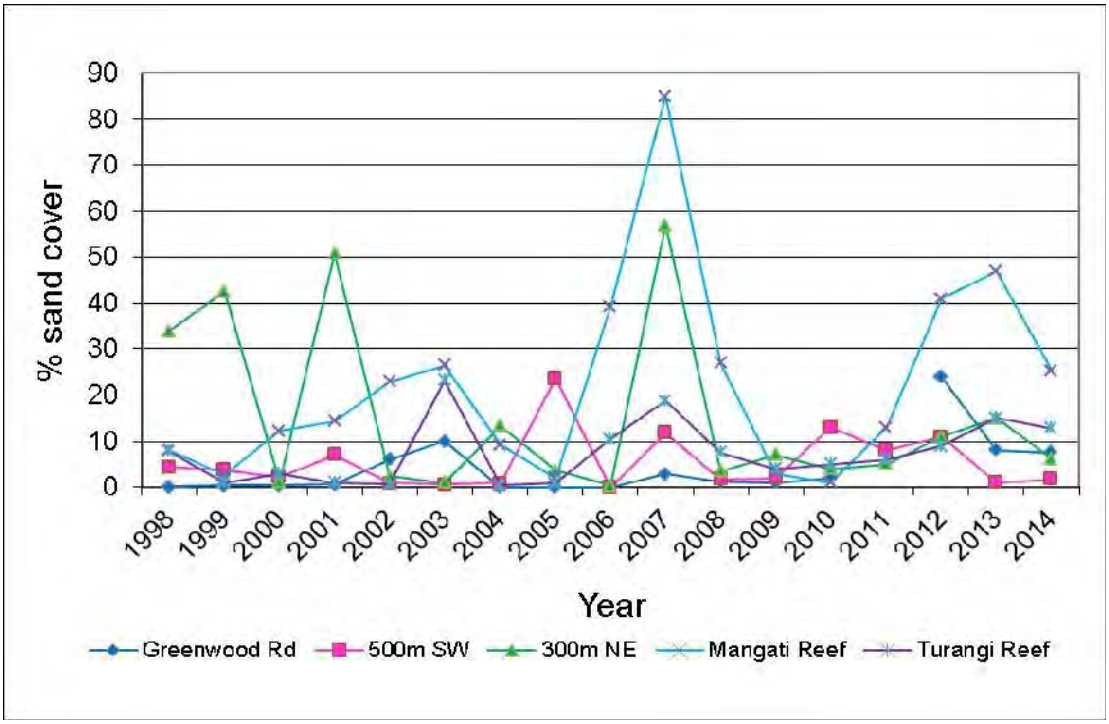


Figure 4 Percentage sand cover at the five reef sites from 1998 to 2014

3.4 Trends over time

Comparisons of the mean number of species per quadrat and the mean Shannon-Weiner index at the five sites surveyed from 1993 to 2014 are shown in Figures 5 and 6, respectively. Species abundance and diversity showed high interannual variability, with no obvious long term trends in diversity evident at the three impact sites over time (Figures 5 and 6). For the 2014 season, both the control sites Turangi Reef and Greenwood Road had a decrease in species abundance and an increased the Shannon-Weiner index since 2013. Mangati Reef had a slight increase in species abundance while both 300m NE and 500m SW had a slight decease. At all sites except 500m SW the Shannon-Weiner index had increased slightly since the previous year.

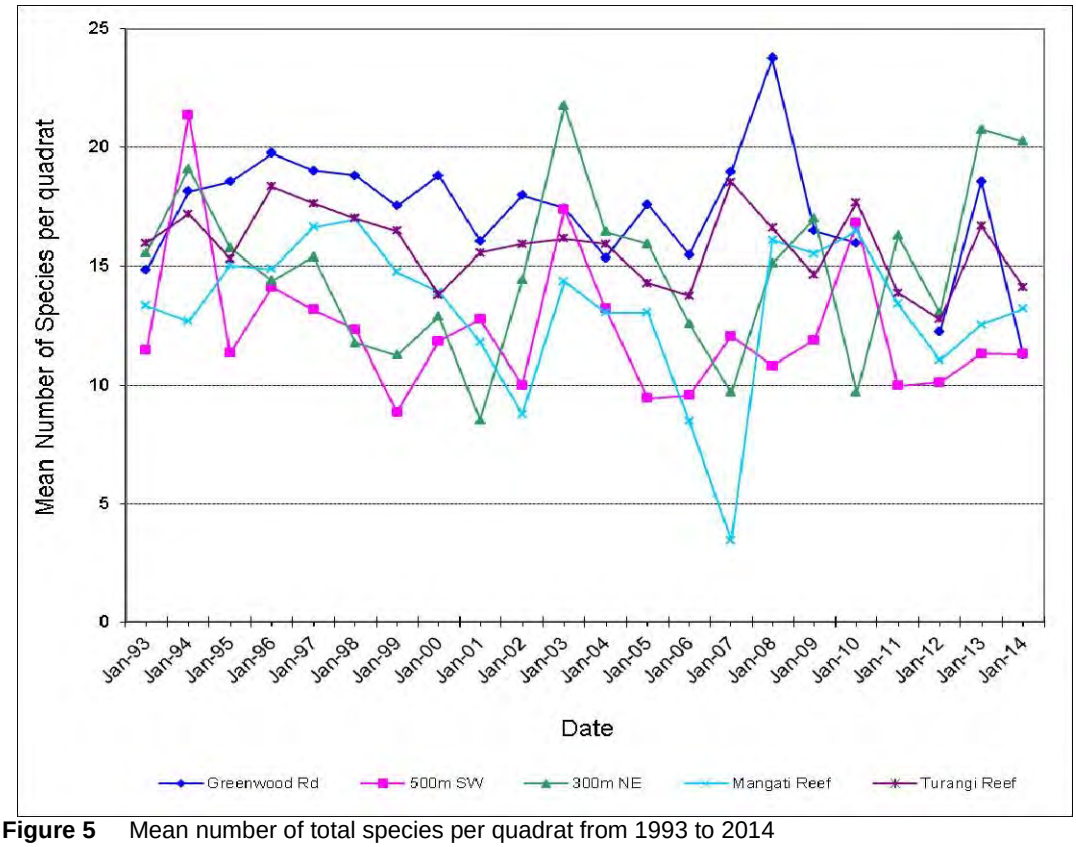


Figure 5 Mean number of total species per quadrat from 1993 to 2014

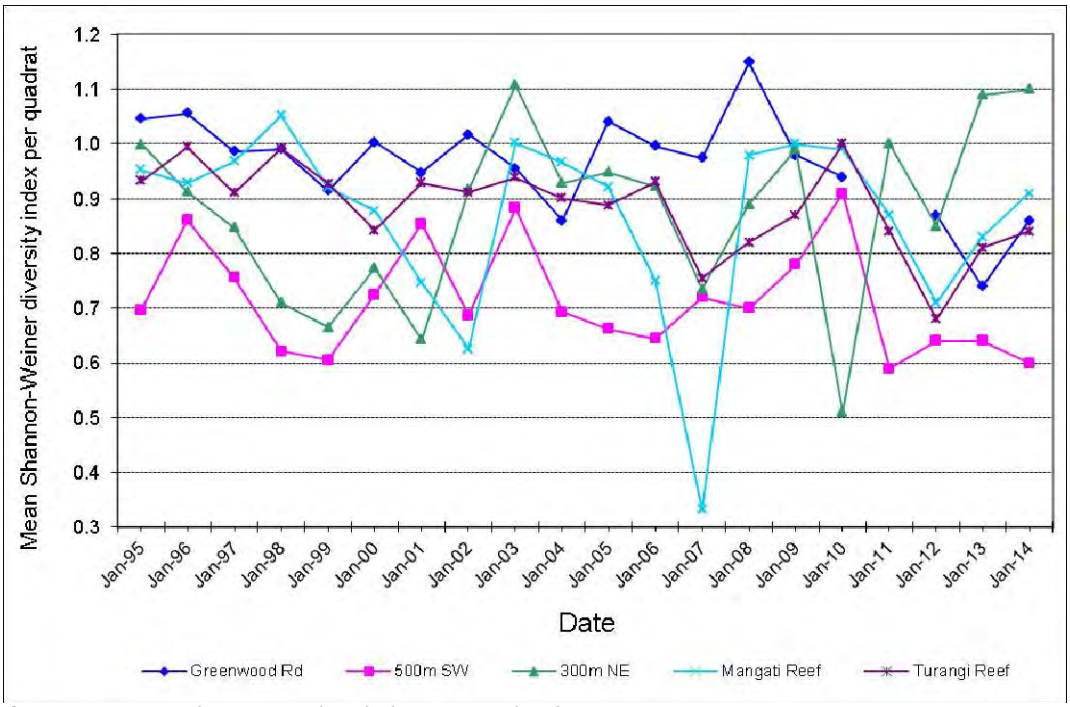


Figure 6 Mean Shannon-Weiner index per quadrat from 1995 to 2014

4. Discussion

An intertidal survey was conducted at five sites between 1 January and 3 February 2014 as part of the 2013-2014 monitoring programme. Potential impact of the NPWWTP outfall discharge on the intertidal community was assessed through comparison of results from potential impact sites and control sites within the same year in addition to the analysis of trends over time. The data analysed in this report covers over a twenty year record of species diversity from January 1993 to January 2014.

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2014 survey results. Both species number and Shannon-Weiner index were greater at the potential impact site closest to the outfall (300m NE) relative to the two control sites (Figure 2 and 3). In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative to the control sites (Figures 5 and 6).

Spatial and interannual variability in the intertidal communities surveyed could be largely attributed to natural changes in physical characteristics of the habitats. In particular sand cover, substrate type and substrate mobility were major drivers of diversity. For example, at the site 500m SW of the outfall, the reef was predominantly composed of relatively uniform, small, rounded rocks/cobbles (Photograph 1, Figure 7). It has been previously noted that the movement of these rocks/cobbles is influenced by the close proximity of the Waiwhakaiho River, with the formation of cobble banks which regularly shift and vary in height. The mobile nature of the substrate prevented many species, in particular macroalgae, from establishing (Table 1). The porcelain crab *Petrolisthes elongates* was one of the few animals able to thrive at this site (Figure 8). This highly mobile, small species of crab is well adapted to such harsh, transient environments, being able to scuttle and filter feed between the rounded rocks (Morton, 2004).

