New Plymouth District Council

New Plymouth Wastewater Treatment Plant

Marine Outfall and Sludge Lagoon Monitoring Programme

Annual Report

2016-2017

Technical Report 2017-80

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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 2016 to June 2017 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess NPDC's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of NPDC's activities.

In relation to the operation of the NPWWTP, NPDC holds five resource consents, which include a total of 49 conditions setting out the requirements that NPDC must satisfy. NPDC holds one consent to discharge treated wastewater into the Tasman Sea, one consent to discharge sludge leachate to groundwater, 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 good level of environmental performance.

The Council's monitoring programme for the year under review included reviewing data supplied by NPDC, four site inspections, two water samples collected for physicochemical analysis (including inter-laboratory comparison), a marine ecological survey at five sites, a recreational water quality survey including five sites, norovirus analysis of mussels at three coastal sites and norovirus analysis of treatment plant influent and effluent.

The monitoring showed that elevated concentrations of contaminants were found in the groundwater and surface water drain adjacent to the sludge lagoon. Additional monitoring has been adopted to investigate the extent and the factors causing this trend.

Low levels of Norovirus GII were detected in mussels collected from the Waiwhakaiho Reef during May 2017. There were no other significant detectable effects in the receiving environment resulting from authorised discharges from the plant.

During the year under review there were a total of 20 incidents which resulted in discharges from the wastewater network to water ways. Three 14 day letters (requiring an explanation from the consent holder) were issued in response to incidents, associated with chlorine breaches at the NPWWTP and a reticulation incident. No further response was considered necessary for any of the incidents. All incidents were assessed against the Council's Enforcement Policy.

For reference, in the 2016-2017 year, consent holders were found to achieve a high level of environmental performance and compliance for 74% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 21% of the consents, a good level of environmental performance and compliance was achieved.

In terms of overall environmental and compliance performance by NPDC over the last several years, this report shows that their performance has improved relative to recent years. NPDC were found to be generally compliant with consents.

This report includes recommendations for the 2017-2018 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 for the period July 2016 to June 2017 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held for 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.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by NPDC that relate to discharges of air and treated wastewater, a marine outfall structure and a culvert.

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 is the 22nd 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:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by NPDC for the NPWWTP;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations at the NPWWTP.

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

Section 3 discusses the results, their interpretations, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2017-2018 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 an activity, and may include cultural and social-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); and

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 activity. 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 the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by NPDC, this report also assigns them a rating for their environmental and administrative performance during the period under review.

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 NPDC'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 2016-2017 year, consent holders were found to achieve a high level of environmental performance and compliance for 74% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 21% of the consents, a good level of environmental performance and compliance was achieved.

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.

Photo 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 metre 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).

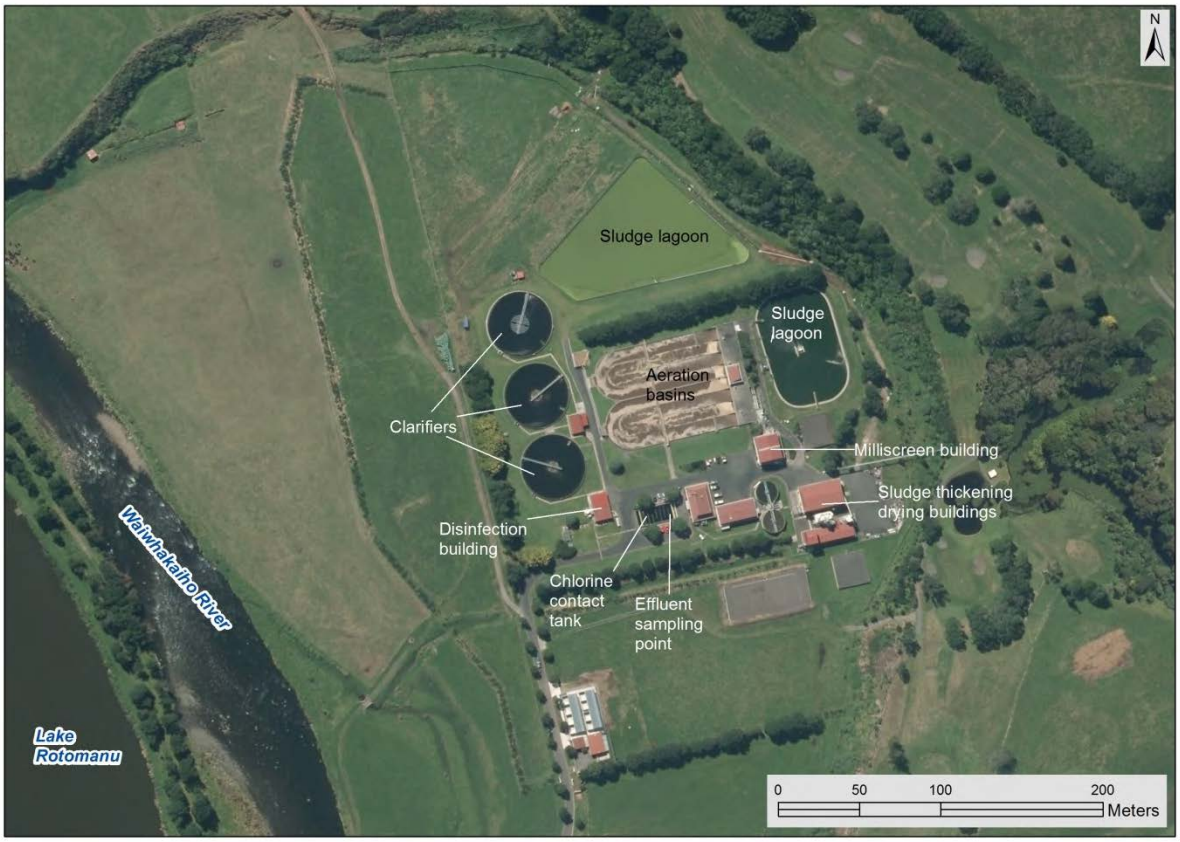

Figure 1 Layout of the New Plymouth Wastewater Treatment Plant

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.

Major construction works were undertaken as part of an upgrade of the NPWWTP between December 2012 and December 2013. The upgrade involved major modification of the plant's two existing aeration basins to make them more efficient.

1.3 Resource consents

1.3.1 Water discharge permit

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.

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.

Condition 2 requires that the unnamed tributary adjacent to the lagoon is monitored.

Condition 3 stipulates that there is to 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.

The permit is attached to this report in Appendix I.

1.3.2 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.

On 29 May 2008, NPDC was granted air discharge permit **4740-2** 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.

The permit is attached to this report in Appendix I.

1.3.3 Coastal permit

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 **4593-3** 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.

The permit is attached to this report in Appendix I.

1.3.4 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.

The permit is attached to this report in Appendix I.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consents which are appended to this report.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

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 seven primary components during the 2016-2017 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 consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

The NPWWTP was visited four times during the monitoring period. With regard to consents for the abstraction of or 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 NPDC 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 Council effluent monitoring

1.4.4.1 Grab samples

Grab samples were collected from the final effluent on three occasions. Samples were analysed for chlorine (total and free) and faecal indicator bacteria (FIB), specifically; *Escherichia coli*, enterococci and faecal coliforms.

1.4.4.2 Inter-laboratory comparison

Two inter-laboratory comparisons between the Council and NPDC were performed during the 2016-2017 monitoring period using 24-hour composite samples. 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. The samples were analysed, by both the Council and NPDC, for cadmium, chromium, copper, nickel, lead and zinc (all acid soluble), mercury and cyanide (total), and phenolic compounds.

1.4.5 Review of NPDC self monitoring data

NPDC monitors the influent and effluent for a number of chemical, biochemical and bacteriological parameters and forwards the results through to the Council on a monthly basis.

1.4.5.1 Composite samples

A number of flow-proportional composite samples were collected from the influent over a 24 hour period and analysed for pH, alkalinity as $CaCO_3$, ammoniacal nitrogen (ammoniacal-N), oxidised nitrogen (oxidised-N), nitrite, nitrate, dissolved reactive phosphorus (DRP), sulphate, biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, and faecal coliforms.

A number of composite samples were collected from the effluent and analysed for various parameters. On a monthly basis, composite samples were collected and analysed for pH, ammoniacal-N, oxidised-N, COD, cyanide, phenols, cadmium, chromium, copper, nickel, lead, zinc, and mercury. Approximately three times a week, samples were collected for the analysis of suspended solids and BOD. Approximately once a week, samples were collected for the analysis of DRP and sulphate. A small number of samples were collected and analysed for alkalinity.

Composite sample results are presented in this report to address Special Conditions 3 and 4 of resource consent 0882-4. A summary of the composite data collected from the influent and effluent is also presented to provide a further indication of plant performance.

1.4.5.2 Grab samples

Grab samples were collected and analysed for total available chlorine twice a day. Grab samples were also collected and analysed for faecal coliform bacteria approximately three times each week.

1.4.5.3 Norovirus sampling

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. One set of influent and effluent samples were analysed for norovirus GI and GII by The Institute of Environmental Science and Research (ESR).

1.4.5.4 Sludge lagoon monitoring

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 collected once a month and analysed for pH, ammoniacal-N, faecal coliform bacteria, DRP, oxidised-N and COD. 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, ammoniacal-N and faecal coliform bacteria.

1.4.6 Marine ecological surveys

An annual intertidal ecological survey was carried out at three potential impact sites and two control sites during the 2016-2017 monitoring period. The objective of this survey 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, as well as a site located downstream of Lake Rotomanu, is carried out every second year during the summer

months. Thirteen samples were collected from each site under dry weather conditions during 2016-2017. The samples were analysed for conductivity and enterococci, faecal coliform and *E. coli* bacteria. The survey is next due to be undertaken in the summer of 2018-2019.

1.4.8 Shellfish monitoring

1.4.8.1 Metals

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 not undertaken in the 2016-2017 period. It is next scheduled to be carried out during the 2017-2018 monitoring period.

1.4.8.2 Norovirus

Mussels were collected once from two sites (Waiwhakaiho Reef and Bell Block Reef) and analysed for norovirus GI and GII by ESR.

2 Results

2.1 Water

2.1.1 Inspections

Four scheduled site inspections were performed at the plant during the monitoring period. 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. No issues were noted regarding effluent appearance. Upgrade works were being undertaken in the sludge processing area during the year.

There was no evidence of effluent contamination in the peripheral drains. The coastal effluent plume was either invisible, or visible as a small clear patch above the diffuser. There was no evidence of contamination of the foreshore or shoreline waters during the inspections.

2.1.2 Council effluent monitoring

2.1.2.1 Grab samples

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

Table 1 Effluent grab samples 2016-2017 (site SWG002002)

Parameter	Unit	Date		Consent Limit
		4 May 2017	20 June 2017	
Free available chlorine	g/m^3	<0.1	<0.1	-
Total available chlorine	g/m^3	0.5	0.2	**0.3 ***
E. coli	cfu/100 ml	N/D	N/D	**-**
Enterococci	cfu/100 ml	7	3	**-**
Faecal coliforms	cfu/100 ml	47	12	**-**

* The total available chlorine in the effluent, prior to entering the outfall pipe, shall be no less than 0.3 g/m^3

The concentration of total available chlorine was compliant with the consent limit on 4 May 2017. However, the concentration was below the consent limit on 20 June 2017. In response to this result, NPDC's self-monitoring data was examined. All grab samples collected on the 19th, 20th and 21st of June showed chlorine concentrations that were well above the consented limit. These results were supported by continuous monitoring data which also showed that the chlorine concentration was maintained well above the consent limit on the 20th of June. Due to these lines of evidence, and the margin of error associated with the Council's test procedure (±0.1 g/m^3), this result has been considered erroneous and as such does not constitute a breach of compliance. It should also be noted that relatively low counts of FIB were recorded on both sampling occasions; indicative of sufficient disinfection.

2.1.2.2 Inter-laboratory comparison

Two 24-hour composite samples of the final effluent 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). For this comparison, a satisfactory agreement between two samples was reached if they were each within 10% of the resultant mean.

Table 2 Inter-laboratory effluent composite samples 2016-2017

Parameter	Unit	7 February 2017			4 May 2017			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	<0.02	√	<0.03	<0.02	√	**0.15**
Copper	g/m^3	<0.01	<0.02	√	<0.01	<0.02	√	**0.1**
Cyanide	g/m^3	0.005	<0.02	√	0.004	<0.02	√	**0.1**
Mercury	g/m^3	<0.0001	<0.00008	√	<0.0001	<0.00008	√	**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	<0.05	√	<0.02	<0.05	√	**1.0**
Zinc	g/m^3	0.012	<0.04	√	0.024	<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 the results obtained were in satisfactory 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 data

2.1.3.1 Composite samples

An annual summary of the composite effluent monitoring undertaken by NPDC in relation to Special Condition 3 is presented in Table 3, along with the associated resource consent limits and a summary of previous results.

Table 3 Summary results of monthly effluent composite samples collected by NPDC (2016-2017)

Parameter	Unit	Consent limit	2016-2017			1990-2016		
			Median	Number of samples	% compliant	Min	Max	Number of samples
Cyanide	g/m^3	**0.1**	0.01	12	100	0.005	0.1	298
Cadmium	g/m^3	**0.04**	0.001	12	100	0.00055	0.01	303
Chromium	g/m^3	**0.15**	0.01	12	100	0.0055	0.05	303
Copper	g/m^3	**0.1**	0.01	12	100	0.005	0.05	303
Lead	g/m^3	**0.1**	0.015	12	100	0.001	0.04	303

Parameter	Unit	Consent limit	2016-2017			1990-2016		
			Median	Number of samples	% compliant	Min	Max	Number of samples
Mercury	g/m^3	**0.002**	0.0005	12	100	0.0005	0	291
Nickel	g/m^3	**0.15**	0.004	12	100	0.004	0.07	303
Phenols	g/m^3	**1**	0.025	12	100	0.005	0.17	295
Zinc	g/m^3	**0.2**	0.02	12	100	0.01	0.15	303

During the 2016-2017 monitoring year, all contaminants were within their consent limits, and all results were comparable with those previously recorded. A full table of results for the period under review can be found in Appendix II. Results from 1990 onwards are also included in Appendix III.

As stated in Special Condition 4, neither BOD nor suspended solids shall exceed a concentration of 25 g/m^3 in more than 5% of samples of the final effluent. Results from the effluent composite samples analysed for BOD and suspended solids during the year under review are presented in Figures 2 and 3.

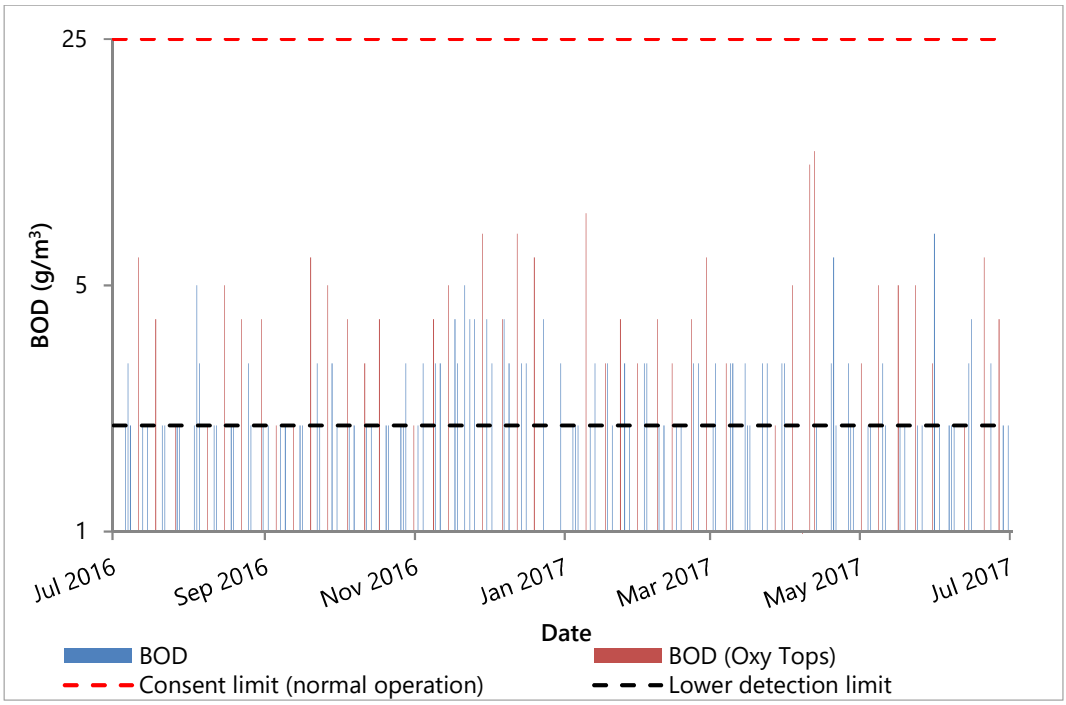

Figure 2 Biochemical oxygen demand results from two different test methods in 24-hour effluent composite samples, presented on a logarithmic scale.

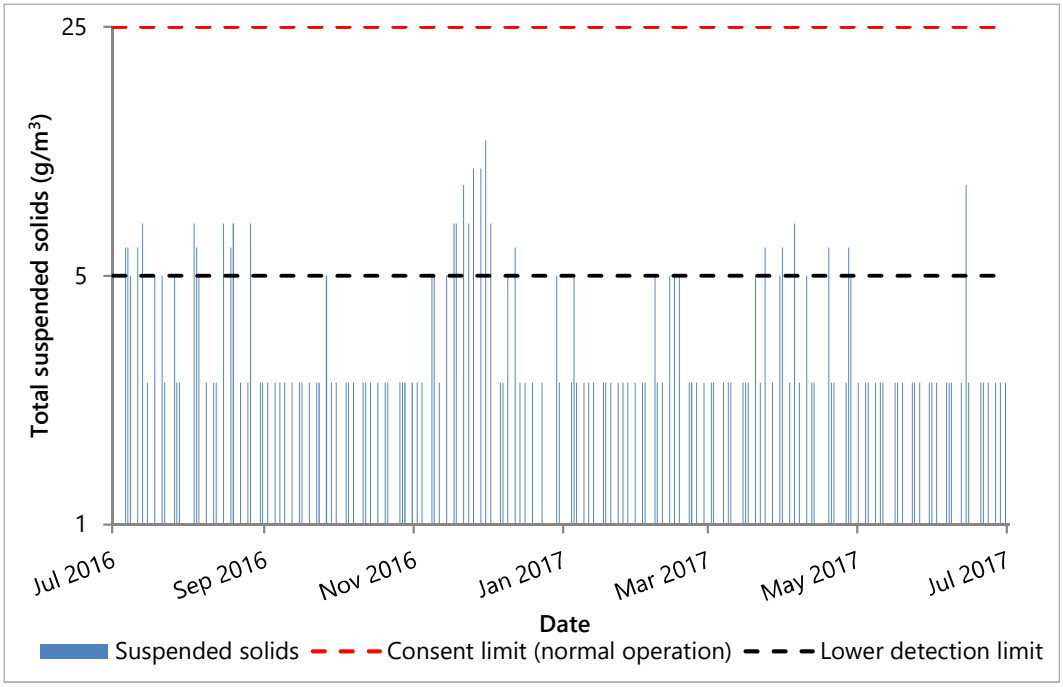

Figure 3 Concentration of total suspended solids in 24-hour effluent composite samples, presented on a logarithmic scale.

The concentrations of both discharge constituents remained below 25 g/m^3 in all samples during this monitoring period. Condition 5 permits greater concentration limits for suspended solids and BOD when plant maintenance is being carried out. There was no work undertaken during the 2016-2017 monitoring year which required these limits to be adopted.

NPDC provided the Council with influent composite data, which, when considered alongside the effluent composite data, is indicative of the performance of the plant. A summary of the influent and effluent composite data from the period under review is presented in Table 4.

Table 4 Summary of composite influent and effluent data from the 2016-2017 monitoring period

Parameter	Units	Detection limits	Influent		Effluent	
			Median	Number of samples	Median	Number of samples
pH	pH units	-	7.4	55	7.2	12
Alkalinity as $CaCO_3$	g/m^3	-	171	55	65	4
Ammoniacal-N	g/m^3	<0.1	28	83	0.05	13
Oxidised-N	g/m^3	<0.1 / <0.02	0.105	48	6.8	12
Nitrite as N	g/m^3	<0.2 / <0.05	0.03	48	-	-
Nitrate as N	g/m^3	<0.15	0.075	48	-	-
DRP as Phosphorus	g/m^3	<0.08 / <0.05	3.775	48	0.405	50
Sulphate	g/m^3	-	34	48	34.35	50
BOD	g/m^3	<1 / <2	170	33	2	109
BOD (Oxy Tops)	g/m^3	<1	170	20	4	44
COD	g/m^3	-	388	84	21	14
Suspended Solids	g/m^3	<5	244	83	2.5	155
Faecal coliforms	No/100ml	<1	6500000	12	Tested with grab samples – see Section 2.1.3.2	

Treatment of influent at the NPWWTP resulted in large reductions in alkalinity, ammoniacal-N, DRP, BOD, COD and suspended solids. Oxidised-N generally increased as the ammonia was converted to nitrate by way of nitrification. Results from the monthly effluent composite samples in the 2016-2017 year are presented in Appendix II. Historical results from the monthly effluent composite samples are presented in Appendix III.

2.1.3.2 Grab samples

Special Condition 10 requires that the concentration of total available chlorine (TAC) in the effluent shall be no less than 0.3 g/m^3. NPDC collect regular grab samples of the effluent to assess this condition. The results from the period under review are presented in Figure 5.

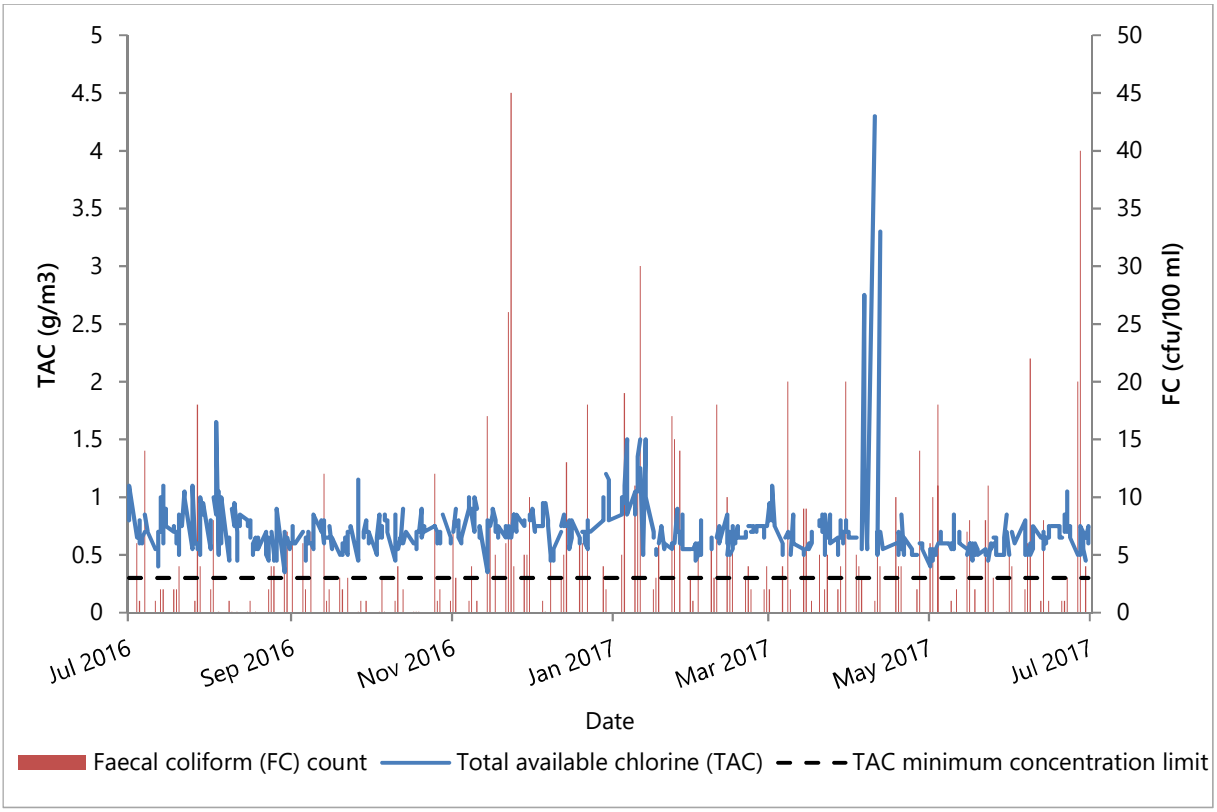

Figure 4 Levels of total available chlorine (TAC) and faecal coliforms (FC), measured in colony forming units (cfu) per 100 ml, in effluent grab samples.

The concentration of TAC was found to be at or above 0.3 g/m^3 in every routine sample collected during the monitoring year. The concentrations of TAC were reflected in the relatively low counts of faecal coliform bacteria present in effluent grab samples throughout the year (Figure 4).

2.1.4 Norovirus samples

Condition 14 requires shellfish to be monitored for microbial contamination in relation to the NPWWTP outfall discharge. In conjunction with this, samples of influent and effluent at the NPWWTP are also collected and analysed for norovirus (GI and GII). The results from this monitoring period are presented in Table 5.

Table 5 Norovirus concentration in the effluent and influent at the NPWWTP

Operation	Date	Norovirus GI (genome copies/L)			Norovirus GII (genome copies/L)		
		Influent	Effluent	Reduction factor	Influent	Effluent	Reduction factor
Pre-upgrade	9 October 2012	280,000	100	2,800	470,000	13,000	36
Pre-upgrade	16 October 2012	37,000	180	206	1,600,000	30,000	53
Pre-upgrade	23 October 2012	17,000	460	37	28,000,000	21,000	1,333
Upgrade	31 July 2013	35,000	8,200	4	1,200,000	140,000	9

Operation	Date	Norovirus GI (genome copies/L)			Norovirus GII (genome copies/L)		
		Influent	Effluent	Reduction factor	Influent	Effluent	Reduction factor
Post-upgrade	9 June 2014	67,000	200	335	480,000	2,300	209
Post-upgrade	20 April 2015	4,300	0.5	8,600	3,000,000	1,300	2,308
Post-upgrade	11 April 2016	92,000	0.5	184,000	1,900,000	770	2,468
Post-upgrade	29 May 2017	7200	0.5	14,400	890,000	0.5	1,780,000

The disinfection rate has continued to improve following the upgrade of the wastewater treatment system.

2.1.5 Sludge lagoon monitoring

The lagoon was designed with the intention that 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. However, monitoring results of shallow groundwater bores and surface waters in the vicinity of the lagoon indicate that leakage occurs here.

The results of sludge lagoon groundwater and surface water monitoring, undertaken monthly by NPDC, are summarised in Figures 6 to 13, along with a summary of previous results from 1990 to 2016. The results from routine monitoring during 2016-2017 are presented in Appendix IV. The locations of the sampling sites in relation to the lagoon are shown in Figure 5. Additional monitoring that was undertaken as part of a 12 month groundwater investigation will be presented in the 2017-2018 annual report.

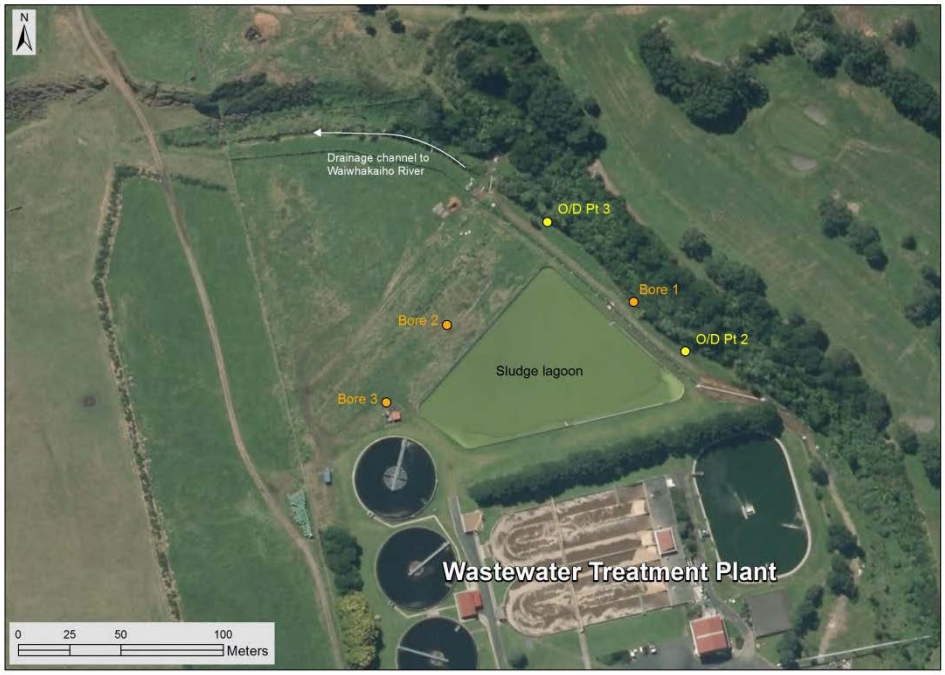

Figure 5 Sludge lagoon showing location of NPDC's groundwater bore and drain sampling sites

During the period under review, the median faecal coliform counts recorded at the three bores and two drain sites were higher than the respective, historical medians. The faecal coliform counts recorded at Bores 1 and 2 were low and within the ranges of historical results, with median counts of 9 and 26.5 per 100 ml, respectively (Figure 6). The median count of 102.5 per 100 ml recorded at Bore 3 was considerably higher, and this site also recorded the highest maximum count of all of the bores (5,400 per 100 ml). Median counts were relatively elevated in the drains, with medians of 211.5 and 571.5 per 100 ml at the upstream and downstream sites, respectively. It should be noted that at these surface water sites, the variation in faecal coliform numbers is affected to a greater extent by fluctuations in drain flow and access by stock and wildlife.