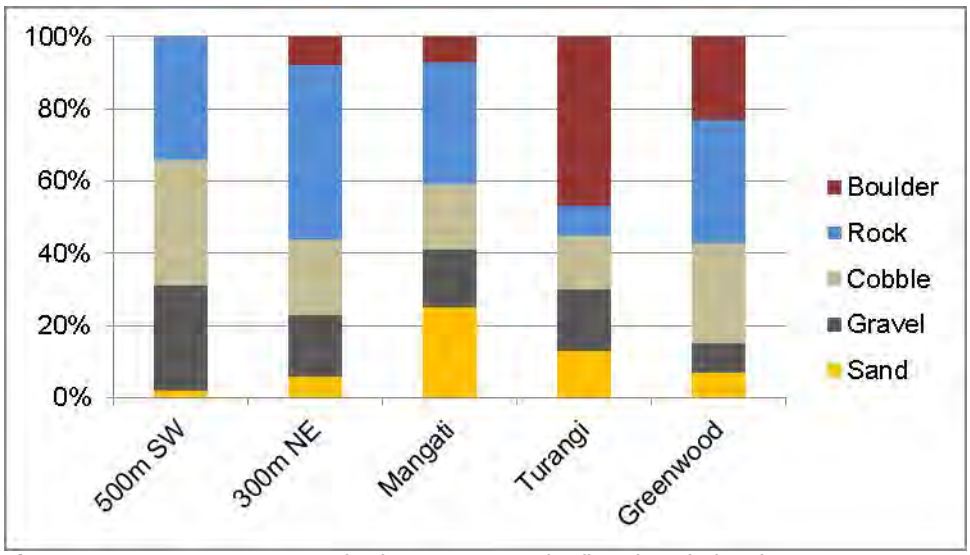


Figure 7 Percentage cover of substrate type at the five sites during the January 2014 survey

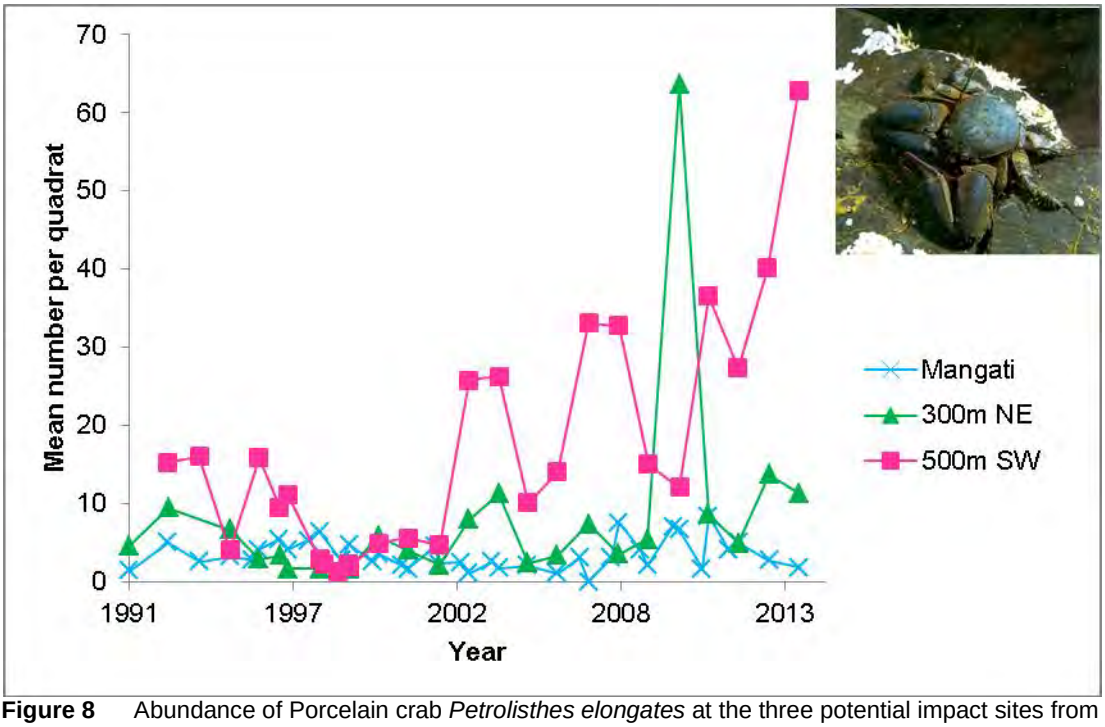


Figure 8 Abundance of Porcelain crab *Petrolisthes elongates* at the three potential impact sites from 1991 to 2014

Relative to the other potential impact sites, the Mangati Reef site was more prone to sand accumulation (Figure 4). Years of high sand accumulation at this site tend to be associated with low diversity (for example 2006, 2007, 2012 and 2013). This is not surprising given that sand deposition has been shown to have a profound effect on under-rock colonisation on intertidal hard-shore environments in Taranaki (Walsby, 1982). Sand cover can result in reduced diversity due to sand scour of the biota, reduced water movement between rocks and temporary sand burial. A combination of these three effects is likely to have resulted in the relatively low species number and Shannon-Weiner index recorded at the Mangati Reef during the 2014 survey.

Although high sand cover is likely to have caused an overall reduction in intertidal diversity at the Mangati Reef in 2014, the more sheltered conditions at this site, relative to the other two impact sites, favoured the growth of coralline turf (Figure 9). The relatively high percentage cover of coralline turf provided an ideal habitat for juvenile cat's-eyes *Turbo smaragdus* (Figure 10), which are known to feed on the small epiphytes present on the calcified surface of the coralline algae (Morton, 2004). Juvenile cat's-eyes are known to live for up to 18 months in the coralline turf, prior to moving further down-shore.

The site 300m NE of the outfall provided an intermediate substrate cover relative to the two other potential impact sites (Figure 7), offering more shelter/stability than 500m SW and less sand accumulation than Mangati Reef. This, combined with the range of habitats/ecological niches provided by the substrate, resulted in a high number of species and Shannon Weiner Index at this site for the January/February 2014 survey.

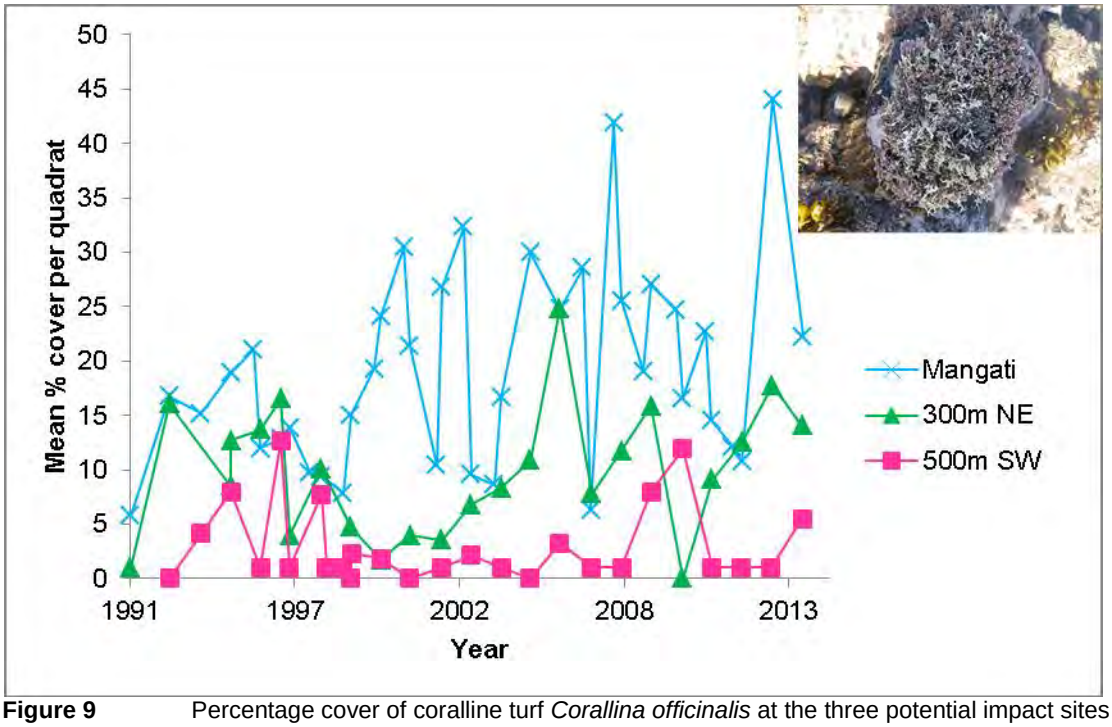


Figure 9 Percentage cover of coralline turf *Corallina officinalis* at the three potential impact sites from 1991 to 2014

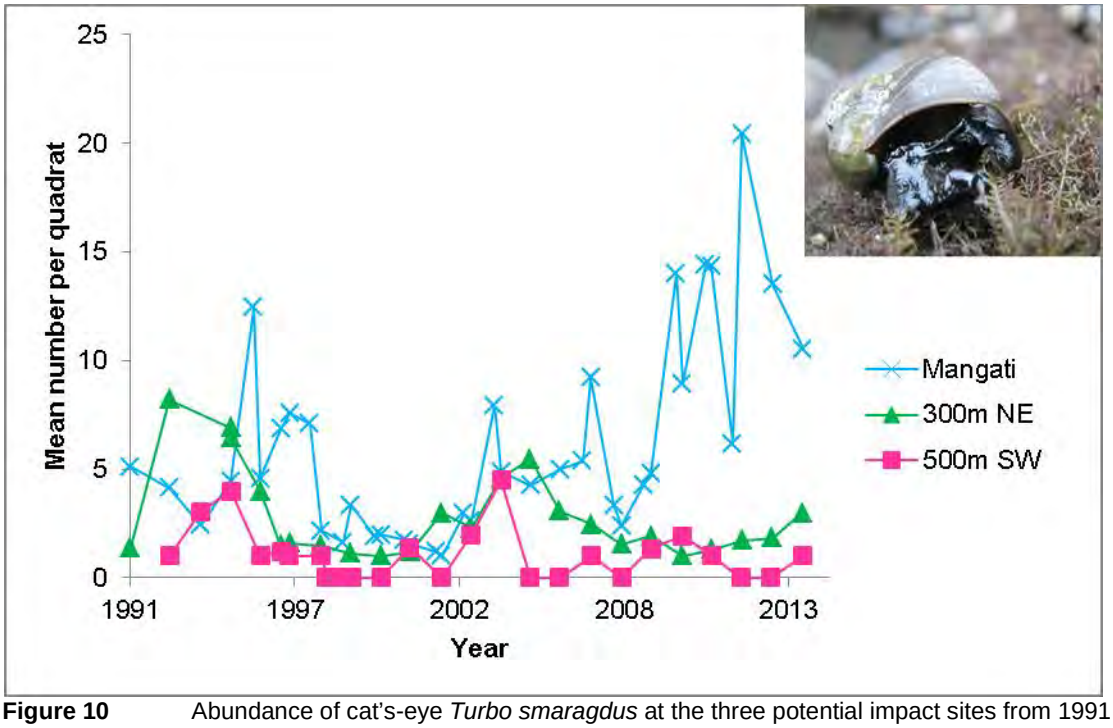


Figure 10 Abundance of cat's-eye *Turbo smaragdus* at the three potential impact sites from 1991 to 2014

The control sites at Turangi Reef and Greenwood Road have typically had a high level of species abundance and diversity. Variation at these sites (lower abundance and diversity) has previously been attributed to sand inundation. Species number and diversity have tended to recover quickly once the sand has been removed. Results from the January/February 2014 survey at Greenwood Road reflect that the site was recovering from heavy sand inundation during spring 2013 (see Waitara Marine Outfall intertidal survey results).

Finally, it must be noted that the high energy receiving environment combined with the effects of suspended sediments from rivers and streams prevent the development of stable biological communities along the Taranaki coastline (Clark *et al*., 2012). Such conditions could potentially mask any subtle ecological effects from the NPWWTP outfall discharge. However, in spite of these limitations, intertidal surveys are useful in detecting more noticeable effects from wastewater, as clearly identified in the TRC Fonterra Whareroa Annual Report 2012-2013 (13-24).