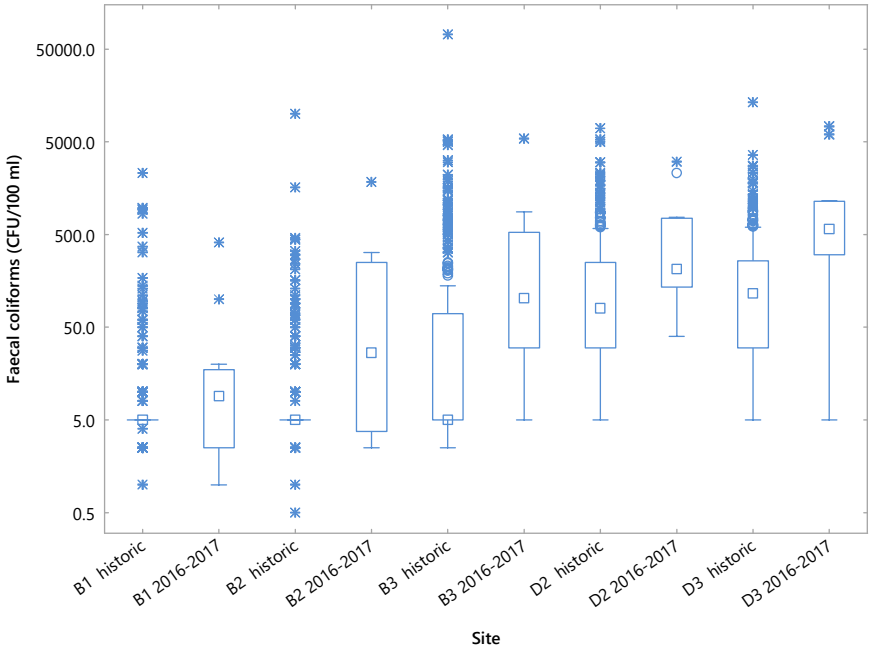

Figure 6 Boxplots of faecal coliform data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2016 (historic) and the current monitoring period (2016-2017) presented on a logarithmic scale

While the median pH values recorded for Bore 3 and the two drains in 2016-2017 were comparable with historical results, the median pH values recorded for Bores 1 and 2 were significantly lower than the respective historical medians (Figure 7).

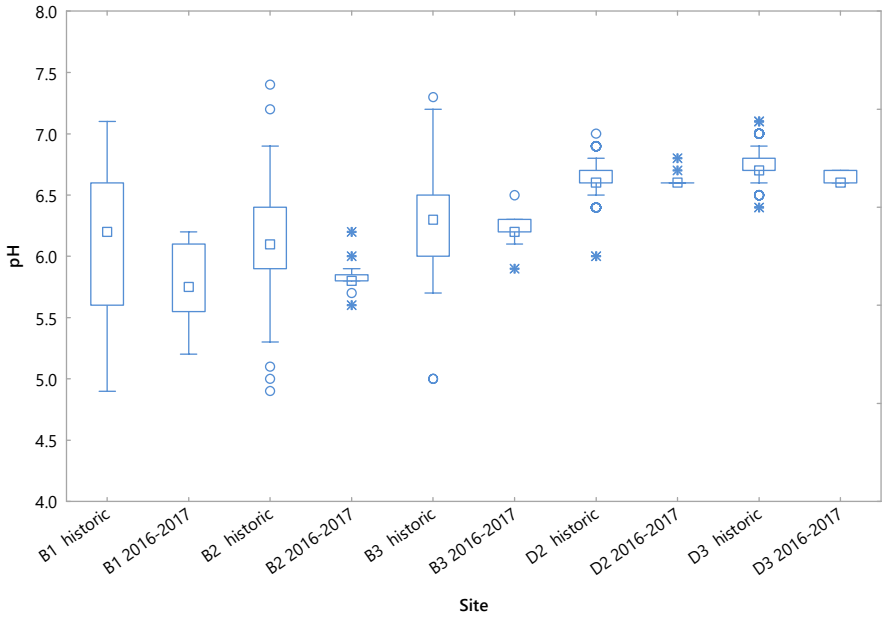

Figure 7 Boxplots of pH data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2016 (historic) and the current monitoring period (2016-2017)

The process of decomposition of nitrogenous fractions within the sludge biomass generates ammoniacal nitrogen. The concentrations of ammoniacal-N at most sites were comparable with historical results, although the median concentrations recorded at Bores 2 and 3 were considerably lower than the respective historical medians (Figure 8, Appendix IV).

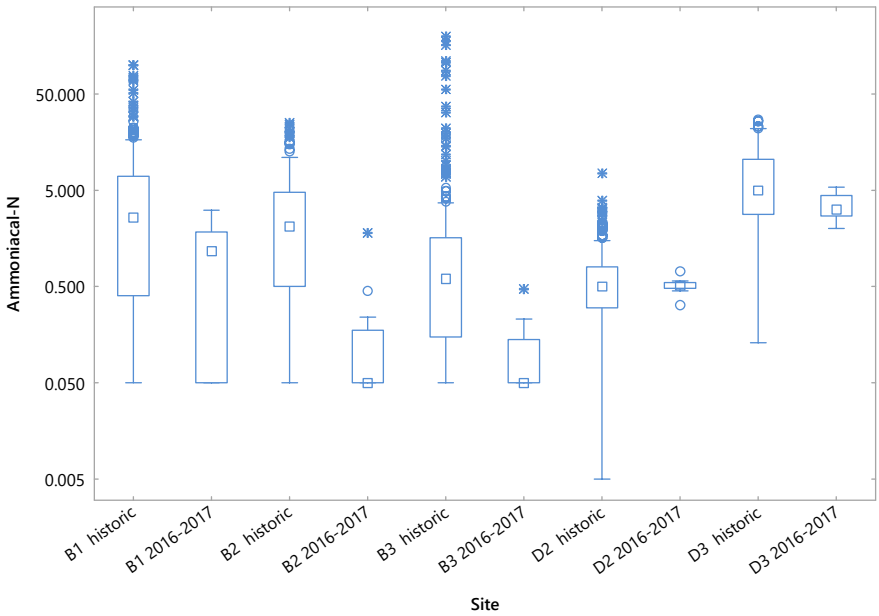

Figure 8 Boxplots of ammoniacal nitrogen data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2016 (historic) and the current monitoring period (2016-2017) presented on a logarithmic scale

The median concentrations of oxidised-N were low in all three bores during the year under review and were comparable with historical results (Figure 9, Appendix IV). However, Bore 1 recorded some elevated results over the winter months, including a maximum concentration of 18.6 g/m^3.

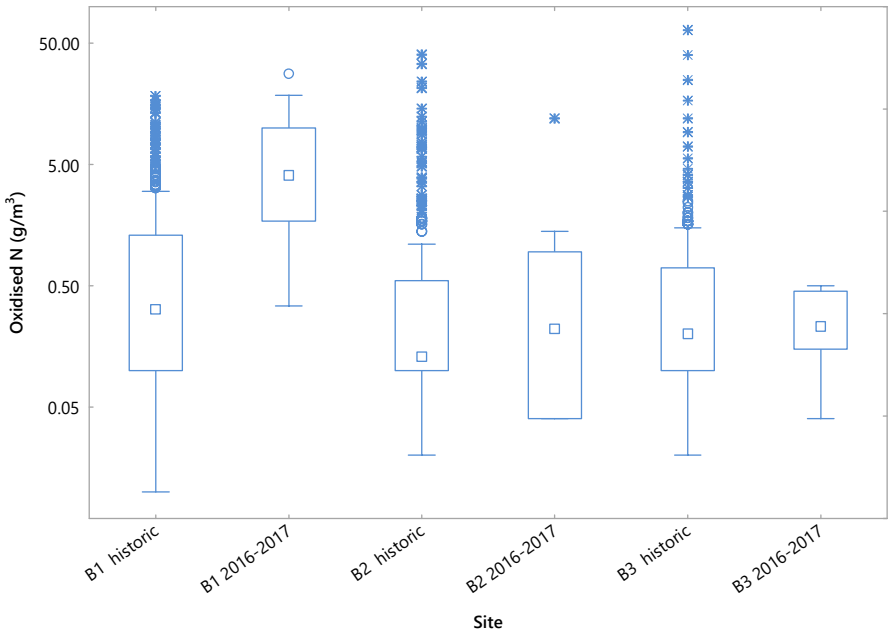

Figure 9 Boxplots of oxidised nitrogen data from the three monitoring bores (B1-3) between 1990 and 2016 (historic) and the current monitoring period (2016-2017) presented on a logarithmic scale

Soluble phosphate is released from the sludge biomass under anaerobic conditions and is therefore the major contributor to dissolved phosphorus levels. In 2016-2017, the concentrations of DRP in the groundwater analysed at all three bores were low and comparable with historical results (Figure 9, Appendix IV).

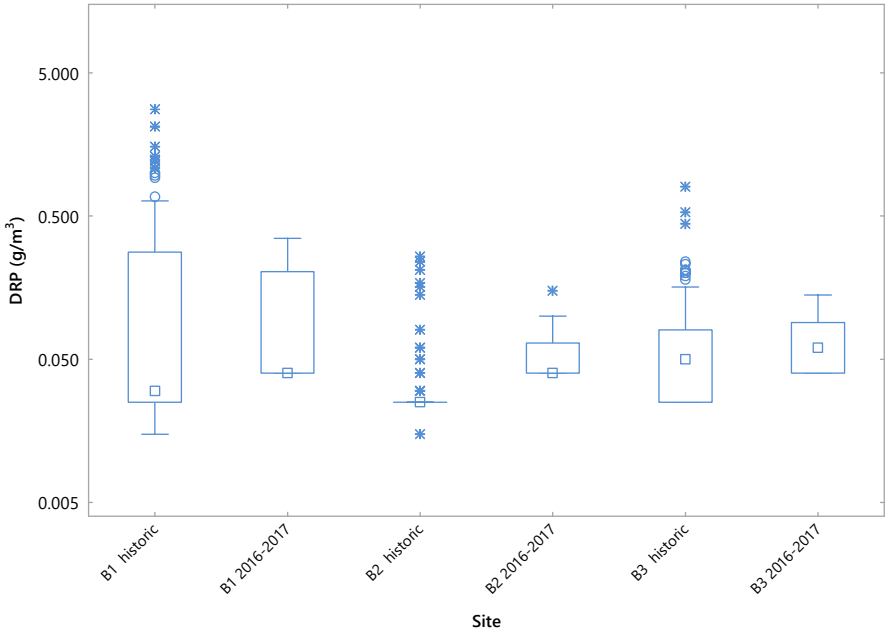

Figure 10 Boxplots of DRP data from the three monitoring bores (B1-3) between 2008 and 2016 (historic) and the current monitoring period (2016-2017)

Median COD levels were elevated at Bores 2 and 3 in 2016-2017, relative to historical results (Figure 11, Appendix IV). These elevated COD levels indicate that seepage from the lagoon may still be occurring.

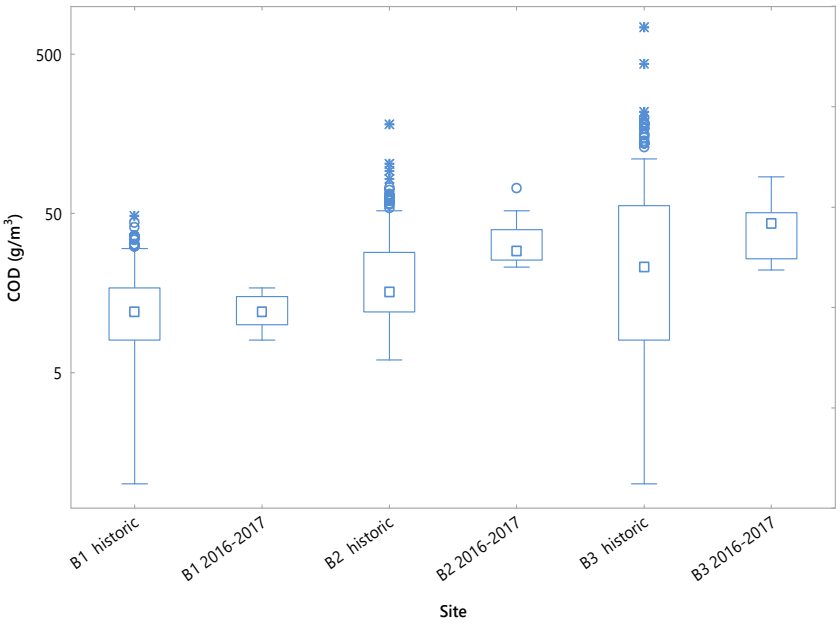

Figure 11 Boxplots of COD data from the three monitoring bores (B1-3) between 1990 and 2016 (historic) and the current monitoring period (2016-2017) presented on a logarithmic scale

Monitoring results in recent years indicate that leachate from the sludge lagoon is having an adverse effect on the groundwater in the vicinity of Bore 1, in addition to Bores 2 and 3. Originally, Bore 1 was intended to be used as a control site for groundwater monitoring due to its position in relation to the lagoon and the assumed direction of groundwater flow. However, it is possible that the deposition and subsequent mounding of sludge in this lagoon has altered the localised groundwater gradient, resulting in some of the leachate being forced out of the lagoon in the direction of Bore 1.

Seasonal cycles in concentrations of groundwater contaminants have become particularly apparent in recent years. This trend is most distinct with concentrations of ammoniacal-N, oxidised-N, and DRP at Bore 1, which are presented in Figure 12. The maximum concentrations of these three contaminants are also considerably higher at this Bore compared to Bores 2 and 3. At Bore 1, concentrations of ammoniacal-N are highest in the summer and subside in the winter. Conversely, oxidised-N concentrations are greatest in the winter, and subside during the summer. DRP mirrors the trend of ammoniacal-N, albeit at much lower concentrations. These trends were evident again in 2016-2017, although the summer flux in ammoniacal-N was lower in the 2016-2017 year than in recent years, with a maximum of 3.1 g/m^3 recorded in January 2017, compared with a maximum of 10.5 g/m^3 in the previous monitoring year. On the other hand, the maximum value recorded for oxidised-N in the current monitoring year (28.0 g/m^3, July 2016) was considerably higher than in recent years. These differences are likely due to the higher than average rainfall experienced over the past year, which has most likely increased the concentration of dissolved oxygen in groundwater above that typically found during both winter and summer months.