5. Conclusions

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, surveys were conducted in January/February 2014 at five sites. These surveys included three potential impact sites and two control sites, north and south of the outfall. It is expected that significant adverse effects of the NPWWTP outfall discharge on the intertidal communities would have been evident as a decline in species diversity at the potential impact sites relative to the control sites.

Both species number and Shannon-Weiner index were greater at the potential impact site closest to the outfall relative to the two control sites. In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative to the control sites. The results indicate that the outfall discharge was not having detectable adverse effects on the intertidal reef communities of North Taranaki. Natural environmental factors, in particular sand cover, substrate type and substrate mobility, appeared to be the dominant drivers of species diversity at the sites surveyed.

Emily Roberts
Scientific Officer – Marine Ecologist

Abbie Bates
Technical Officer

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Taranaki Regional Council, 2013: Fonterra Whareroa Compliance Monitoring Programme Annual Report 2012-2013. Technical Report 2013-24.

Walsby, J.R. (1982) Marine ecological baseline programme NZSFC Synthetic Petrol Plant Motunui.

Appendix VI
Shoreline bacteriological water quality report
2012-2013

Memorandum

To: Science Manager – Hydrology/Biology, Regan Phipps
From: Scientific Officers, Kate Giles and Emily Roberts
Document: 1200628
Date: 4 May 2015

Bathing beach water quality survey: New Plymouth Wastewater Treatment Plant marine discharge monitoring – November 2012 to March 2013

1. Introduction

Faecal indicator bacteria (FIB) have been monitored every second spring/summer since 1996-1997 at five shoreline sites around the New Plymouth Waste Water Treatment Plant (NPWWTP) outfall. This report presents the results of the ninth survey to monitor shoreline FIB in relation to this discharge.

2. Microbiological water quality guidelines (2003)

In 2003, the Ministry for the Environment (MfE) developed the *Guidelines for Recreational Water Quality* to assess the safety of water for contact recreation. The coastal guidelines focus on enterococci as this indicator provides the closest correlation with health effects in New Zealand coastal waters. 'Alert' and 'Action' guideline levels are summarized in Table 1 and are based on keeping illness risk associated with recreational use to less than approximately 2%. For freshwater, the MfE 2003 guidelines use *E. coli* as the preferred indicator (Table 1).

Table 1 Recreational bathing guidelines (MfE 2003)

	Indicator	Mode		
		Surveillance	Alert	Action
Marine	Enterococci (cfu/100ml)	No single sample >140	Single sample >140	Two consecutive single samples >280
Freshwater	*E. coli* (cfu/100ml)	No single sample >260	Single sample >260	Single sample >550

3. Monitoring methodology

3.1 Sample collection

Sample collection, field measurements and analyses were undertaken according to documented Taranaki Regional Council procedures. Sampling was undertaken under dry weather flow conditions (therefore not within three days of a fresh). Bathing water samples were taken between 0900 and 1800 hours (NZDT). Samples were collected immediately beneath the water surface and at a minimum of calf depth. Thirteen samples were collected from each site during the season.

3.2 Sample analysis

Samples were analysed for enterococci, *E. coli* and faecal coliform bacteria and conductivity. Both *E. coli* and faecal coliform numbers were assessed using mTec agar method #9213-d of the Standard Methods for the Examination of Waters and Wastewaters (APHA, 2005). Enterococci numbers were assessed using the EPA modified method #1600 on mEI agar.

3.3 Site locations

The locations of the five sites sampled in the 2012-2013 monitoring programme are shown in Figure 1 and Table 2.

Figure 1 Location of monitoring sites in relation to the New Plymouth Wastewater Treatment Plant

Table 2 Location of sampling sites

Site Name	Location	GPS	Site code
Mangati	Approximately 1.5km NE of NPWWTP outfall	1697609E- 5679749N	SEA902008
300m NE	300m NE NPWWTP outfall	1696721E-5679002N	SEA902010
500m SW	500m SW NPWWTP outfall	1696132E-5678755N	SEA902015
Fitzroy Beach	Opposite surf lifesaving club	1694948E-5677598N	SEA902025
Waiwhakaiho River	Downstream of Lake Rotomanu	1696587E-5678336N	WKH000950

4. Results

4.1 Mangati

4.1.1 Monitoring programme

The Mangati site (Photograph 1) is accessed through a farm via the Mangati walking track. This site does not have a high recreational bathing use.

The data for this site are presented in Table 3 and Figure 2, with a statistical summary provided in Table 4.

Table 3 Bacteriological results for the Mangati site

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E. coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
1-Nov-12	13:35	4410	<1	<1	<1	16.7
28-Nov-12	08:05	4580	8	12	8	15.1
13-Dec-12	08:05	4720	<1	3	<1	17.6
28-Jan-13	12:50	4500	13	9	13	21.6
31-Jan-13	13:15	4740	<1	1	<1	22.0
11-Feb-13	08:30	4720	<1	1	<1	19.6
14-Feb-13	12:40	4700	9	5	11	19.5
18-Feb-13	15:25	4740	1	3	1	20.3
25-Feb-13	11:30	4750	16	13	16	20.2
28-Feb-13	11:45	4760	29	24	29	19.9
4-Mar-13	14:50	4660	11	15	11	20.2
12-Mar-13	12:35	4790	1	1	1	18.9
27-Mar-13	08:05	4740	33	36	35	19.5

Table 4 Statistical summary for the Mangati site

Parameter	Conductivity @ 20°C (mS/m)	*E. coli* (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	Temperature (°C)
Number of samples	13	13	13	13	13
Minimum	4410	<1	<1	<1	15.1
Maximum	4790	33	36	35	22.0
Median	4720	8	5	8	19.6

No high individual enterococci counts were recorded throughout the season (all counts •36 cfu / 100ml) and the median enterococci count was low (Table 4).

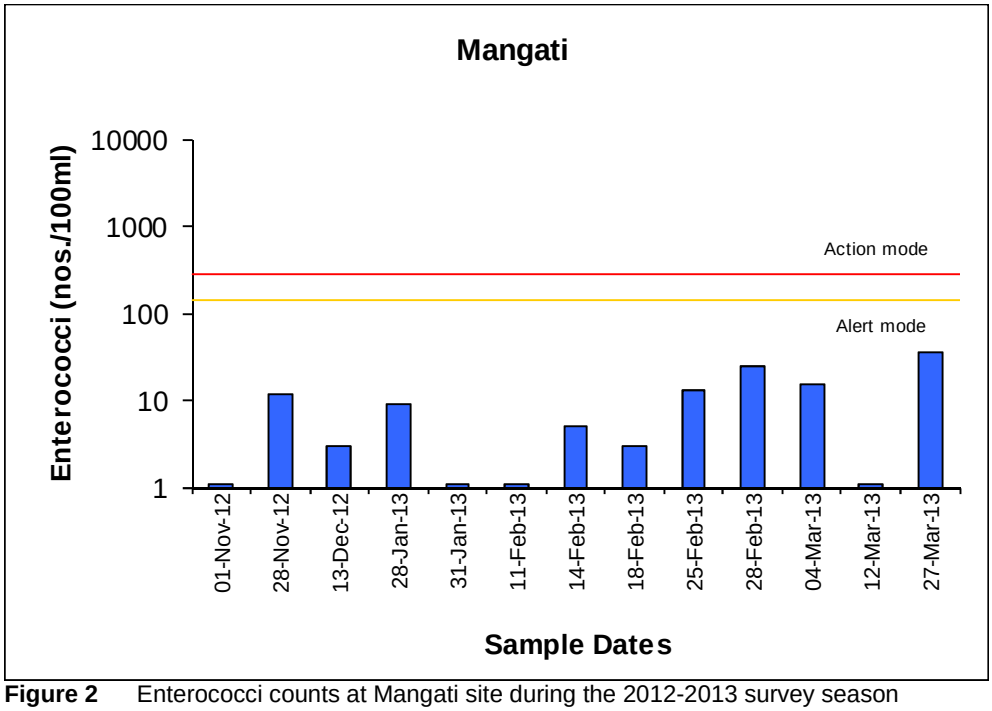


Figure 2 Enterococci counts at Mangati site during the 2012-2013 survey season

4.1.2 Compliance with guidelines

Compliance with the 2003 guidelines for marine contact usage is summarised in Table 5. All samples were below guideline 'Alert' levels.

Table 5 Bacterial guidelines performance at Mangati Beach

Parameter	Number of exceedances of enterococci guidelines [% of 13 samples]	
	ALERT Single sample >140/100ml	ACTION Two consecutive samples >280/100 ml
Enterococci	0 [0]	0 [0]

4.1.3 Comparison with previous summer surveys

Previous summer data for the Mangati site are summarised in Table 6 and Figure 3.

Table 6 Summary enterococci data (cfu/100ml) for summer surveys at Mangati site

Summer	96-97	98-99	00-01	02-03	04-05	06-07	08-09	10-11	12-13
Minimum	1	<1	<1	<1	<1	<1	<1	<1	<1
Maximum	110	16	40	7	21	20	120	19	36
Median	4	3	3	1	1	1	1	<1	5

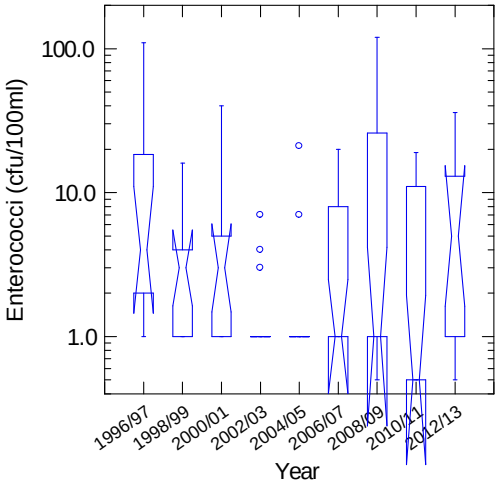


Figure 3 Box and whisker plots for all summer SEM surveys at Mangati site

Water quality was generally good during the 2012-2013 summer period; maximum, mean and minimum were all low, similar to previous monitoring periods.

Photograph 1 The Mangati site, looking SW towards the outfall

4.2 East of the outfall

4.2.1 Monitoring programme

The 300m NE site is located in line with the prevailing north-easterly current and is potentially a high impact site with regards to discharges from the outfall. This site is not a recreational bathing site due to poor public access.

Data from the site are presented in Table 7 and Figure 4, with a statistical summary provided in Table 8.