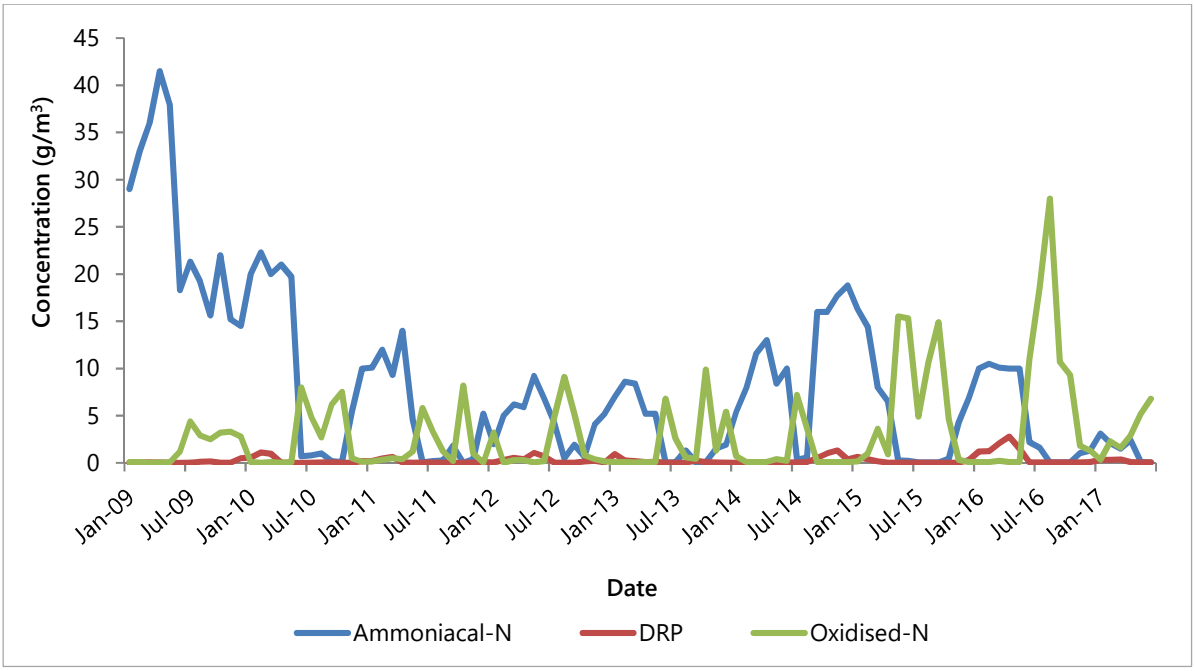

Figure 12 Concentrations of ammoniacal-N, DRP and oxidised-N in monthly groundwater samples taken from Bore 1 (2009-2017)

There are a number of possible mechanisms driving the seasonal cycle of contaminants in the groundwater adjacent to the lagoon. The first possible mechanism relates to the wastewater treatment process, prior to the lagoon. Sludge would be deposited from the clarifiers into the lagoon in layers with varying ratios of oxidised-N to ammoniacal-N as the treatment process would produce a higher proportion of oxidised-N during the warmer summer months than during the winter. Once the leachate from each layer has reached groundwater, the elapsed time may explain why the concentration of oxidised-N is greatest in the winter months. There may also be an oxidation-reduction cycle occurring within the lagoon itself, also driven by seasonal conditions, complimenting the first mechanism.

Another possible mechanism driving the conversion between ammoniacal-N and oxidised-N could occur within the groundwater surrounding the lagoon. This mechanism assumes that nitrogen is continuously leaching from the lagoon and into the soil in the form of ammoniacal-N. In the summer months, there is typically less rainfall and therefore less oxygenated water entering the soil. The low concentration of dissolved oxygen in the groundwater limits the capacity for the microbial community to respire and convert the ammoniacal-N into oxidised-N. Therefore, the concentration of ammoniacal-N remains high. Conversely, greater rainfall in the winter months increases the concentration of dissolved oxygen in the groundwater as there is more oxygenated water entering the soil. The microbial community is therefore more able to respire and oxidise the available nitrogen. The results from the current monitoring year suggest that this may be the dominant mechanism behind the cycling, as the higher than average rainfall recorded over the past year coincides with a higher than average oxidised-N summer flux and a lower than average ammoniacal-N winter flux.

No seasonal cycle is apparent in the concentrations of ammoniacal-N at the two open drain sites. Whilst the concentration of ammoniacal-N has remained consistently low at the upstream site in recent years, the downstream site has shown a slight increase, potentially due to leaking of the system or increasing permeability of the pond (Figure 13).

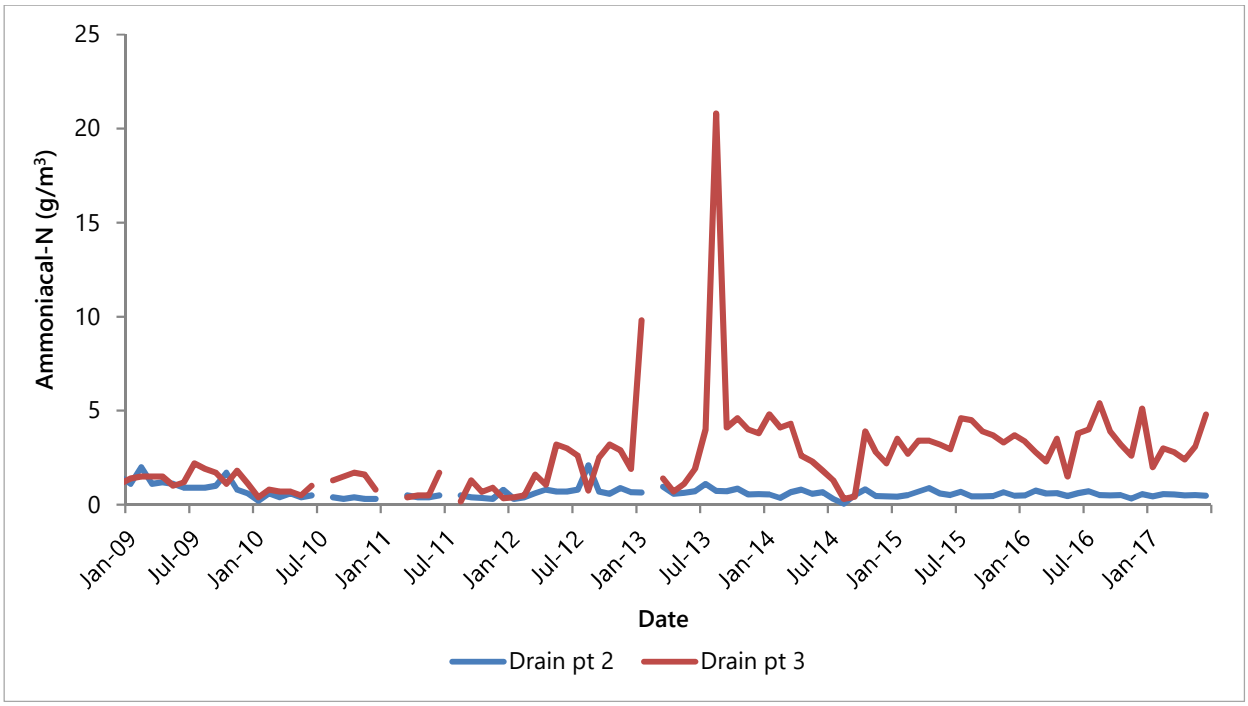

Figure 13 Concentrations of ammoniacal-N in the monthly drain samples collected upstream and downstream of the sludge lagoon (2009-2017)

2.1.6 Marine ecological surveys

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, ecological surveys were conducted in February 2017 at five sites (Figure 13). 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 likely have been evident as a significant decline in species diversity at the potential impact sites relative to the control sites. While sand inundation and climatic factors remain the primary drivers influencing local marine biodiversity, significant decreases in species abundance and diversity could signal a potential issue or severe contamination related to the NPWWTP.

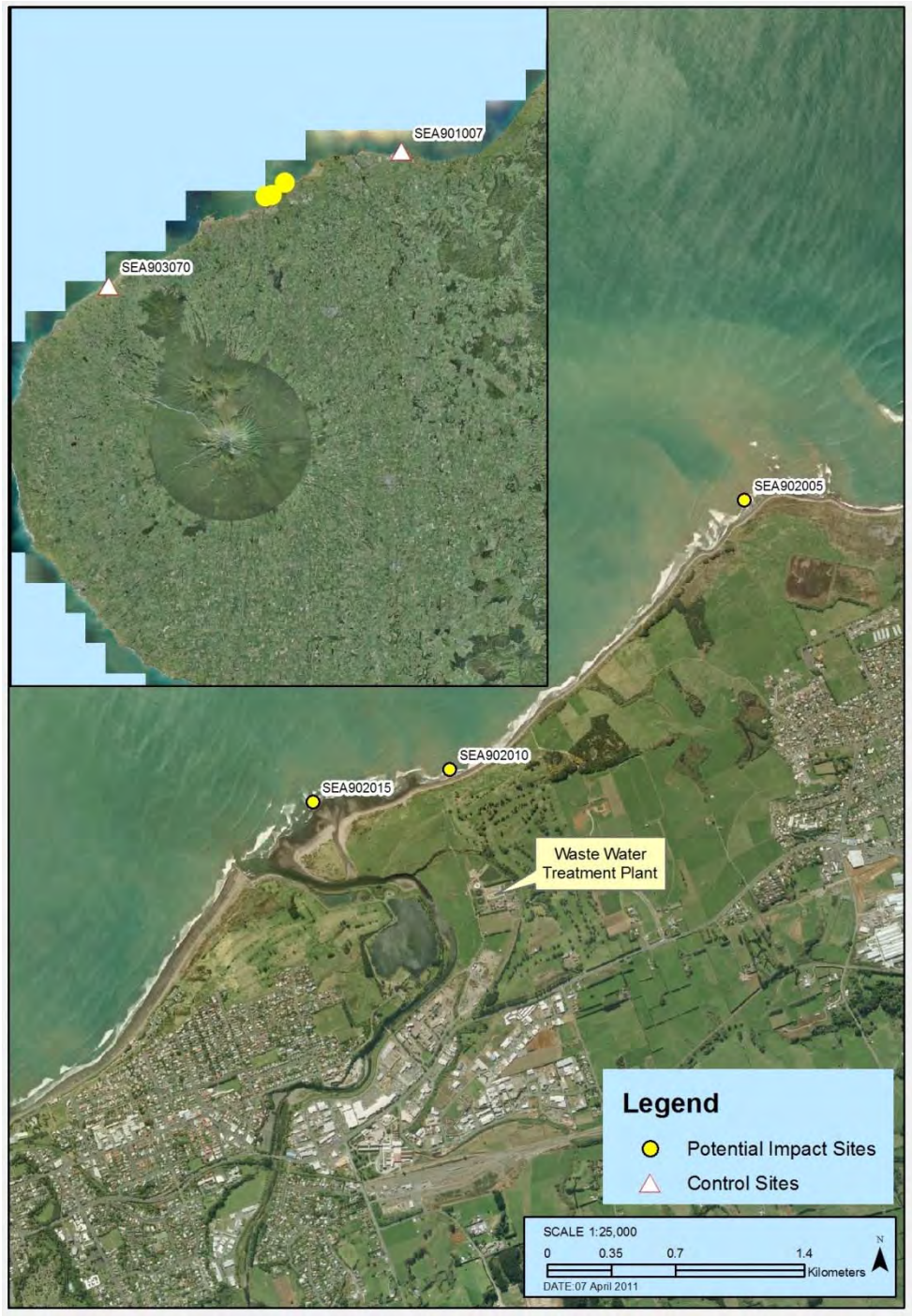

Figure 14 Marine ecological survey sites for NPWWTP

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2016-2017 survey, as there was no distinguishable shift in species richness or diversity at the potential impact sites compared with the control sites. The intertidal communities on the Mangati Reef and at the site located 300 m NE of the NPWWTP continue to recover from the sand inundation event of 2015 (TRC, 2015), with species number and diversity found to increase at these sites proportionately to ongoing decreases in the mean percentage cover of sand, silt and mud (Figures 15-17).

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.