Table 7 Bacteriological results for the 300m NE site

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E. coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
1-Nov-12	12:30	4490	3	7	3	16.4
28-Nov-12	11:30	4620	31	230	32	17.5
13-Dec-12	11:15	4650	58	40	60	19.0
28-Jan-13	11:35	4740	10	12	14	22.2
31-Jan-13	09:17	4390	8	25	12	22.7
11-Feb-13	08:25	4720	7	28	7	19.6
14-Feb-13	10:30	4640	22	68	26	19.7
18-Feb-13	13:25	4700	3	1	3	24.1
25-Feb-13	10:50	4750	20	27	20	18.3
28-Feb-13	12:40	4740	44	41	47	21.2
4-Mar-13	11:30	4540	12	16	12	20.0
21-Mar-13	08:45	4750	4	7	4	17.6
27-Mar-13	11:00	4760	35	150	36	20.9

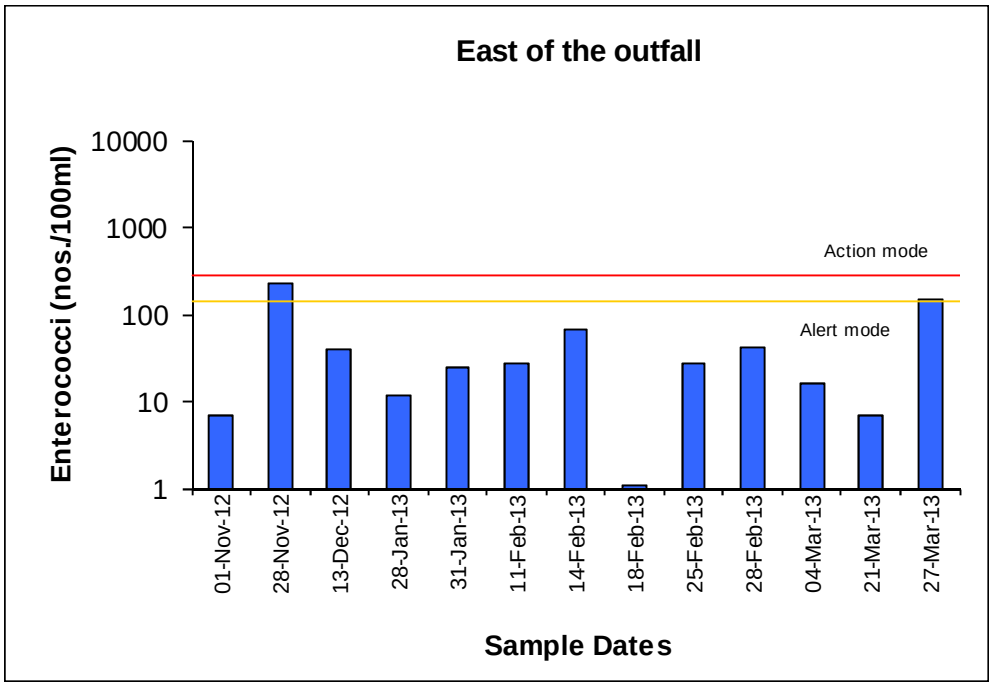


Figure 4 Enterococi counts for 300m NE during the 2012-2013 survey season

Table 8 Statistical summary for 300m NE site

Parameter	Conductivity @ 20°C (mS/m)	*E. coli* (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	Temperature (°C)
Number of samples	13	13	13	13	13
Minimum	4390	3	1	3	16.4
Maximum	4760	58	230	60	24.1
Median	4700	12	27	14	19.7

Concentrations of all three indicator bacteria were occasionally high over the season, exceeding the alert level on two occasions. Median counts of all three indicators were moderate - between 12 and 27 cfu/100 ml. Elevated enterococci counts could not be explained by significant rainfall prior to the sampling dates, nor was there elevated flow in the Waiwhakaiho River (Figure 12).

4.2.2 Compliance with guidelines

Compliance with the 2003 guidelines for marine contact usage is summarised in Table 9. Two of the samples collected at the 300m NE site exceeded 'Alert' levels.

Table 9 Bacterial guidelines performance at the 300m NE site

Parameter	Number of exceedances of enterococci guidelines [% of 13 samples]	
	ALERT Single sample >140/100ml	ACTION Two consecutive samples >280/100 ml
Enterococci	2 [15]	0 [0]

4.2.3 Comparison with previous summer surveys

Summary statistics for enterococci data collected at the 300m NE site are presented in Table 10 and Figure 5.

Table 10 Summary enterococci data (cfu/100 ml) for summer surveys at the 300m NE site

Summer	96-97	98-99	00-01	02-03	04-05	06-07	08-09	10-11	12-13
Minimum	1	<1	<1	<1	<1	<1	<1	<1	1
Maximum	82	110	240	160	60	180	250	250	230
Median	9	3	3	6	8	20	38	9	27

The median value of 27 cfu/100 ml was within the range of previous results, although one of the highest recorded. The maximum of 230 cfu/100 ml was slightly lower than found in the previous two surveys

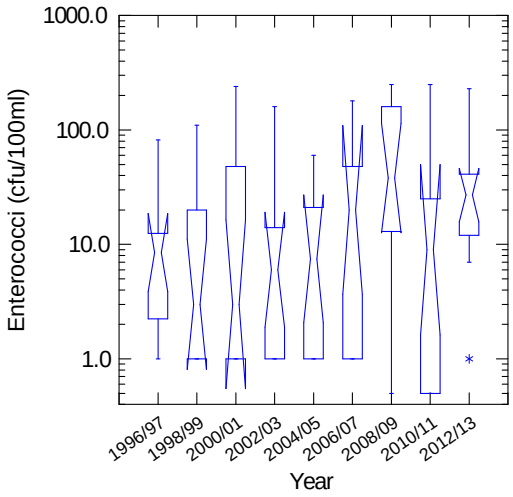


Figure 5 Box & whisker plots of enterococci for all surveys at 300m NE

4.3 West of the outfall

4.3.1 Monitoring programme

The 500m SW site (Photograph 2) is not used for recreational bathing, as there is public access by foot/bike only. However, surfing at Waiwhakaiho Reef is very popular year round, with surfers paddling across the Waiwhakaiho River to access the reef break situated a few hundred meters from the site. The close proximity of the site to the Waiwhakaiho River means bacterial contamination from freshwater may occur, especially after floods.

Data from the site are presented in Table 11 and Figure 6, with a statistical summary provided in Table 12.

Table 11 Bacteriological results for 500m SW

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-12	12:20	4580	40	140	40	16.5
28-Nov-12	11:20	4600	46	300	51	18.1
13-Dec-12	11:00	4650	120	960	120	19.0
28-Jan-13	11:25	4720	140	800	140	22.1
31-Jan-13	09:26	4620	300	280	300	23.7
11-Feb-13	08:34	4700	260	340	270	20.2
14-Feb-13	10:45	4660	36	170	36	21.1
18-Feb-13	13:35	4710	660	1700	760	21.8
25-Feb-13	10:40	4620	590	3500	610	19.6
28-Feb-13	12:25	4750	1000	5600	1100	21.0
04-Mar-13	11:20	4600	23	80	23	19.5
19-Mar-13	14:15	4700	80	170	80	*
27-Mar-13	11:10	4790	210	770	210	21.1

Photograph 2 The 500m SW site

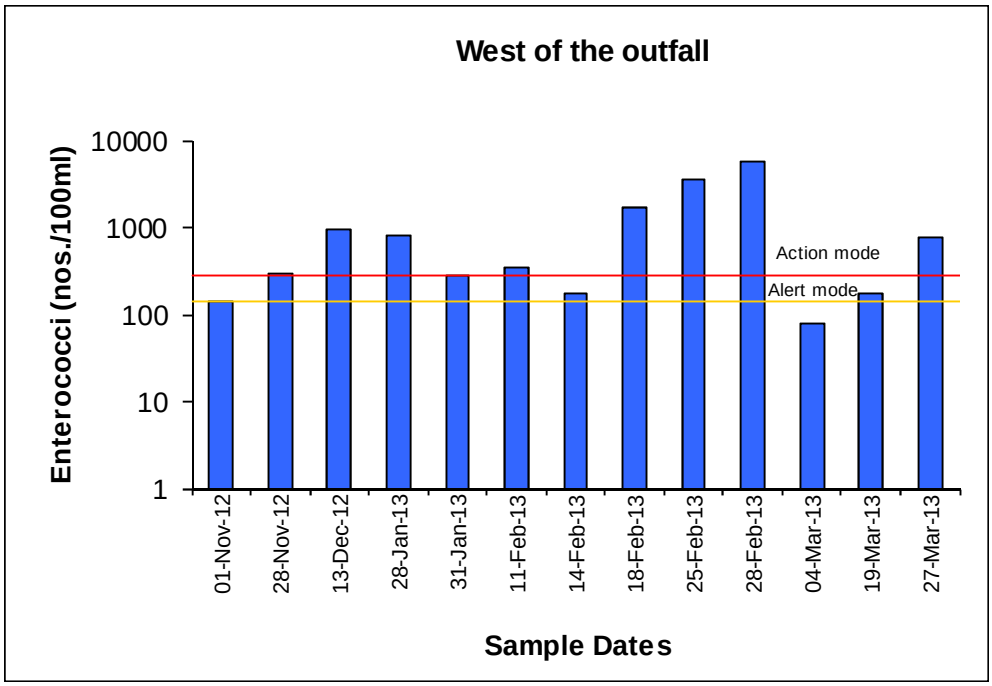


Figure 6 Enterococci counts 500m SW during the 2012-2013 survey season

Table 12 Statistical summary for 500m SW

Parameter	Conductivity @ 20°C (mS/m)	*E. coli* (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	Temperature (°C)
Number of samples	13	13	13	13	12
Minimum	4580	23	80	23	16.5
Maximum	4790	1000	5600	1100	23.7
Median	4660	140	340	140	20.6

Faecal indicator bacteria medians and maxima were high, indicating poor water quality at this site. Faecal indicator bacteria counts from the 300m NE site were lower than at the 500m SW site. This would not be expected if discharge from the outfall was the main source of faecal contamination, taking into consideration the predominant north easterly flow.

High bacterial counts in the Waiwhakaiho River can influence the 500m SW site. This is partially supported by the data given the highest enterococci counts at the 500m SW site coincided with those from the Waiwhakaiho River (Tables 11 and 19). However, conductivity data indicates that only minor freshwater influence occurred at the 500m SW site during the 2012-2013 summer season (Table 11). Gulls have been observed in high numbers on the cobbles and sand banks of the Waiwhakaiho Reef (Photograph 3), at the Waiwhakaiho River mouth and immediately upstream of the Waiwhakaiho River site (Photograph 4). Results from faecal source tracking indicate that gulls are likely to be the primary source of faecal contamination at these sites.

Photograph 3 Gulls at site 500m SW (west of the outfall)

4.3.2 Compliance with guidelines

Compliance with the 2003 guidelines for marine contact usage is summarised in Table 13. In terms of contact recreational usage guidelines, bacteriological water quality at this site was very poor with 11 of the 13 samples above guideline levels. Five (38%) of the samples were within the 'Alert' mode. Six samples (46%) were classified within the 'Action' mode, with enterococci counts exceeding 280 cfu/ml on two consecutive occasions.

Table 13 Bacterial guidelines performance at the 500m SW site

Parameter	Number of exceedances of enterococci guidelines [% of 13 samples]	
	ALERT Single sample >140/100ml	ACTION Two consecutive samples >280/100 ml
Enterococci	5 [38]	6 [46]

4.3.3 Comparison with previous summers' surveys

Summary statistics for enterococci data collected at 500m SW are presented in Table 14 and Figure 7.

Table 14 Summary enterococci data (cfu/100ml) for summer surveys at the 500m SW site

Summer	96-97	98-99	00-01	02-03	04-05	06-07	08-09	10-11	12-13
Minimum	1	<1	4	4	3	84	160	6	80
Maximum	2400	140	1400	700	10000	4300	4500	3000	5600
Median	27	11	120	91	275	400	100	320	340

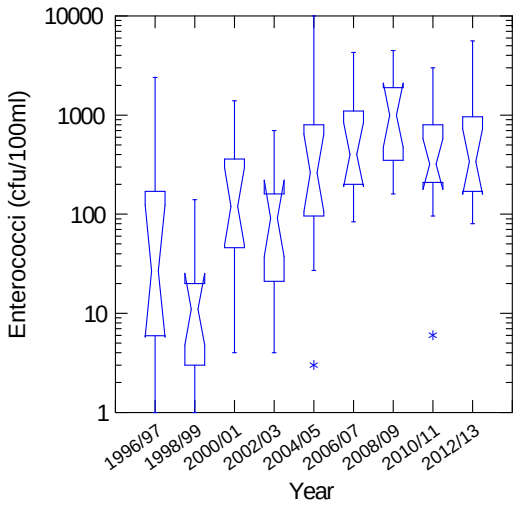


Figure 7 Box & whisker plots of enterococci for all summer surveys 500m SW

Median and maximum enterococci counts were some of the highest recorded to date. Figure 7 shows a trend of steadily decreasing water quality over time.

4.4 Fitzroy Beach

4.4.1 Monitoring programme

Fitzroy Beach is situated in New Plymouth and is one of the most popular bathing beaches in Taranaki. It is also a popular year-round surfing beach, especially for young surfers, due to its central location and generally smaller waves. The mouth of the Waiwhakaiho River enters the sea at the eastern end of the beach, approximately 800 m from the sample site, which on rare occasions can contribute significant amounts of freshwater during floods.

The data for this site are presented in Table 15 and Figure 8, with a statistical summary provided in Table 16.

Table 15 Bacteriological results for Fitzroy Beach

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-12	11:30	4640	<1	1	<1	15.6
28-Nov-12	10:40	4540	15	9	16	16.3
13-Dec-12	10:10	4690	7	3	7	19.0
28-Jan-13	10:22	4760	3	3	3	21.2
31-Jan-13	09:56	4700	1	36	1	21.8
11-Feb-13	08:57	4730	<1	3	<1	19.9
14-Feb-13	11:10	4630	8	8	8	19.3
18-Feb-13	14:30	4650	<1	<1	<1	20.1
25-Feb-13	10:10	4750	<1	4	<1	18.2
28-Feb-13	11:40	4750	<1	4	<1	20.1
04-Mar-13	14:25	4730	3	3	3	20.1
21-Mar-13	09:35	4760	<1	<1	<1	19.3
27-Mar-13	10:05	4790	<1	9	<1	20.4

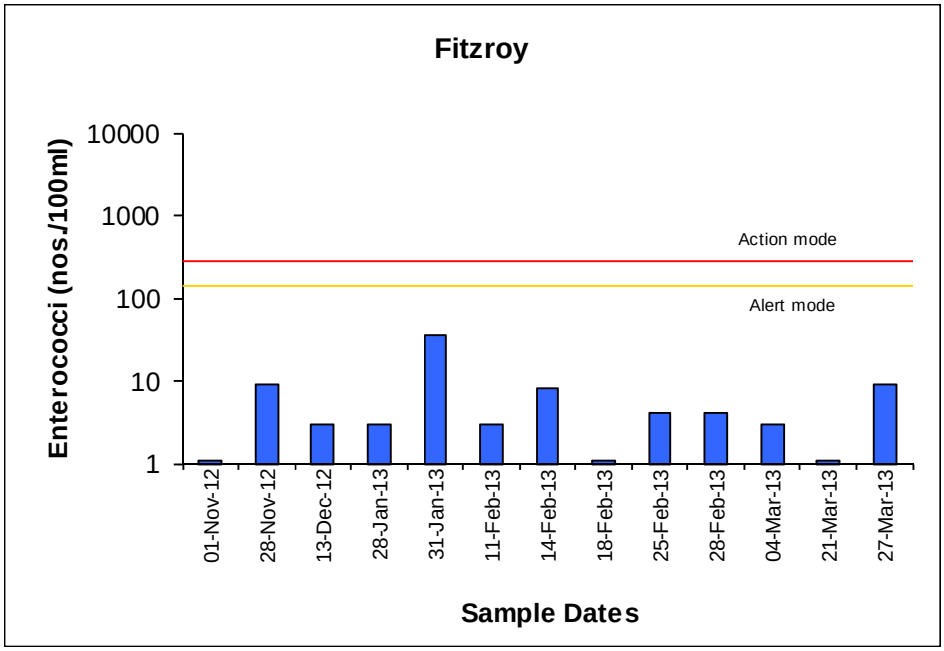


Figure 8 Enterococci counts at Fitzroy Beach during the 2012-2013 survey season

Table 16 Statistical summary for Fitzroy Beach

Parameter	Conductivity @ 20°C (mS/m)	*E. coli* (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	Temperature (°C)
Number of samples	13	13	13	13	13
Minimum	4540	<1	<1	<1	15.6
Maximum	4790	15	36	16	21.8
Median	4730	<1	3	<1	19.9

Bacteriological water quality was good throughout the season, with low median counts for all faecal indicator bacteria.

4.4.2 Compliance with guidelines

Compliance with the 2003 guidelines for marine contact usage is summarised in Table 17. Enterococci counts in all samples were below both Alert and Action guideline levels.

Table 17 Bacterial guidelines performance at Fitzroy Beach

Parameter	Number of exceedances of enterococci guidelines [% of 13 samples]	
	ALERT Single sample >140/100ml	ACTION Two consecutive samples >280/100 ml
Enterococci	0 [0]	0 [0]

4.4.3 Comparison with previous summer surveys

Summary statistics for enterococci data collected at Fitzroy Beach during previous summer bathing seasons are presented in Table 18 and Figure 9. The median enterococci count (3 cfu / 100ml) obtained for the 2012-2013 summer season at Fitzroy Beach was one of the lowest to date

Table 18 Summary enterococci data (cfu/100 ml) for summer surveys at Fitzroy Beach

Summer	96-97	98-99	00-01	02-03	04-05	06-07	08-09	10-11	12-13
Minimum	1	<1	<1	<1	<1	<1	<1	1	<1
Maximum	280	79	98	580	52	33	110	43	36
Median	15	7	7	5	4	3	10	4	3

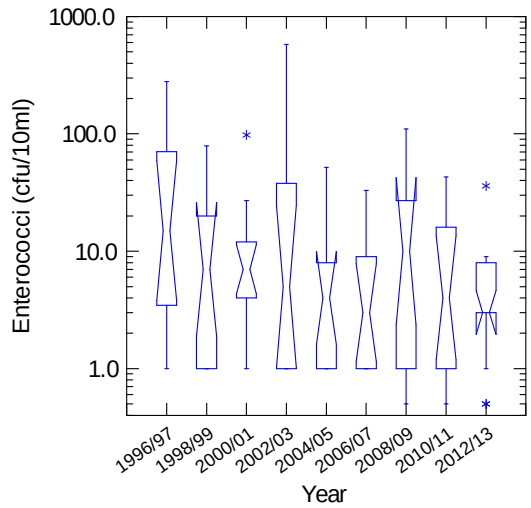


Figure 9 Box and whisker plots of enterococi at Fitzroy Beach

4.5 Waiwhakaiho River

4.5.1 Monitoring programme

The main purpose for including this lower Waiwhakaiho River site is to provide an indication of bacterial contamination from the river entering the sea and influencing the coastal sites.

The data for this site are presented in Table 19 and Figure 10, with a statistical summary provided in Table 21.

Table 19 Bacteriological results for the Waiwhakaiho River site

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-12	12:00	10.7	230	330	240	16.4
28-Nov-12	11:00	13	1100	880	1200	19.8
13-Dec-12	10:40	11.7	1900	1600	1900	19.9
28-Jan-13	11:00	14	800	800	1000	23.2
31-Jan-13	08:50	14.7	1100	600	1500	22.0
11-Feb-13	07:55	13.3	670	640	820	18.7
14-Feb-13	10:05	13.4	600	870	640	20.4
18-Feb-13	14:00	13.6	5000	8700	5500	24.3
25-Feb-13	11:10	15.2	930	5400	1000	20.2
28-Feb-13	12:05	17.9	4200	4000	4900	22.3
04-Mar-13	10:55	15.3	1800	2200	2200	19.7
21-Mar-13	08:15	11.6	620	830	680	15.1
27-Mar-13	11:25	14.3	1400	2500	1600	19.0

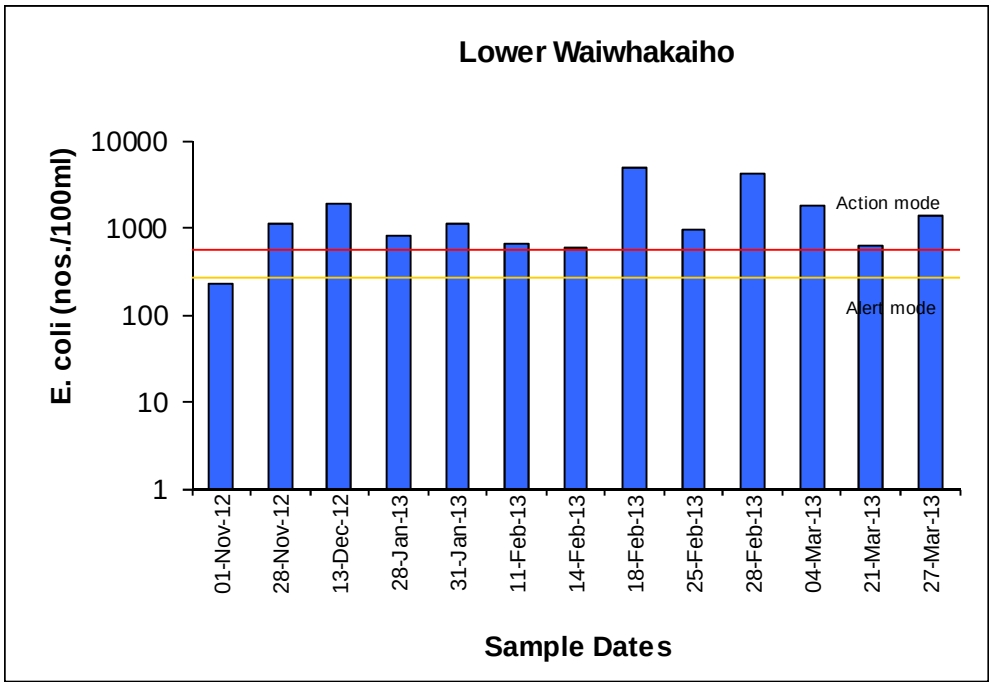


Figure 10 *E. coli* counts in the Waiwhakaiho River during the 2012-2013 survey season

Table 20 Statistical results summary for the Waiwhakaiho River site

Parameter	Conductivity @ 20°C (mS/m)	*E. coli* (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	Temperature (°C)
Number of samples	13	13	13	13	13
Minimum	10.7	230	330	240	15.1
Maximum	17.9	5000	8700	5500	24.3
Median	13.6	1100	880	1200	19.9

Minima, maxima and medians for all faecal indicator bacteria were very high, indicating poor water quality at this site. Faecal source tracking results indicate that gulls are the main source of contamination (Photograph 4). Faecal contamination at this site can affect nearby coastal sites surrounding the river mouth- in particular the 500m SW site.