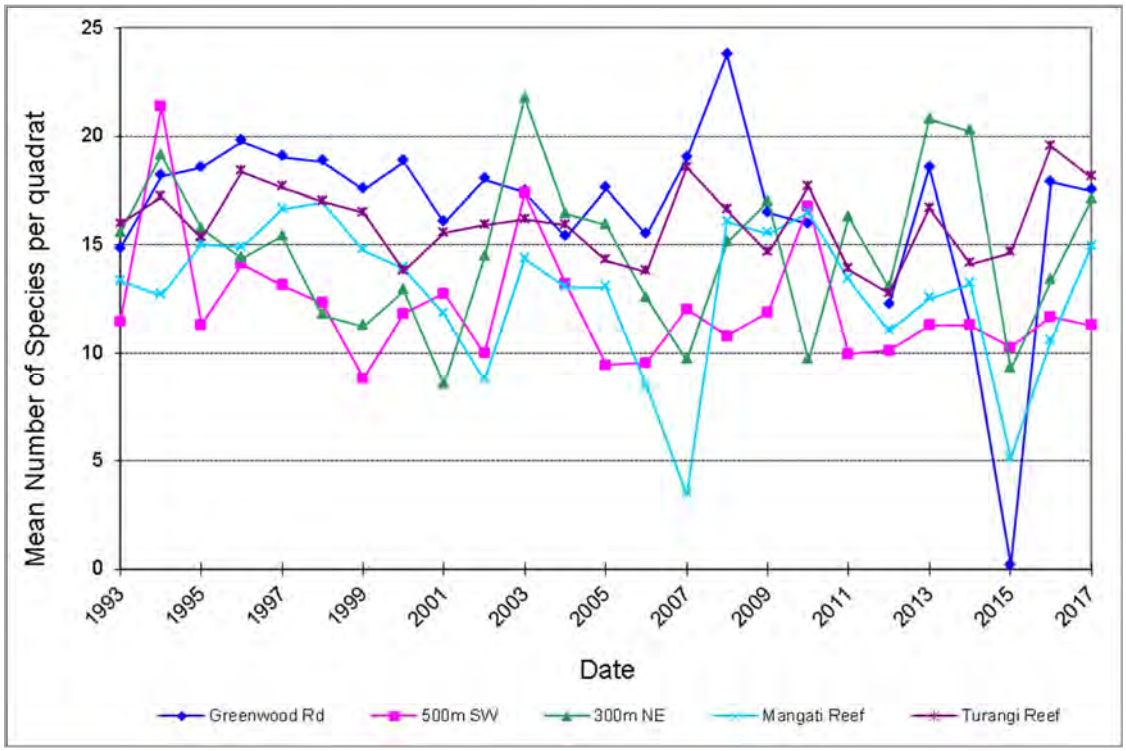

Figure 15 Mean number of species per quadrat from 1993 to 2017

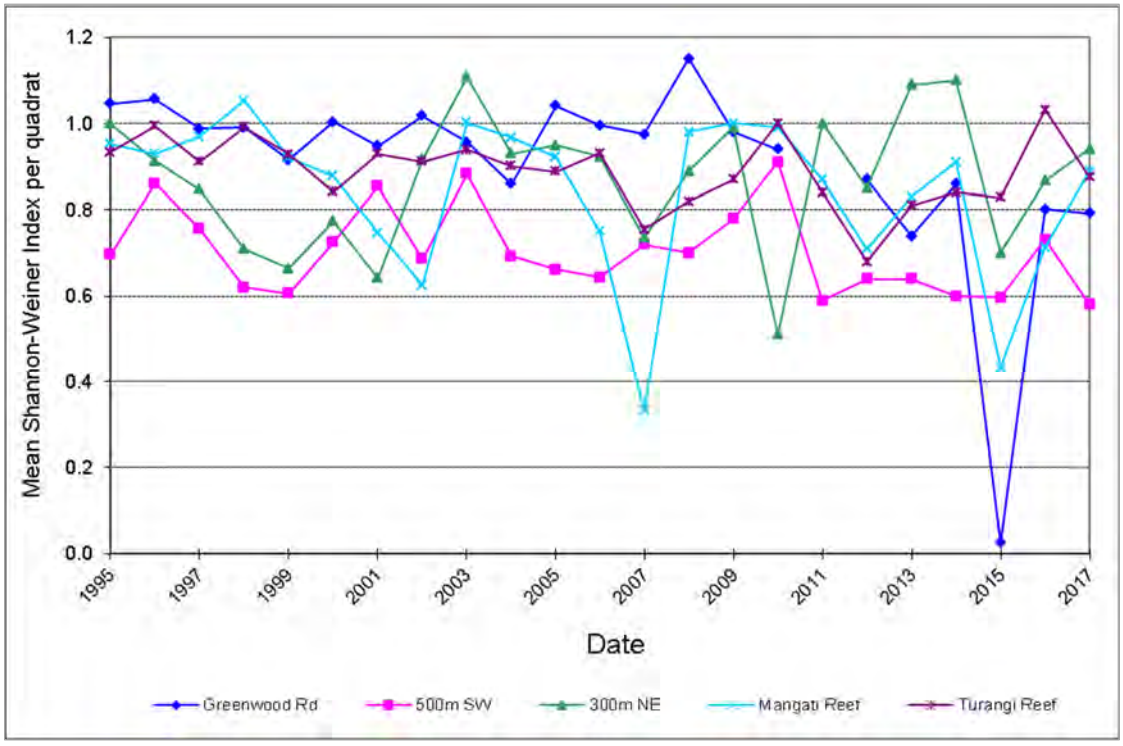

Figure 16 Mean Shannon-Weiner index per quadrat from 1995 to 2017

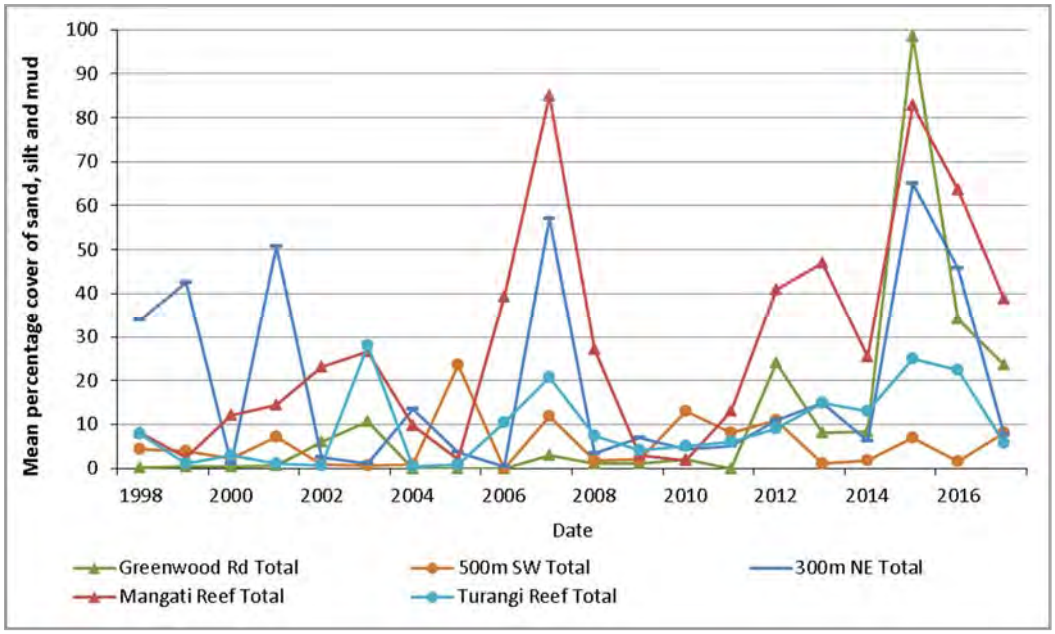

Figure 17 Mean percentage cover of sand, silt and mud at the five reef sites from 1998 to 2017

A full copy of the marine ecological survey report, including a comprehensive analysis and interpretation of results, is provided in Appendix V.

2.1.7 Shoreline bacteriological surveys

Bacteriological water quality was monitored at four coastal sites in the vicinity of the marine outfall (Figure 18) during the summer months of 2016-2017 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 18 Locations of monitoring sites in relation to the NPWWTP

During the 2016-2017 summer season, bacteriological water quality was generally good at the Fitzroy, Mangati, 300 m NE and 500 m SW sites. Water quality was relatively poor at the Waiwhakaiho River sampling site, although the faecal indicator bacteria (FIB) counts at this site were considerably lower in 2016-2017 than in the previous monitoring period.

All four coastal sites were in surveillance mode for the duration of the summer season, with no 'Alert' or 'Action' levels exceeded (Table 6). However, the majority of the 13 samples collected at the Waiwhakaiho River site exceeded the 'Action' level for *E. coli* (Table 6).

Table 6 Summary faecal indicator bacteria results for the NPWWTP sites. Enterococci counts were analysed for the four coastal sites, and *Eschericia coli* counts were analysed for the riverine Waiwhakaiho River site.

Site	Faecal indicator bacteria (cfu/100 ml)			Number of exceedances of faecal indicator bacteria guidelines [% of 13 samples]		
	No. samples	Median	Maximum	Surveillance	Alert	Action
Mangati	13	3	110	13 [100]	0 [0]	0 [0]
300m NE	13	5	140	13 [100]	0 [0]	0 [0]
500m SW	13	12	72	13 [100]	0 [0]	0 [0]
Fitzroy Beach	13	4	92	13 [100]	0 [0]	0 [0]
Waiwhakaiho River	13	610	1900	3 [23] *	2 [15] *	8 [62] *

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

Enterococci counts have typically been higher at the 500 m SW site, relative to the other three coastal sites, since monitoring began in 1996 (Figure 2). This trend was not found in the current monitoring year, with relatively low FIB counts recorded at all four coastal sites). Previous faecal source tracking investigations have indicated that gulls are likely to be the main source of faecal contamination at the 500 m SW and Waiwhakaio River sites, with these findings supported by frequent observations of high numbers of gulls at the Waiwhakaiho River and the Waiwhakaiho Reef (Photo 2).

Photo 2 Gulls at the mouth of the Waiwhakaiho River

Given the prevailing north-easterly flow, elevated FIB counts would have been expected at the 300 m NE site if wastewater discharge from the outfall was adversely affecting coastal water quality. The absence of such a

pattern and the overall low FIB counts recorded at all coastal sampling sites in 2016-2017 suggest that the outfall did not affect coastal water quality in the year under review. Ongoing monitoring will continue to shed light on the factors influencing bacteriological water quality at the sampling sites around the NPWWTP outfall.

A full copy of the report on shoreline bacteriological water quality is contained in Appendix VII.

2.1.8 Shellfish monitoring

2.1.8.1 Norovirus in shellfish flesh

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 is believed to pose the greatest health risk in seawater containing treated wastewater. Norovirus is 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 programme for the NPWWTP. Mussel flesh has been monitored for norovirus (GI and GII) at two potential impact sites (Waiwhakaiho Reef and Bell Block) since October 2012. A control site (Oakura) was also monitored initially; however this has since been discontinued as it was decided that a control site was not required for interpretation of the results. Norovirus (GI and GII) concentrations were also measured within the NPWWTP influent and effluent (see Section 2.1.3.3).

Table 7 Mussel flesh microbiology results since the NPWWTP upgrade

Operation	Date	Site	Mussel flesh norovirus	
			GI	GII
Normal: Pre-Upgrade	5 October 2012	Waiwhakaiho Reef	Negative	Negative
		Bell Block	Negative	Low
		Oakura	Negative	Negative
Upgrade: Bypass	20 August 2013	Waiwhakaiho Reef	Moderate	Extremely high
		Bell Block	Low	Moderate
		Oakura	Negative	Low
Normal: Post-upgrade	15 June 2014	Waiwhakaiho Reef	Low	Negative
		Bell Block	Negative	Low
	20 April 2015	Waiwhakaiho Reef	Negative	Low
		Bell Block	Negative	Negative
		Oakura	Negative	Negative
	6 April 2016	Waiwhakaiho Reef	Negative	Negative
		Bell Block	Negative	Negative
	25 May 2017	Waiwhakaiho Reef	Negative	Low
		Bell Block	Negative	Negative

Following the completion of the upgrade, norovirus levels in mussel flesh dropped back to low or below detection levels (on 15 June 2014; Table 7). Results from this monitoring period found that norovirus levels in mussels collected from both sites were low or below detection limits (25 May 2017). 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).

Photo 3 Shellfish health warning sign at the Waiwhakaiho River mouth

Photo 4 Green lipped mussels at Bell Block

2.2 Air

2.2.1 Inspections

Air inspections were undertaken in conjunction with the five scheduled site inspections. Odours ranging from slight to moderate were often detected at and downwind of the milliscreening building and sludge processing area. No odours were noted beyond the plant boundary on any occasion.

2.3 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with NPDC. During the year 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 consent holder 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).

In the 2016-2017 period, the Council was required to undertake significant additional investigations and interventions, and record incidents, in association with NPDC's conditions in resource consents and provisions in Regional Plans. During the year under review, there were a total of 20 incidents which resulted in discharges from the wastewater network to water ways. Twelve of these incidents related to pipe blockages or breakages, four were related to high rainfall events, one event related to power failure and the remaining three events were a result of mechanical failures. Three 14 day letters were issued in association with incidents in 2016-2017.

For the purpose of discussion, incidents have been separated into those directly associated with the NPWWTP, sewage pump station incidents and reticulation overflows.

2.3.1 New Plymouth Wastewater Treatment Plant incidents

Three incidents were reported from the NPWWTP during the 2016-2017 year (Table 8). All three of these incidents resulted from equipment failures which meant that the minimum chlorine concentration in the effluent (0.3 g/m^3) could not be met. Grab samples confirmed chlorine compliance was still being achieved. Corrective actions were taken by NPDC and the Council was not required to take any further action following the explanations provided in 14 day letters (Table 8).

Table 8 Summary of incidents at the NPWWTP during the 2016-2017 monitoring year

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
14/11/2016	Unauthorised discharge	Chlorine disinfection system failure caused the chlorine to fall below required limit in the discharged effluent due to blockage of the pump inlet filters due to an earthquake shaking up sediment in the lines.	N/A	No further action
01/02/2017	Unauthorised discharge	Chlorine disinfection system failure caused the online chlorine to fall below required limit in the discharged effluent. Grab samples confirmed chlorine compliance was still being achieved.	Analyser failures reported if the low chlorine is for greater than 15 minutes and no grab sampling was undertaken to confirm compliance with special condition 10 of the consent As per NPDC reply to 14 day letter dated 13 April 2017.	14 day letter issued; no further action following NPDC response
18/03/2017	Unauthorised discharge	Chlorine disinfection system failure caused the online chlorine to fall below required limit in the discharged effluent. Grab samples confirmed chlorine compliance was still being achieved.	Same as above	14 day letter issued; no further action following NPDC response

2.3.2 Sewage pump station incidents

There were five unauthorised discharges from sewage pump stations reported during the 2016-2017 monitoring year, summarised in Table 9. It is estimated that during the reporting period a total volume of approximately 4,000 m^3 of sewage was discharged into the receiving environment as a result of pump station discharges. Incidents were assessed on a case by case basis and no further enforcement action was taken.

Table 9 Summary of pump station overflows during the 2016-2017 year

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
06/04/2017	Colson Road SPS	High rainfall caused the Landfill leachate pump stage 1 and 2 manhole to overflow to the bypass line into the Puremu stream.	NPDC instructed the contractor to insert a bung in the discharge line and monitor the level of the overflow pond.	No further action
06/04/2017	Glen Avon SPS	High rainfall event caused wastewater overflow from the pump station.	NPDC checked site and reset pumps.	No further action
06/04/2017	Waitara Outfall SPS - to Outfall	High rainfall event caused wastewater overflow from the pump station.	Work was undertaken by NPDC to reinstall the repaired Waitara transfer pumps to increase flows able to be pumped to New Plymouth. Manual intervention was undertaken to fill all storage to the highest level possible.	No further action
02/08/2016	Inglewood Oxidation Pond	High rainfall event causing wastewater overflow from the Inglewood oxidation pond.	Samples taken of wastewater overflow.	No further action
19/07/2016	Bell Block SPS	Power outage resulted in pump failure causing wastewater overflow from the pump station.	Power restored and pumps reset.	No further action

2.3.3 Reticulation overflow incidents

Twelve unauthorised discharges occurred due to blockages in the reticulation network (Table 10). Pipe blockages were usually related to a build-up of fat in the line, or as a result of tree roots. All incidents were responded to as defined in the Incident Response Plan although there was a delay in locating the overflow reported on the 15 March 2017 resulting in a 14 day letter. No further enforcement action was required.

Table 10 Summary of reticulation overflows during the 2016-2017 year

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
29/06/2017	75 Glenpark Avenue, New Plymouth	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
16/05/2017	9 Hillside Crescent Westown, New Plymouth	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Site cleaned and sanitised.	No further action
01/05/2017	101 Seaview Road, New Plymouth	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
15/03/2017	81 Wills Road, Bell Block	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	14 day letter issued; no further action following NPDC response
13/02/2017	16 Northgate Road, New Plymouth.	Sewer line blockage from tree roots caused an overflow of wastewater from a manhole.	Site cleaned and sanitised.	No further action
05/12/2016	10 Nevada Drive, New Plymouth	Sewer line blockage caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
23/11/2016	32 Magnolia Drive, New Plymouth	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
17/11/2016	12 Frederick Place, New Plymouth	Sewer line blockage caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
31/10/2016	19a Pembroke Street, New Plymouth.	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
04/09/2016	28 Coby Sydney Drive, Bell Block.	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
29/08/2016	30 Brooklands Road, New Plymouth	Sewer line blockage from tree roots caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action
25/07/2016	65a Frankley Road, New Plymouth	Sewer line blockage from fat caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No further action

3 Discussion

3.1 Discussion of plant performance

Significant activities that occurred during the 2016-2017 period relating to the New Plymouth WWTP included the design of a master plan for the new inlet works, implementation of the master plan for the sludge dewatering process and addition of emergency storage within the Waitara sewage system. Further details are provided in the New Plymouth WWTP Annual Report provided by NPDC.

During the reporting period both Bioreactors were in full service and therefore condition 5 of consent 0882-4 was not exercised.

Conditions 18 and 19 relate to the ongoing peer review of the monitoring plan and provision of a technology report at various times during the consent period. The monitoring plan was reviewed in early 2017 and included a rerun of the Quantitative Microbial Risk Assessment (QMRA) using data collected since the original QMRA in 2012-2013. The updated monitoring plan was independently peer reviewed by John Crawford and the amended plan was approved by Council on 31 March 2017. The updated monitoring plan has been implemented since this date.

The key changes to the monitoring plan are summarised as follows:

- Reduced frequency of analysis for selected contaminants listed in condition 3 from monthly to 6 monthly recognising the long record of compliance and trend in these contaminants;
- The chlorine analyser being recognised as not suitable for compliance monitoring purposes but to be used as a back-up indicator of compliance in the absence of grab samples;
- Increasing the sampling frequency of norovirus monitoring in the plant and receiving environment from one survey to two surveys a year; and
- Removal of SEA902015 from the recreational water quality surveys due to influence from other environmental factors.