Photograph 4 Gulls upstream of the Waiwhakaiho River site

4.5.2 Compliance with guidelines

Compliance with the 2003 guidelines for freshwater contact usage is summarised in Table 21. *E. coli* is used as the FIB in relation to recreational guidelines in freshwater.

Table 21 Bacterial guidelines performance at Waiwhakaiho River

Parameter	Number of exceedances of *E. coli* guidelines [% of 13 samples]	
	ALERT Single sample >260/100ml	ACTION Single samples >550/100 ml
E. coli	0 [0]	12 [92]

Samples exceeded 'Action' levels on 12 out of 13 sampling occasions (92%). This indicates very poor water quality in the Waiwhakaiho River at this site.

4.5.3 Comparison with previous summer surveys

Previous summer data for the Waiwhakaiho River are presented in Table 22 and Figure 11.

Table 22 Summary *E. coli* data (cfu/100 ml) for summer surveys at the Waiwhakiaho RIver site

Summer	96-97	98-99	00-01	02-03	04-05	06-07	08-09	10-11	12-13
Minimum	9	52	26	54	46	71	160	220	230
Maximum	740	510	870	470	1000	1600	2600	3400	5000
Median	72	120	110	210	270	320	490	800	1100

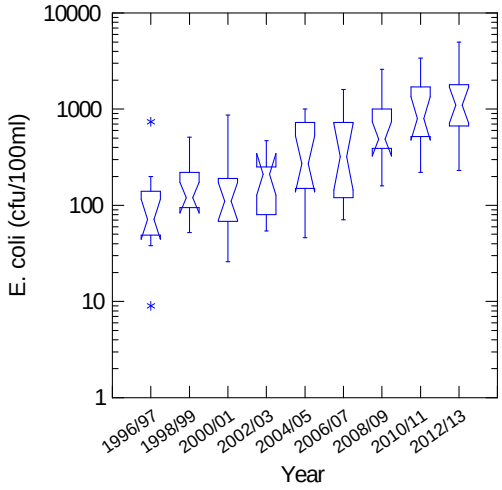


Figure 11 Box and whisker plots of *E. coli* in the Waiwhaiho River

All *E. coli* parameters were the highest recorded to date at this site (Table 22). This, along with the box plot in Figure 11, indicate declining water quality in the lower reaches of the Waiwhakaiho River.

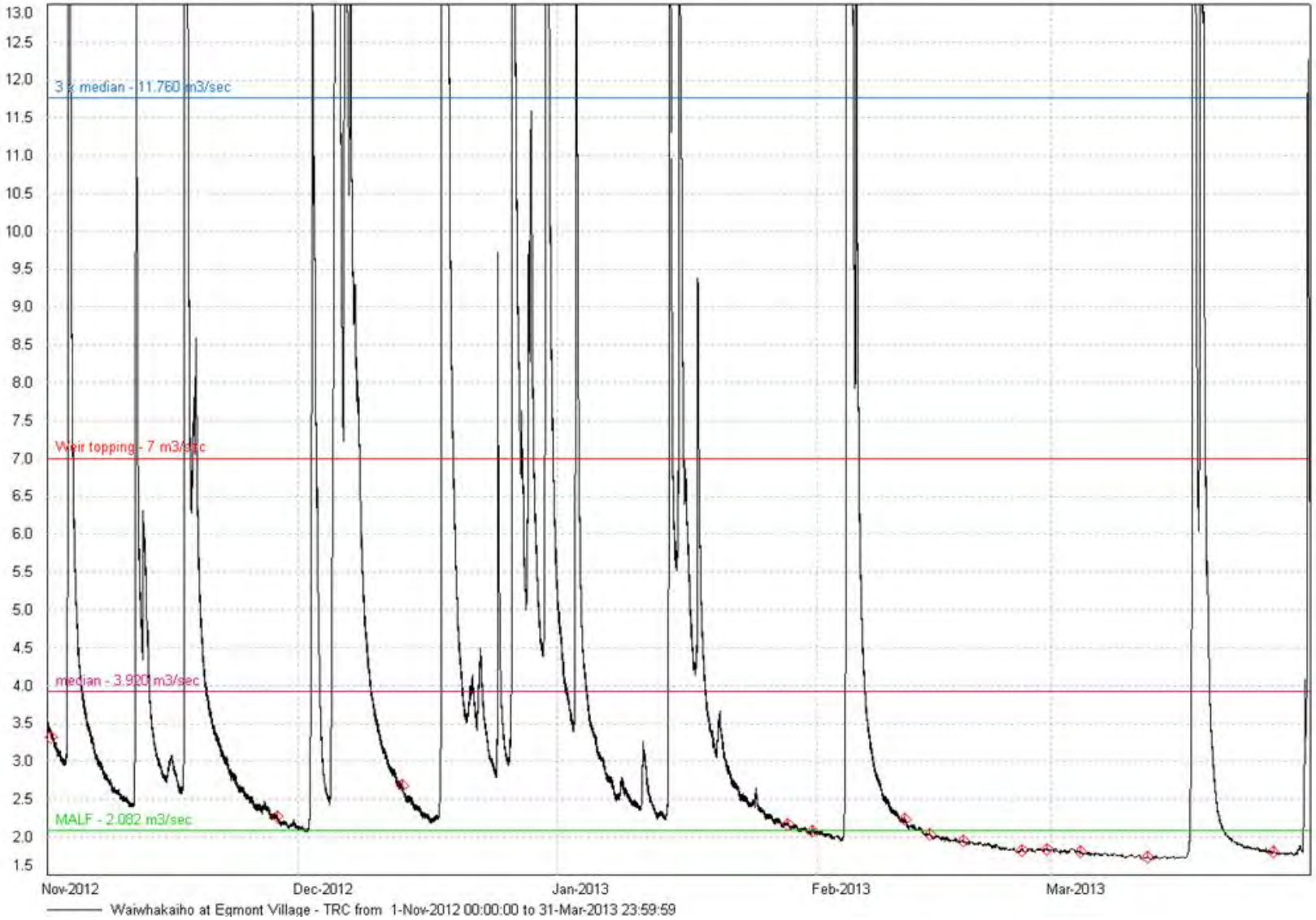


Figure 12 Hydrograph showing flow in the Waiwhakaiho River over the survey period

5. Summary

During the 2012-2013 summer season bacteriological water quality was generally good at the Fitzroy Beach, Mangati and 300m NE sites, but poor at the 500m SW and Waiwhakaiho River sites (Table 23). Mangati and Fizroy Beach sites remained in surveillance mode all summer season. The 300m NE site obtained 'Alert' mode on 2 out of 13 occasions sampled. The 500m SW and the Waiwhakaiho River sites had the majority of samples within 'Alert' mode.

Table 23 Summary enterococci results for the NPWWTP sites

Site	Enterococci (cfu/100 ml)		MfE Guideline Modes (2003)		
	Median	Maximum	Surveillance	Alert	Action
Mangati	5	36	13	0	0
300m NE	27	230	11	2	0
500m SW	340	5600	2	5	6
Fitzroy Beach	3	36	13	0	0
Waiwhakaiho River	880	8700	1*	0	12*

* *Guideline limits for Waiwhakaiho River based on E. coli counts*

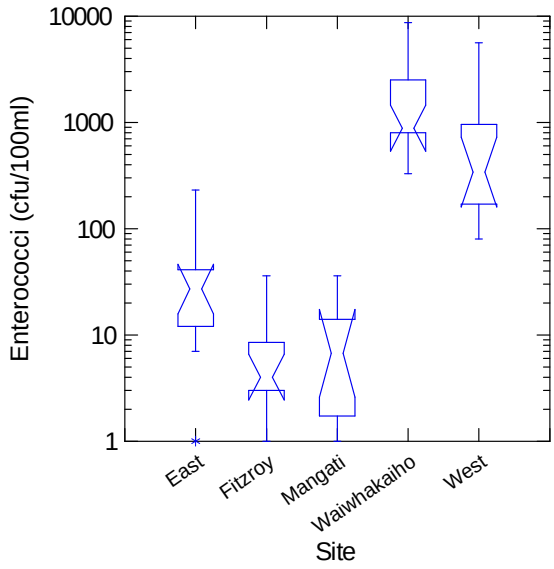


Figure 13 Box and whisker plots comparing enterococci data at all sites for the 2012-2013 period

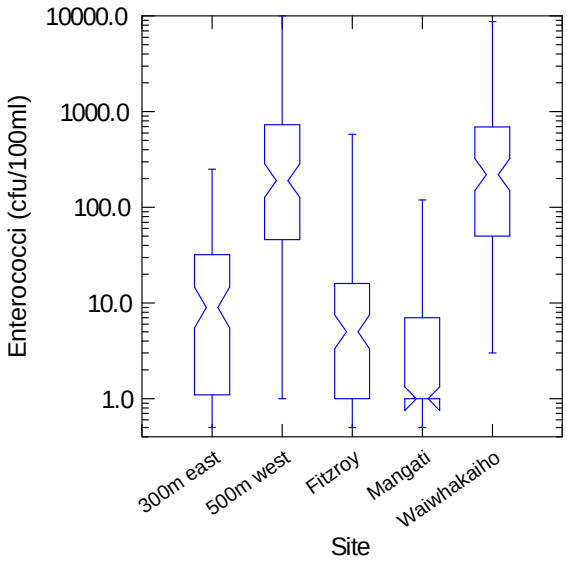


Figure 14 Box and whisker showing all enterococci data collected at the sites from 1996-2013

In general, enterococci counts have been higher at the 500m SW site relative to the

other coastal sites since monitoring began in 1996 (Figure 14). However, recent results indicate that there has been a further decline in water quality at the 500m SW site (Figure 7). Gulls are believed to be the main source of faecal contamination at this site, with bird faeces entering the site from both the Waiwhakaiho River and the Waiwhakaiho Reef (Photographs 3 and 4). High numbers of gulls have been observed and results from faecal source tracking support these observations.

If the wastewater discharge from the outfall was having a greater influence on water quality, higher faecal indicator bacteria counts would be expected at the 300m NE site given the north easterly prevailing flow. Such a pattern did not occur.

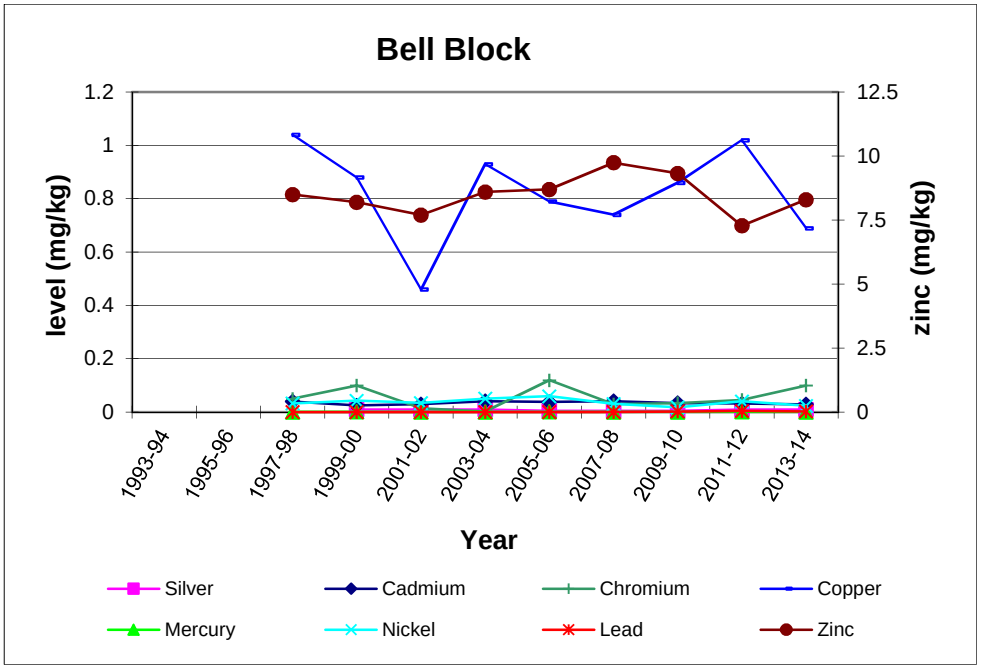
6. Recommendations

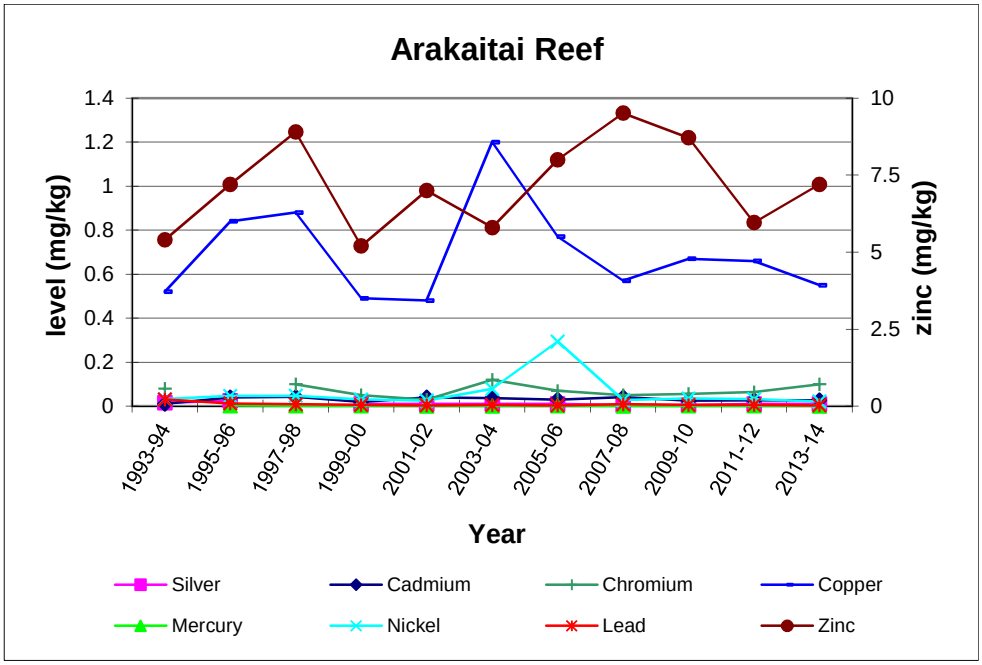
As a result of the 2012-2013 summer marine contact recreation bacteriological survey it is recommended that:

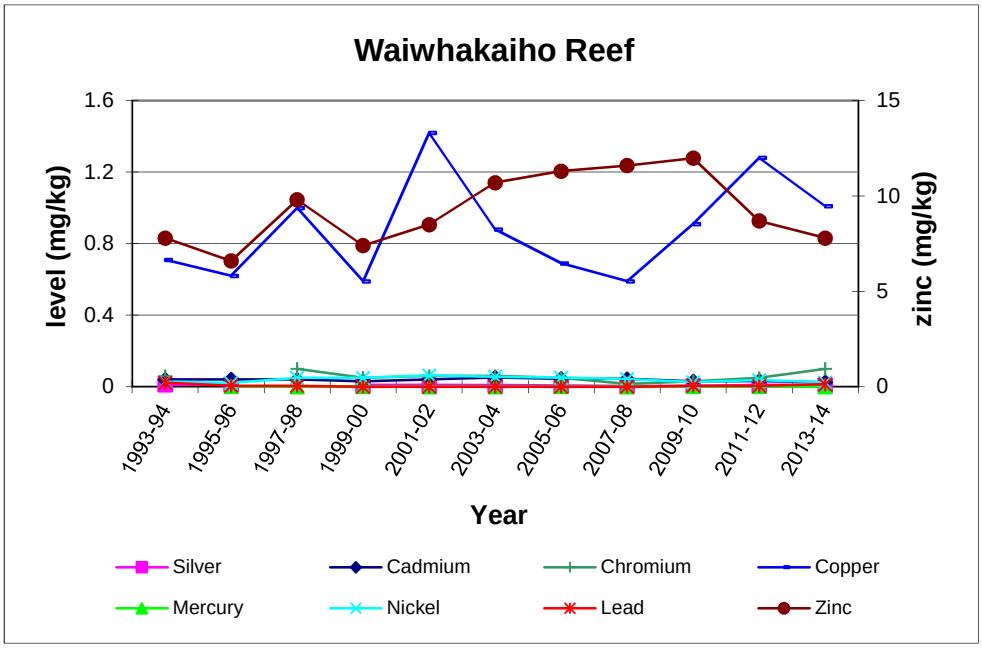
1. THAT the 2014-2015 summer survey be performed at five sites continuing with the existing sampling protocol.
2. THAT follow-up sampling be performed as deemed necessary by TRC staff.
3. THAT reporting of results be performed as appropriate during the season, and in an Annual Report upon completion of the season's programme.

Appendix VII
Metals in shellfish tissue
Summary of previous results 1994 – 2012

Parameter (mg/kg)	Site								
	Bell Block (control)			Arakaitai Reef (control)			Waiwhakaiho Reef (impact)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.03	0.04	0.04	0.01	0.04	0.03	0.03	0.05	0.04
Chromium	<0.03	0.12	0.05	0.03	0.12	0.07	<0.03	0.1	0.05
Copper	0.46	1.04	0.84	0.48	1.20	0.71	0.59	1.42	0.87
Mercury	<0.01	0.016	0.012	<0.01	0.020	0.014	<0.01	0.02	0.01
Nickel	0.19	0.62	0.40	0.18	2.10	0.46	0.19	0.60	0.40
Lead	<0.05	<0.05	<0.05	<0.05	0.22	0.06	<0.05	0.22	0.04
Zinc	7.3	9.7	8.5	5.2	9.5	7.2	6.6	12.0	9.4




Arakaitai Reef
level (mg/kg)
zinc (mg/kg)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
7.5
5
2.5
0
1993-94
1995-96
1997-98
1999-00
2001-02
2003-04
2005-06
2007-08
2009-10
2011-12
2013-14
Year
Silver
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc


Waiwhakaiho Reef
level (mg/kg)
zinc (mg/kg)
1.6
1.2
0.8
0.4
0
15
10
5
0
1993-94
1995-96
1997-98
1999-00
2001-02
2003-04
2005-06
2007-08
2009-10
2011-12
2013-14
Year
Silver
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc

Appendix VIII
Upgrade monitoring:
Shoreline bacteriological results

Fitzroy Beach

Weekly monitoring started 7 Dec 2012

		CONDY	ECOL	ENT	FC	TEMP	Comments
		mS/m@20C	/100ml	/100ml	/100ml	Deg.C	
01-Nov-12	11:30	4640	<1	1	<1	15.6	
06-Nov-12	10:05	4720	3	<1	3	14.9	
28-Nov-12	10:40	4540	15	9	16	16.3	Rain prior to sampling
07-Dec-12	7:45	4420	170	50	170	15.5	Heavy rain prior to sampling
13-Dec-12	10:10	4690	7	3	7	19.0	
19-Dec-12	11:20	4560	31	4	32	19.5	Rained for 2 days prior to sampling
21-Dec-12	7:40	4500	23	19	23	18.9	Light rain the night before sampling
07-Jan-13	11:45	4340	1	<1	1	21.1	
18-Jan-13	7:15	4710	3	8	3	17.1	Rained on days prior to sampling
22-Jan-13	11:25	4650	<1	<1	<1	21.8	
28-Jan-13	10:22	4760	3	3	3	21.2	
31-Jan-13	9:56	4700	1	36	1	21.8	
07-Feb-13	11:30	4750	5	1	5	19.7	
11-Feb-13	8:57	4730	<1	3	<1	19.9	
14-Feb-13	11:10	4630	8	8	8	19.3	
18-Feb-13	14:30	4650	<1	<1	<1	20.1	
21-Feb-13	10:45	4730	3	1	3	20.3	
25-Feb-13	10:10	4750	<1	4	<1	18.2	
28-Feb-13	11:40	4750	<1	4	<1	20.1	
04-Mar-13	12:25	4730	3	3	3	20.1	
12-Mar-13	10:30	4790	<1	<1	<1	19.4	
19-Mar-13	14:35	4710	80	31	80	-	Overwash event at the NPWWTP
21-Mar-13	9:35	4760	<1	<1	<1	19.3	
27-Mar-13	10:05	4790	<1	9	<1	20.4	
04-Apr-13	7:20	4760	16	29	16	19.3	APS Competition (1st heat)
08-Apr-13	11:09	4790	<1	<1	<1	19.3	
16-Apr-13	13:22	4720	56	98	56	18.5	Rain prior to sampling
24-Aprl-13	7:44	4660	140	140	140	18.0	Heavy rain prior to sampling
29-Aprl-13	11:04		4	5	4	18.0	
09-May-13	8:30	4680	4	8	4	16.8	
16-May-13	7:50	4610	7	3	7	15.8	
22-May-13	14:00	3830	170	110	170	15.8	Heavy rain prior to sampling
30-May-13	10:55	4710	1	3	1	16.2	
06-Jun-13	10:10	4760	1	<1	1	14.0	

13-Jun-13	9:10	4670	<1	4	1	14.5	
20-Jun-13	9:25	4370	68	88	74	14.0	Unauthorised discharge at East End on 17/6/13
27-Jun-13	13:04	4660	1	1	1	14.4	
04-Jul-13	10:05	4600	17	60	17	14.3	Rain prior to sampling
11-Jul-13	9:25	4610	1	1	1	13.0	
17-Jul-13	9:20	4610	<1	8	<1	12.2	
24-Jul-13	8:30	4510	16	110	16	13.4	Raining heavily on day
01-Aug-13	8:30	4700	<1	<1	<1	12.8	
08-Aug-13	9:00	4580	6	22	6	13.9	Raining on day
15-Aug-13	9:06	4700	11	13	11	13.4	
21-Aug-13	9:00	4640	<2	14	<2	13.5	Raining on day
28-Aug-13	9:00	4720	17	7	17	13.8	