Condition 20 of consent 0882-4 requires that NPDC provide an annual report to the Council by 31 July each year. The report details 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. A report addressing these requirements for 2016-2017 was received on 31 July 2017.

The NPDC Sewer System Emergency Discharge Contingency Plan is incorporated into the Water and Waste Incident Response Plan (IRP). As required by condition 21 of consent 0882-4, the IRP was last reviewed in December 2015, and further updates to the wastewater section were completed in July 2016 and February 2017.

An annual meeting with representatives of the Council, Ngati Tawhirikura Hapu, and interested submitters is required by condition 22 of consent 0882-4. This meeting was held 19 January 2017. 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.

3.2 Environmental effects of exercise of consents

3.2.1 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 2016-2017 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 24-hour composite samples. Inter-laboratory comparisons and checks of compliance with consent conditions were also undertaken by the Council. Through this monitoring, NPDC demonstrated 100% compliance regarding contaminants as per condition 3 of consent 0882-4. There were no breaches of the SS or BOD limit prescribed by condition 4. Assessment of compliance with condition 10, consent 0882-4, is assessed using results from the effluent grab sample. In the reporting period 355 effluent grab samples were analysed for total available chlorine, achieving 100% compliance. From influent to effluent, norovirus numbers were reduced by over four orders of magnitude. Overall, monitoring results indicated that the effluent discharge from the NPWWTP to the Tasman Sea was of a high quality during the 2016-2017 year.

Monitoring of effects on the receiving environment consisted of an intertidal marine ecological survey, shoreline faecal indicator bacteria monitoring and the analysis of norovirus in mussel tissue. Low levels of Norovirus GII were detected in mussels collected from the Waiwhakaiho Reef on 25 May 2017. Apart from this, there were no other significant detectable effects in the receiving environment resulting from authorised NPWWTP discharges during the 2016-2017 monitoring period.

3.2.2 Sludge lagoon and sludge disposal monitoring

NPDC holds consent 2982-4 which allows the discharge of leachate from the sludge stabilisation lagoon to groundwater.

Monitoring of the sludge lagoon facility during the 2016-2017 monitoring period consisted of monthly testing of groundwater bores and nearby surface water in an open drain by NPDC, and inspections by the Council. Additional monitoring was also undertaken by the Council as part of a 12 month groundwater investigation following a recommendation in the 2015-2016 compliance report.

The groundwater results from the three bores, along with the surface water results from the two drain sites indicate that seepage from the lagoon to groundwater and the drainage channel may be occurring. This is indicated by elevated levels of different contaminants found in the groundwater and drain surrounding the lagoon, particularly nitrogen. Additional monitoring is being undertaken to provide data that can be used to improve the understanding of the localised groundwater flow paths and the potential for any wider environmental impact from the seepage. The monitoring is being undertaken as part of a 12 month investigation and includes:

- Surveying the elevations of the sludge lagoon, peripheral drain and all monitoring wells in order to provide a reference against a common datum (sea level) to allow for the assessment of hydraulic gradients and groundwater flow directions. Ultimately, leading to a greater understanding of the movement of leachate from the lagoon.
- Increasing the sludge lagoon sampling regime to include an existing two additional monitoring bores, as well as a third drain sampling site.
- Biannual testing for metals in the samples collected at the additional sites.
- Quarterly sampling across all monitoring bores using a low-flow sampling methodology with the intention of assessing the potential for attenuation of nitrogen species and microbes along the groundwater flow path.

The extended sampling programme is still underway and the results from this investigation will be assessed upon completion and used to determine recommendations for potential work in the future.

3.2.3 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 existing biofilter. This facility is 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 that odours ranged from slight to moderate. No odours were noted beyond the plant boundary on any occasion.

3.3 Evaluation of performance

A tabular summary of NPDC's compliance record for the year under review is set out in Tables 11-15.

Table 11 Summary of performance for Consent 0882-4

Purpose: ***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, NPDC annual report, operated as per design	Yes
3. Concentration limits upon potential contaminants in discharge	Samples collected by both Council and consent holder: 100% compliance achieved	Yes
4. Concentration limits upon suspended solids (SS) and BOD	Samples collected by both Council and consent holder: 95% compliance required, 100% compliance achieved for SS and BOD	Yes
5. Concentration limits upon SS and BOD when aeration basins off-line	Samples collected by both Council and consent holder	N/A
6. Public notification prior to taking aeration basin off-line	Not exercised during 2016-2017	N/A
7. Minimum duration off-line to achieve purpose	Not exercised during 2016-2017	N/A
8. Notification to Council prior to taking aeration basins off-line	Not exercised during 2016-2017	N/A
9. Consent holder to erect signage during off-line periods	Not exercised during 2016-2017	N/A
10. Total available chlorine at least 0.3 gm^{-3} in effluent	Presence of chlorine in effluent grab samples collected by Council and consent holder.	Yes
11. Effluent through 3 mm screen	Inspections, consultation with consent holder	Yes

Purpose: *To discharge wastewater to the Tasman Sea*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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	Approved March 2017	Yes
19. Provide Technology Report in March 2027 and 2037	Due March 2027	N/A
20. Provide Annual Report by 31 July	Reports received for 2016-2017	Yes
21. Maintain Contingency Plan	Last comprehensive review of the Incident Response Plan undertaken December 2015, further updates made in July 2016 & February 2017	Yes
22. Annual meeting with Council, iwi and others	Meeting held January 2017	Yes
23. Meeting to include future management of wastewater	Next scheduled in 2027	N/A
24. Review of consent	Next scheduled in June 2022	Not required
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **High**

N/A = not applicable

Table 12 Summary of performance for Consent 1826-2

Purpose: *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	Yes
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 Overall assessment of administrative performance in respect of this consent		**High** **High**

N/A = not applicable

Table 13 Summary of performance for Consent 2982-4

Purpose: *To discharge leachate from a sludge stabilisation lagoon to groundwater*		
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 River	Monitoring undertaken by consent holder	Yes
3. No direct discharge of contaminants to surface water from sludge lagoons	Inspections and results of monitoring	Yes

Purpose: *To discharge leachate from a sludge stabilisation lagoon to groundwater*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
4. No adverse effects upon ground or surface waters	Inspections and results of monitoring	**No** Elevated concentrations of contaminants were found in the groundwater and surface water adjacent to the sludge lagoon
5. Review of consent	No further provision for review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**Improvement required** **High**

N/A = not applicable

Table 14 Summary of performance for Consent 4593-3

Purpose: *To erect, place, maintain and use a marine outfall*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Structures maintained	NPDC inspection	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	Next scheduled in June 2020	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**N/A** **N/A**

N/A = not applicable

Table 15 Summary of performance for Consent 4740-2

Purpose: *To discharge contaminants to 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
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **High**

N/A = not applicable

During the year, NPDC demonstrated an overall good level of environmental and high level of administrative performance with the resource consents as defined in Section 1.1.4. During the year under review, there were a total of 20 incidents which resulted in discharges from the wastewater network to water ways. Twelve of these incidents related to pipe blockages or breakages, four were related to high rainfall events, one event related to power failure and the remaining three events were a result of mechanical failures. Three 14 day letters were issued in association with incidents in 2016-2017. Ratings are as defined in Section 1.1.4

3.4 Recommendations from the 2015-2016 Annual Report

In the 2015-2016 Annual Report, it was recommended:

1. THAT aside from monitoring related to the sludge lagoon, shoreline water quality and shellfish metals content, the monitoring programme for the NPWWTP in the 2016-2017 year remains unchanged from that of 2015-2016.
2. THAT a survey is undertaken to determine the elevations of the sludge lagoon, peripheral drain and all monitoring wells.
3. THAT the monthly sludge lagoon monitoring regime is extended to include an additional two monitoring wells, an additional drain sampling site and biannual metals analyses.
4. THAT all monitoring wells are sampled on a quarterly basis using 'low-flow' methodology.

5. THAT bacteriological shoreline water quality monitoring at five sites is included in the 2016-2017 monitoring programme.
6. THAT monitoring of metals in mussel tissue is next undertaken in the 2017-2018 year.
7. THAT the optional review of resource consent 0882-4 is not exercised in 2017.

These recommendations were implemented during the 2016-2017 monitoring year.

3.5 Alterations to monitoring programmes for 2017-2018

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting to the regional community.

The Council also takes into account 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 exercising resource consents.

During the 2016-2017 monitoring period recommendations made in the monitoring programme review were implemented.

It is proposed that for 2017-2018 that the monitoring programme remains the same as that outlined in the review of the monitoring programme, as implemented in the 2016-2017 year.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2017-2018.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the NPWWTP in the 2017-2018 year continue at the same level as in 2016-2017 with recommendations from the review of the monitoring programme implemented.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT results of the additional groundwater monitoring are reported and recommendations made in relation to future monitoring.
4. THAT monitoring of metals in mussel tissue is undertaken.

Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

Ammoniacal-N	Both forms of ammonia; unionised and ionised (NH_3 and NH_4).
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.
DRP	Dissolved reactive phosphorous.
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/m3	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.
Incident Register	The 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.
Oxidised-N	Total oxidised nitrogen; nitrite and nitrate (NO_2 and NO_3).
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.
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 including all subsequent amendments.

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

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Appendix I

Resource consents held by NPDC

(For a copy of the signed resource consent
please contact the TRC Consents department)

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

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

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

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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 1826-2

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

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Director-Resource Management

Consent 2982-4

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

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Director-Resource Management

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:	10 September 2014
Commencement Date:	10 September 2014

Conditions of Consent

Consent Granted:	To occupy the Coastal Marine Area with a marine outfall as part of the New Plymouth wastewater treatment system
Expiry Date:	01 June 2041
Review Date(s):	June 2020, June 2026, June 2032, June 2038
Site Location:	115 Rifle Range Road, Waiwakaiho
Legal Description:	Secs 5-6 SO 314271 Pt Sec 224 Hua Dist Blk II Paritutu SD (Site of structure)
Grid Reference (NZTM)	1696272E-5679362N
Catchment:	Tasman Sea

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

General condition

a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. This consent authorises the occupation of space in the Coastal Marine Area by the structure existing at the time the application for this consent was lodged, and as described in the application. Any change to the nature or scale of the structure may therefore need to be authorised by a formal process in accordance with the Resource Management Act 1991.

2. The consent holder shall maintain the structure in a safe and sound condition such that it continues to function effectively as an outfall and as required in the conditions of any consent to discharge through it.

3. 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 2020 and/or June 2026 and/or June 2032 and/or June 2038, 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 10 September 2014

For and on behalf of
Taranaki Regional Council

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A D McLay
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

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Director-Resource Management

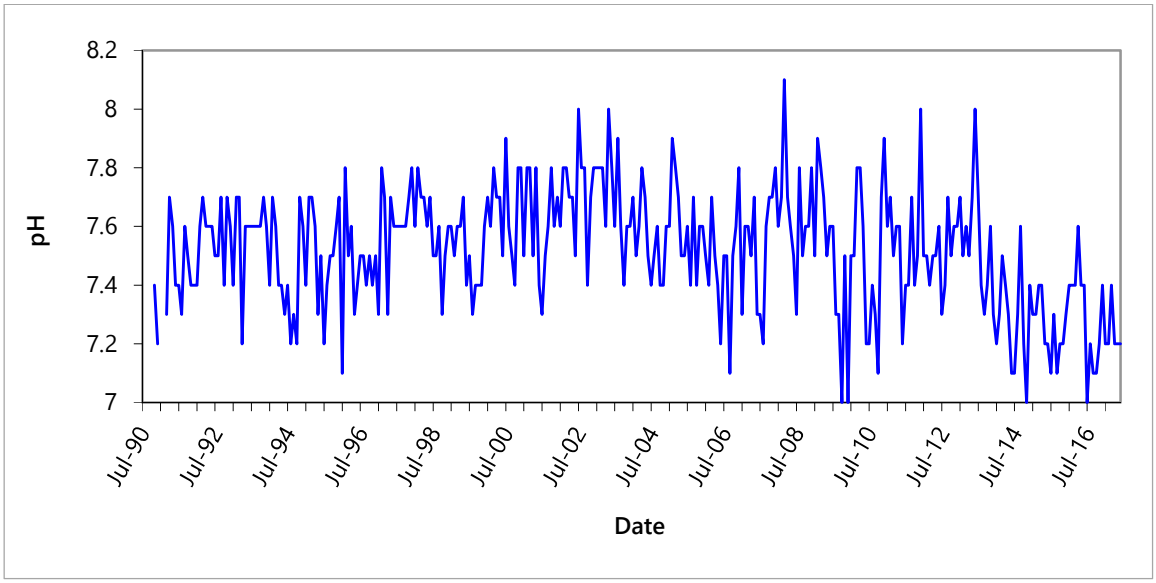
Appendix II

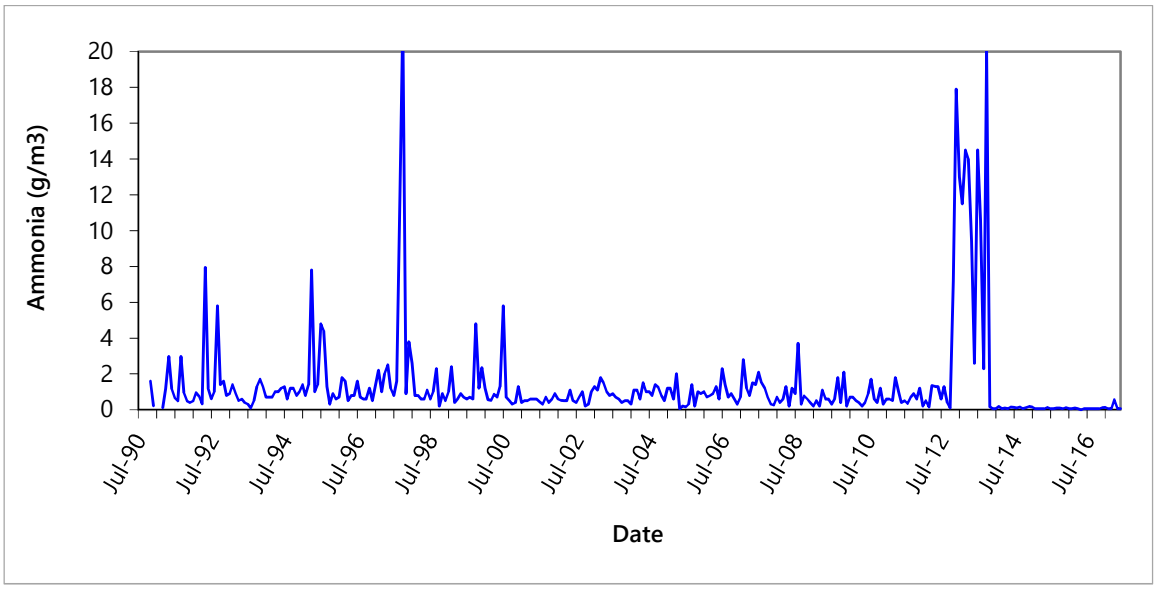
Results of monthly composite effluent monitoring 2016-2017

Results from monthly effluent composite samples (2016-2017)														
Month	**pH**	**Ammoniacal - N (g/m^3)**	**COD (g/m^3)**	**NOx (g/m^3)**	**RDP (g/m^3)**	**Cyanide (g/m^3)**	**Phenols (g/m^3)**	**Zinc (g/m^3)**	**Copper (g/m^3)**	**Chromium (g/m^3)**	**Nickel (g/m^3)**	**Cadmium (g/m^3)**	**Lead (g/m^3)**	**Mercury (g/m^3)**
Jul-16	7.0	<0.1	25	8.4	2.07	0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Aug-16	7.2	<0.1	18	4.7	0.58	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Sep-16	7.1	<0.1	20	6.9	<0.08	<0.02	<0.05	<0.04	<0.02	<0.1	<0.008	<0.002	<0.03	<0.001
Oct-16	7.1	<0.1	20	7	0.41	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Nov-16	7.2	<0.1	22	6.9	0.65	0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Dec-16	7.4	0.11	26	6.7	0.53	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Jan-17	7.2	0.13	19	7.9	2.01	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Feb-17	7.2	<0.1	16	5.8	0.36	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.001
Mar-17	7.4	<0.1	23	6.5	0.81	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	
Apr-17	7.2	0.56	28	6.8	0.96	0.025	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	
May-17	7.2	<0.1	17	6.8	0.11	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	
Jun-17	7.2	<0.1	20	6.8	0.62	<0.02	<0.05	<0.04	<0.02	<0.02	<0.008	<0.002	<0.03	<0.00008

Appendix III

Graphical results of monthly composite effluent monitoring 1990-2017


pH
8.2
8
7.8
7.6
7.4
7.2
7
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Jul-16
Date


Ammonia (g/m3)
20
18
16
14
12
10
8
6
4
2
0
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
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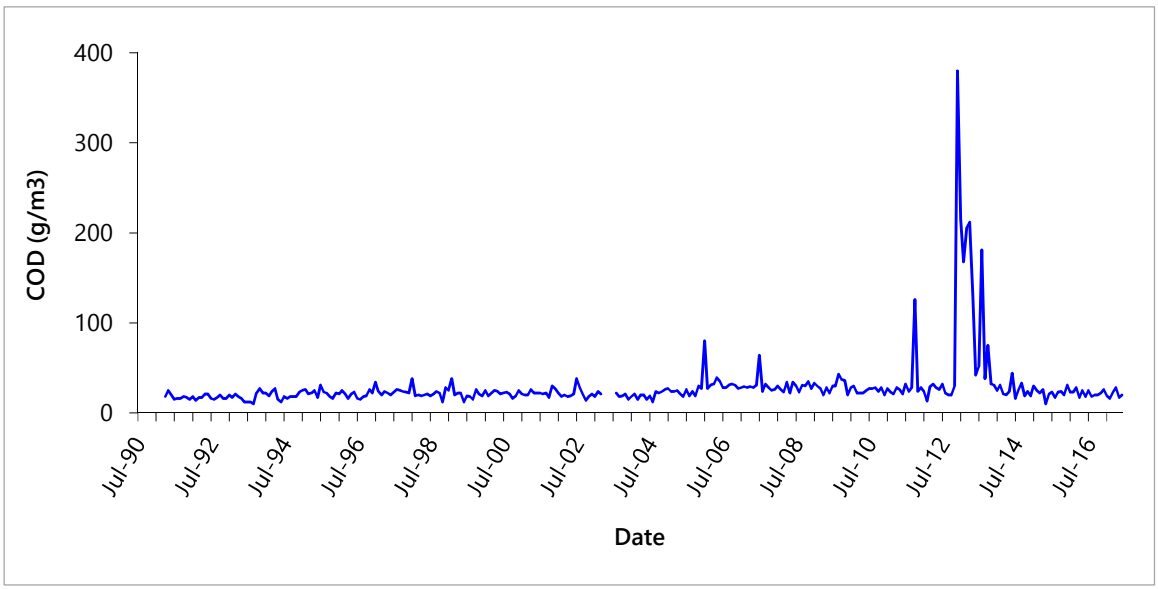
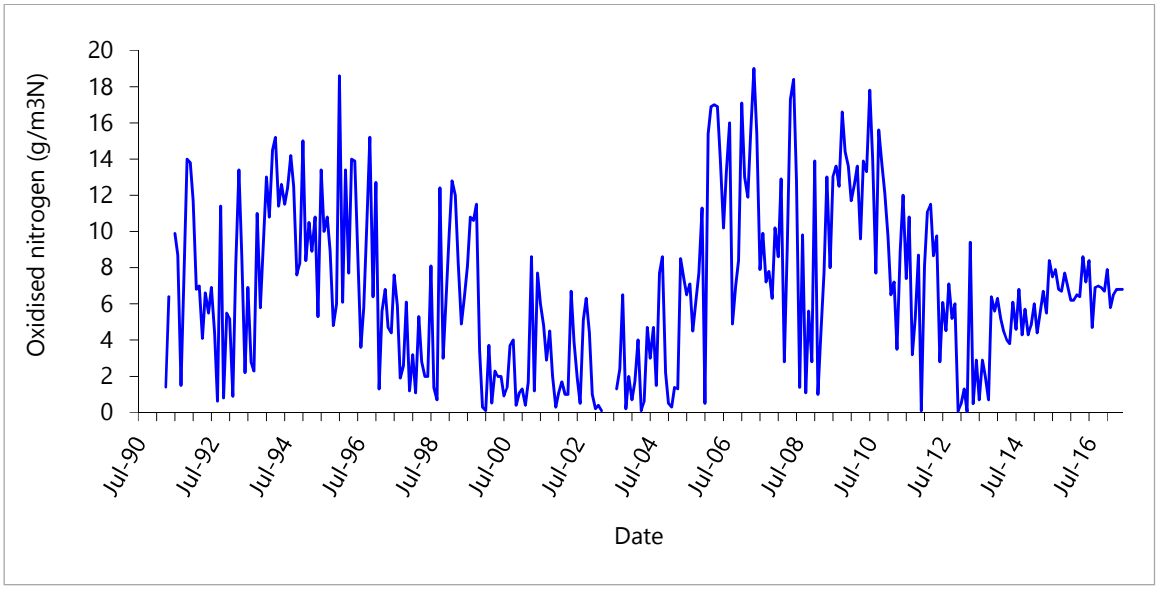
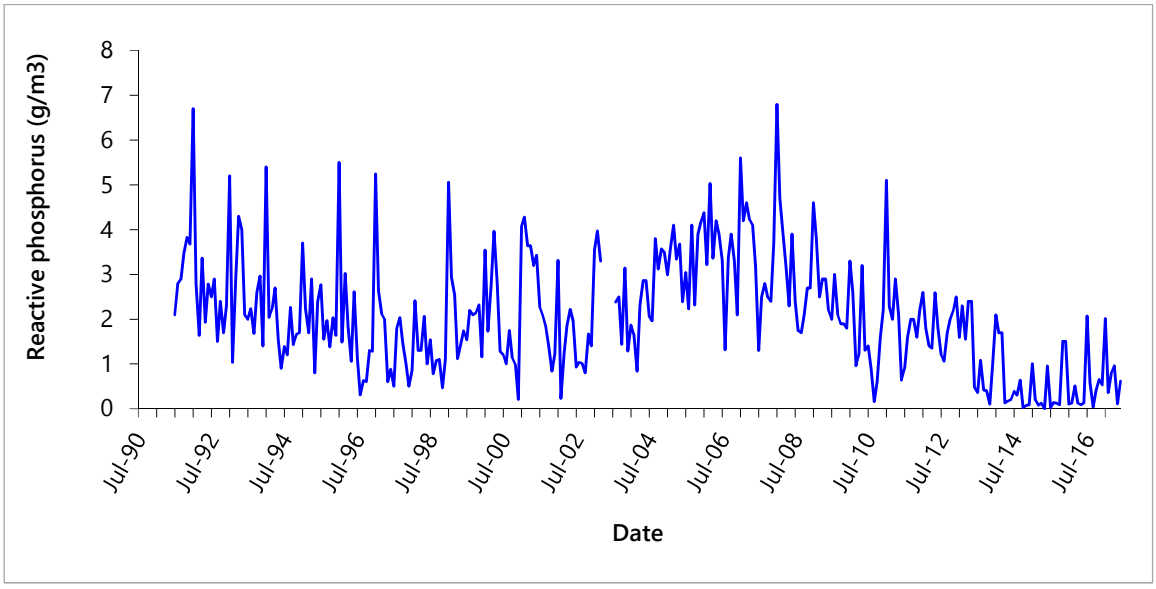
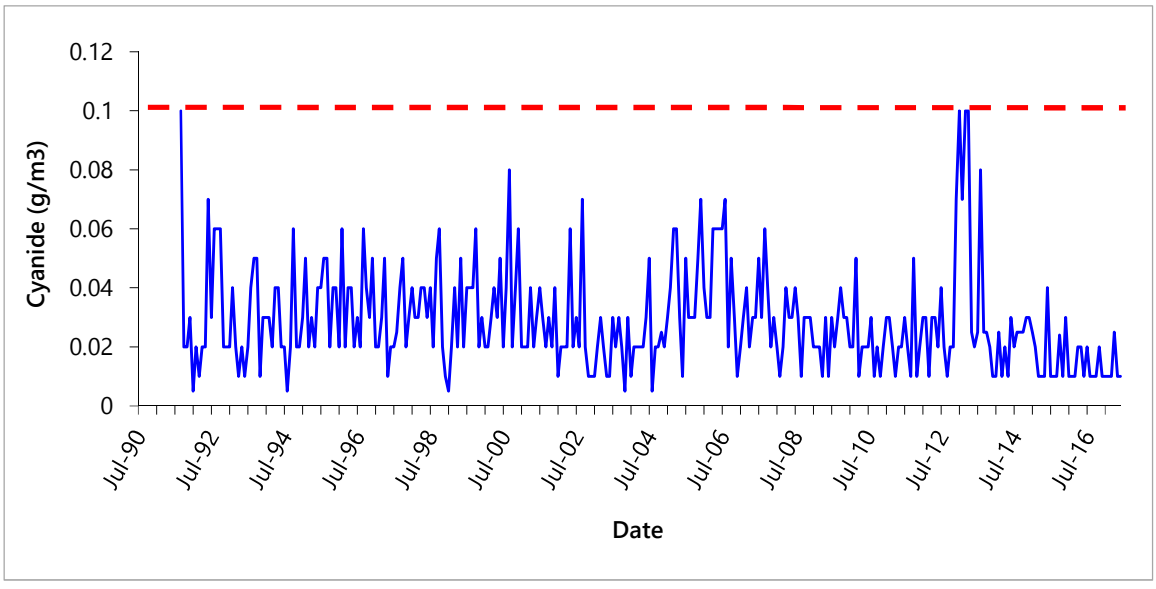
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Jul-16
Date

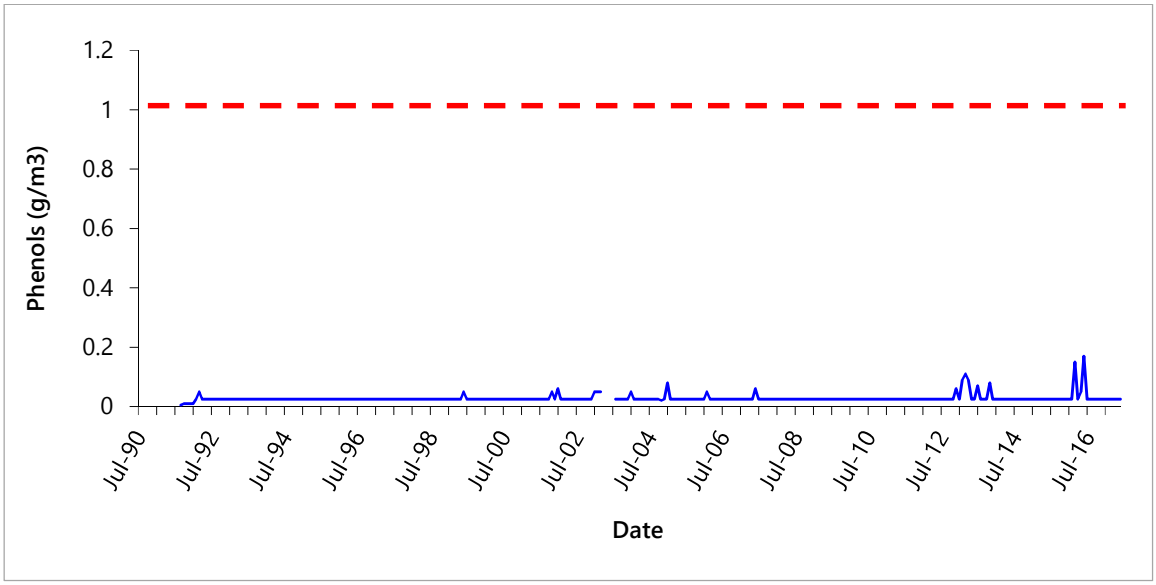

COD (g/m3)
400
300
200
100
0
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Jul-16
Date







Note: Consent limit indicated by dashed red line - Detection limit = 0.02 g/m^3



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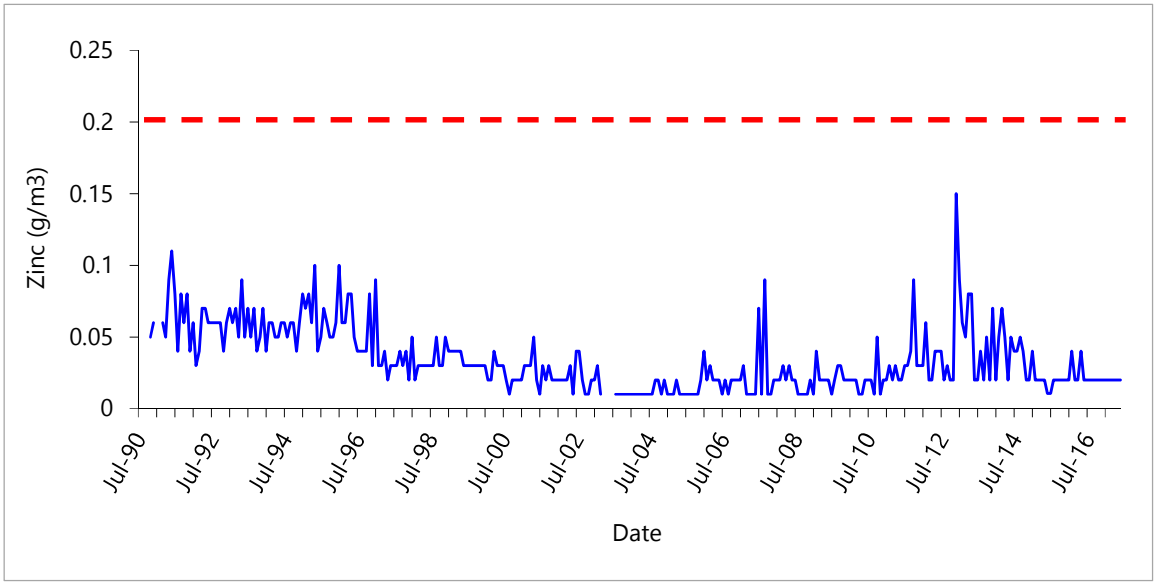