Condy = conductivity NB the typical conductivity of seawater is 4750 mS/m
ECOL = Escherichia coli
ENT = Enterococci NB indicator most closely correlated with health effects in New Zealand marine waters
FC = Faecal coliforms
Temp = Temperature

Bell Block

Weekly monitoring started 7 Dec 2012

		CONDY	ECOL	ENT	FC	TEMP	Comments
		mS/m@20C	/100ml	/100ml	/100ml	Deg.C	
28-Nov-12	8:31	4570	<1	1	<1	15.9	Rain prior to sampling
07-Dec-12	9:15	4340	170	110	170	15.5	Heavy rain prior to sampling
13-Dec-12	9:30	4660	11	51	13	17.7	
19-Dec-12	9:25	3550	680	630	720	18.4	Rained for 2 days prior to sampling
21-Dec-12	9:05	4390	3	1	3	20.1	Light rain the night before sampling
07-Jan-13	10:00	4500	16	19	16	20.0	
18-Jan-13	8:34	4600	29	24	37	17.4	Rained on days prior to sampling
22-Jan-13	9:30	4700	<1	<1	<1	19.2	
28-Jan-13	13:20	4710	<1	<1	<1	22.2	
31-Jan-13	12:45	4610	750	680	750	21.9	
07-Feb-13		4720	4	<1	4	18.9	
11-Feb-13	8:45	4580	23	13	23	19.4	
14-Feb-13	11:25	4720	1	4	3	19.6	
18-Feb-13	15:10	4730	<1	15	<1	21.2	
25-Jan-13	11:00	4730	4	36	5	18.6	
28-Feb-13	11:25	4690	23	93	24	19.6	
04-Mar-13	14:20	4670	8	1	8	20.4	
12-Mar-13	11:46	4780	1	1	1	18.9	
21-Mar-13	8:00	4580	84	78	84	17.8	
27-Mar-13	8:20	4640	16	45	19	19.0	
04-Apr-13	8:35	4650	40	59	45	19.6	
08-Apr-13	10:38	4790	1	1	1	19.7	
16-Apr-13	10:52	4780	4	5	4	18.8	Rain prior to sampling
23-Aprl-13	12:40	4480	300	1100	320	18.7	Heavy rain prior to sampling
29-Aprl-13	12:20		11	32	11	18.2	
09-May-13	10:10	4430	11	23	11	17.0	
16-May-13	9:25	4600	19	35	19	16.1	
22-May-13	12:35	4200	320	220	330	16.6	Heavy rain prior to sampling
30-May-13	9:45	4630	7	5	7	14.7	
06-Jun-13	11:30	4750	<3	17	<3	13.9	
13-Jun-13	9:50	4660	1	5	1	14.6	
20-Jun-13	7:45	3800	150	210	160	12.3	Heavy rain prior to sampling (an unauthorised discharge into the Mangati Stream may have coincide
27-Jun-13	14:09	4600	8	34	8	13.4	
04-Jul-13	9:40	4430	160	1800	170	13.9	Rain prior to sampling
11-Jul-13	10:05	4590	8	8	8	12.3	
17-Jul-13	10:20	4220	17	28	19	12.2	
24-Jul-13	-						Sample not taken due to heavy, dangerous shore break

01-Aug-13	9:55	4670	<1	<1	<1	13.3	
08-Aug-13	10:15	4590	34	16	46	14.1	Raining on day
15-Aug-13	10:40	4580	5	12	5	13.6	
21-Aug-13	10:10	4580	12	22	14	13.3	Raining on day
28-Aug-13	9:45	4600	8	8	8	13.8	

Condy = conductivity NB the typical conductivity of seawater is 4750 mS/m
ECOL = Escherichia coli
ENT = Enterococci NB indicator most closely correlated with health effects in New Zealand marine waters
FC = Faecal coliforms
Temp = Temperature

300m NE of the Marine Outfall

Weekly monitoring started 7 Dec 2012

		CONDY	ECOL	ENT	FC	TEMP	Comments
		mS/m@20C	/100ml	/100ml	/100ml	Deg.C	
01-Nov-12	12:30	4490	3	7	3	16.4	
28-Nov-12	11:30	4620	31	230	32	17.5	Rain prior to sampling
07-Dec-12	8:40	3940	110	29	110	15.7	Heavy rain prior to sampling
13-Dec-12	11:15	4650	58	40	60	19.0	
19-Dec-12	10:45	4140	64	10	72	21.6	Rained for 2 days prior to sampling
21-Dec-12	8:30	4570	53	45	53	19.4	Light rain the night before sampling
07-Jan-13	11:15	4620	1	<1	1	22.7	
18-Jan-13	7:50	4260	20	17	21	17.1	Rained on days prior to sampling
22-Jan-13	10:50	4590	<1	1	<1	21.3	
28-Jan-13	11:35	4740	10	12	14	22.2	
31-Jan-13	9:17	4390	8	25	12	22.7	
07-Feb-13	11:00	4730	<1	7	<1	21.6	
11-Feb-13	8:25	4720	7	28	7	19.6	
14-Feb-13	10:30	4640	22	68	26	19.7	
18-Feb-13	13:25	4700	3	1	3	24.1	
25-Feb-13	10:50	4750	20	27	20	18.3	
28-Feb-13	12:40	4740	44	41	47	21.2	
04-Mar-13	12:30	4540	12	16	12	20.0	
21-Mar-13	8:45	4750	4	7	4	17.6	
27-Mar-13	11:00	4760	35	150	36	20.9	
04-Apr-13	8:05	4660	76	92	76	18.8	
08-Apr-13	12:02	4790	1	3	1	20.0	
16-Apr-13	10:21	4740	7	24	7	18.5	Rain prior to sampling
24-Aprl-13	8:26	4460	240	740	240	17.9	Heavy rain prior to sampling
29-Aprl-13	11:39	-	300	100	300	18.2	
09-May-13	9:30	4670	8	9	8	16.9	
16-May-13	8:50	4560	200	83	200	14.8	
22-May-13	13:30	4160	130	28	140	17.2	Heavy rain prior to sampling
30-May-13	10:20	4660	7	4	7	15.6	
06-Jun-13	11:00	4730	6	3	6	14.1	
13-Jun-13	10:15	4650	7	7	11	14.9	
20-Jun-13	8:25	2970	340	660	360	12.4	Unauthorised discharge (17/6/13) & heavy rain prior to sampling
27-Jun-13	13:53	4660	<1	1	<1	13.8	
04-Jul-13	9:10	4510	40	200	40	14.2	Rain prior to sampling
11-Jul-13	10:40	4610	1	3	1	12.3	
17-Jul-13	9:55	4550	1	4	1	12.3	
24-Jul-13	9:45	4580	4	9	4	13.4	Raining heavily on day
01-Aug-13	9:35	4700	<1	<1	<1	13.0	

08-Aug-13	10:00	4630	8	14	8	14.1	Raining on day
15-Aug-13	10:20	4560	15	9	15	13.5	
21-Aug-13	9:55	4620	2	12	2	13.1	Raining on day
28-Aug-13	10:15	4600	1	4	1	14.3	

Condy = conductivity NB the typical conductivity of seawater is 4750 mS/m
ECOL = Escherichia coli
ENT = Enterococci NB indicator most closely correlated with health effects in New Zealand marine waters
FC = Faecal coliforms
Temp = Temperature

Waiwhakaiho River

Weekly monitoring started 7 Dec 2012

		CONDY	ECOL	ENT	FC	TEMP	Comments
		mS/m@20C	/100ml	/100ml	/100ml	Deg.C	
01-Nov-12	12:00	10.7	230	330	240	16.4	
28-Nov-12	11:00	13.0	1100	880	1200	19.8	Rain prior to sampling
07-Dec-12	8:15	6.7	1600	660	1700	13.6	Heavy rain prior to sampling
13-Dec-12	10:40	11.7	1900	1600	1900	19.9	
19-Dec-12	10:25	6.7	1500	1100	1500	16.5	Rained for 2 days prior to sampling
21-Dec-12	8:00	9.8	660	430	690	19.1	Light rain the night before sampling
07-Jan-13	10:55	11.4	1100	1800	1100	22.2	
18-Jan-13	7:30	10.5	770	300	780	15.5	Rained on days prior to sampling
22-Jan-13	10:20	-	2200	1900	2600	20.9	
28-Jan-13	11:00	14.0	800	800	1000	23.2	
31-Jan-13	8:50	14.7	1100	600	1500	22.0	
07-Feb-13	11:00	9.2	1200	680	1200	18.0	
11-Feb-13	7:55	13.3	670	640	820	18.7	
14-Feb-13	10:05	13.4	600	870	640	20.4	
18-Feb-13	14:00	13.6	5000	8700	5500	24.3	Flush from hydro power generation
25-Feb-13	11:10	15.2	920	5400	1000	20.2	
28-Feb-13	12:05	17.9	4200	4000	4900	22.3	
04-Mar-13	11:55	15.3	1800	2200	2200	19.7	
12-Mar-13	11:10	1100	970	1200	1300	19.6	
19-Mar-13	14:35	9.2	3000	5400	3000	-	Rained heavily the night before sampling
21-Mar-13	9:15	11.6	620	830	680	15.1	
27-Mar-13	11:25	14.3	1400	2500	1600	19.0	
04-Apr-13	8:35	13.7	770	700	770	16.1	
08-Apr-13	11:33	17.9	250	650	300	16.5	
16-Apr-13	13:05	1.8	1600	2200	1600	15.9	Rain prior to sampling
24-Aprl-13	8:02	8.8	350	420	380	14.6	Heavy rain prior to sampling
29-Aprl-13	11:19	-	370	250	400	15.5	
09-May-13	9:00	9.6	370	140	410	12.1	
16-May-13	8:10	12.7	260	160	270	12.1	
22-May-13	14:25	6.9	1500	480	1500	12.9	Heavy rain prior to sampling
30-May-13	11:18	10	69	8	69	9.3	
06-Jun-13	10:25	9.2	260	38	270	8.9	
13-Jun-13	9:25	12	100	80	100	10.0	
20-Jun-13	9:05	7.1	390	230	400	11.1	Heavy rain prior to sampling
27-Jun-13	13:19	11.3	63	60	66	9.3	
04-Jul-13	10:24	8.4	260	200	270	11.1	Rain prior to sampling
11-Jul-13	9:40	8.8	160	46	160	8.1	
17-Jul-13	9:20	12	160	46	160	8.5	

24-Jul-13	8:50	13.3	2500	3600	2500	11.1	Raining heavily on day
01-Aug-13	9:00	13.5	130	37	130	9.0	
08-Aug-13	9:25	14.7	70	180	100	13.3	Raining on day
15-Aug-13	9:23	9.8	280	140	300	10.3	
21-Aug-13	9:15	9.2	560	170	590	10.0	Raining on day
28-Aug-13	9:20	11.3	440	31	440	11.7	

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