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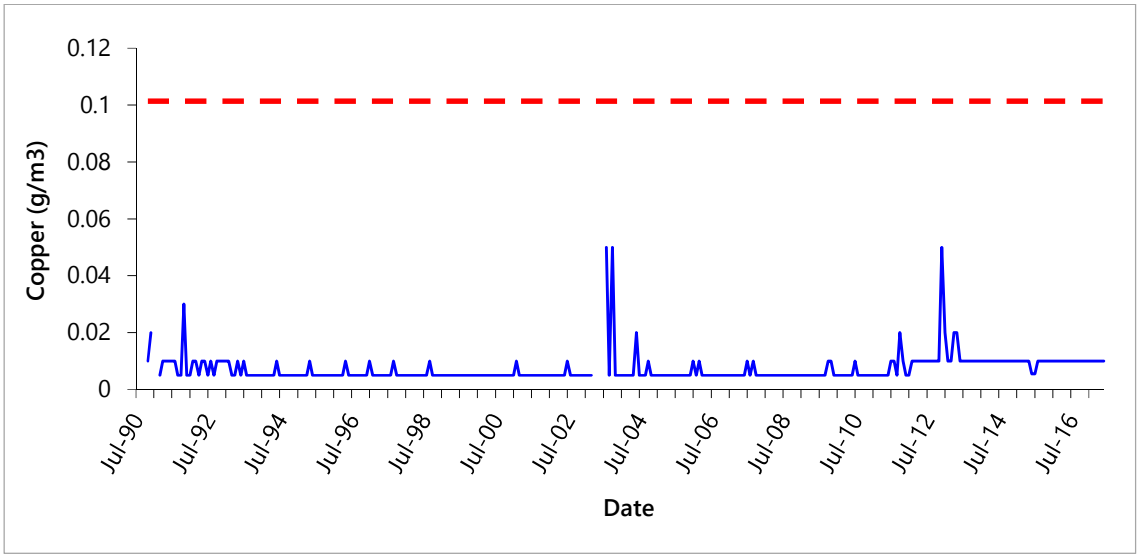

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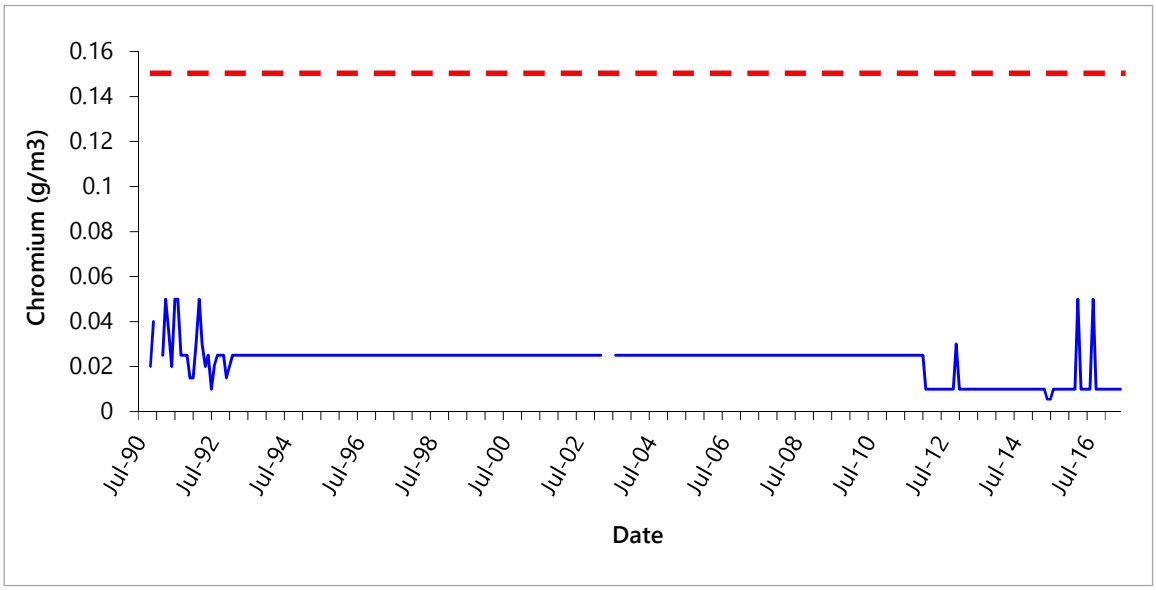

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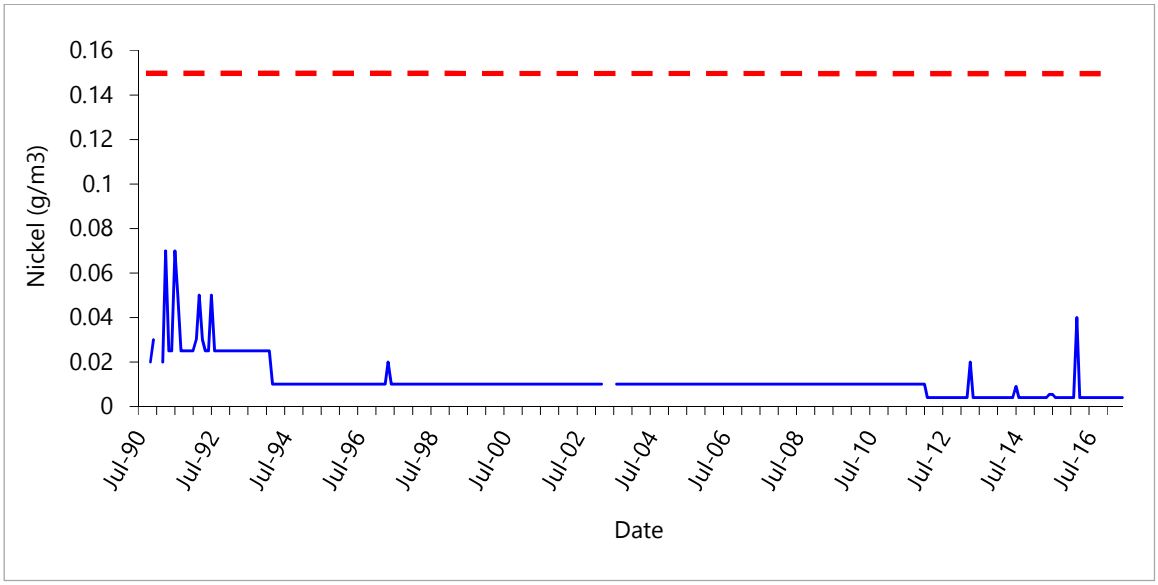

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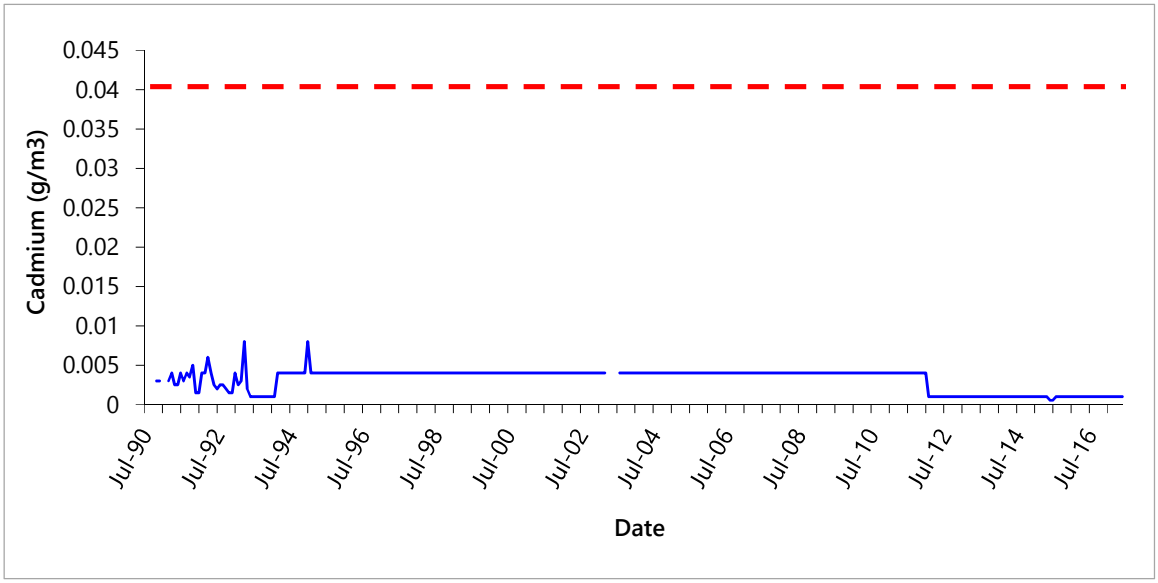

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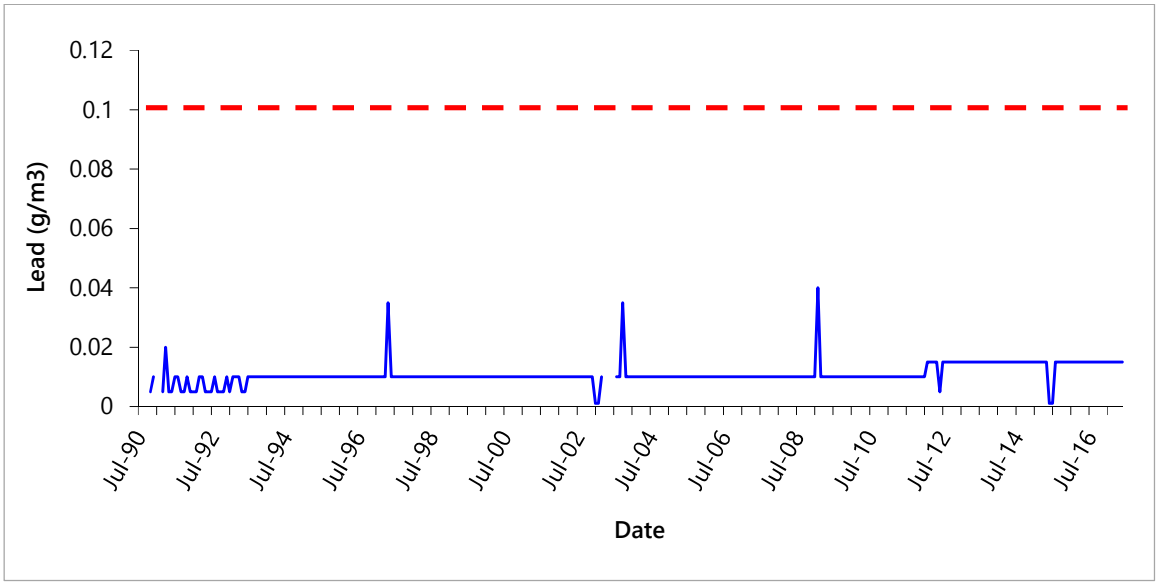
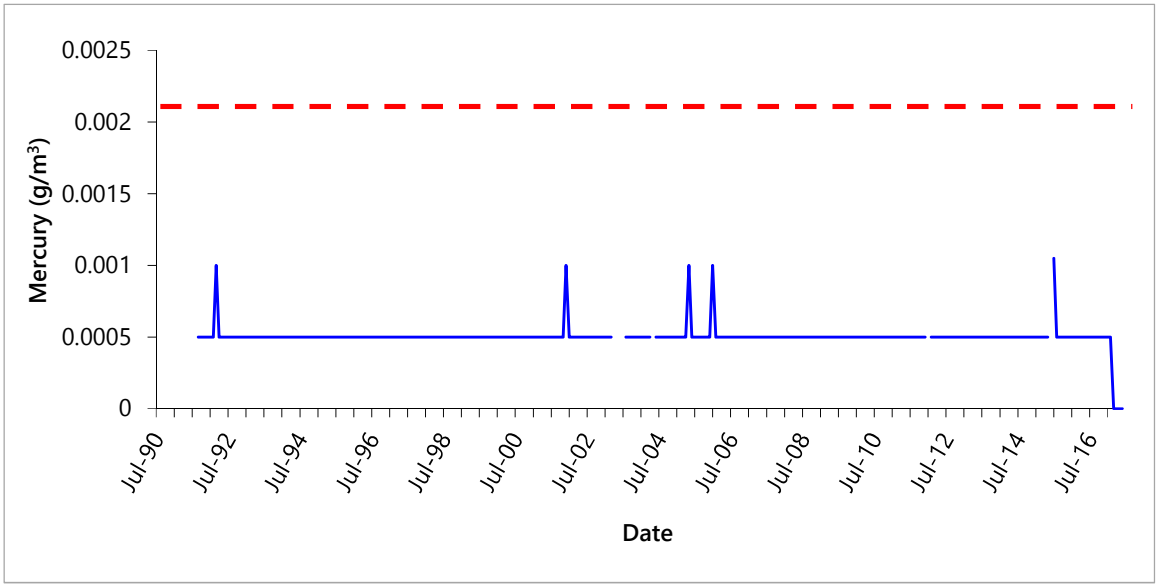


Note: Consent limit indicated by dashed red line - Detection limit between 0.0021 - 0.03 g/m^3



Note: Consent limit indicated by dashed red line - Detection limit between 0.001 - 0.0021 g/m^3

Appendix IV

Results of sludge lagoon monitoring 2016-2017

Bore 1	Parameter					
	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml	RDP g/m³	NOx g/m³	COD g/m³
Jun-16	5.8	2.2	2.5	0.04	11	4
Jul-16	5.7	1.6	2.5	0.04	18.6	10
Aug-16	5.2	0.05	410	0.04	28	8
Sep-16	5.7	0.05	2.5	0.04	10.7	10
Oct-16	5.5	0.05	2.5	0.04	9.3	10
Nov-16	5.8	1.02	100	0.04	1.8	12
Dec-16	6.1	1.3	15	0.08	1.3	17
Jan-17	6.2	3.1	2.5	0.31	0.34	12
Feb-17	6	2.1	1	0.31	2.3	11
Mar-17	6.2	1.5	5	0.35	1.6	16
Apr-17	6.1	2.4	13	0.1	2.9	16
May-17	5.5	0.1	15	0.04	5.2	14
Summary of 2016-2017 results						
Minimum	5.2	0.05	1	0.04	0.34	8
Maximum	6.2	3.1	410	0.35	28	17
Median	5.75	1.16	9	0.04	4.05	12
Historical statistics (1990-2016)						
Number	285	285	282	95	285	284
Minimum	4.9	0.05	1	0.015	0.01	1
Maximum	7.1	100	2300	2.78	18.3	48
Median	6.2	2.6	5	0.03	0.32	12

Note: Figures in red indicate that the result was below detection limit (the lower limit being twice the value of the red figure). Data has been expressed this way for statistical purposes.

Bore 2	Parameter					
	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml	RDP g/m³	NOx g/m³	COD g/m³
Jul-16	5.7	0.05	180	0.04	0.14	23
Aug-16	5.8	0.05	320	0.04	0.04	35
Sep-16	5.9	0.05	2.5	0.09	0.8	28
Oct-16	5.8	0.05	5	0.04	0.12	26
Nov-16	6	0.45	5	0.04	0.04	35
Dec-16	5.8	0.24	2.5	0.04	0.3	30

Bore 2	Parameter					
	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml	RDP g/m³	NOx g/m³	COD g/m³
Jan-17	6.2	1.8	2.5	0.15	0.04	44
Feb-17	5.8	0.11	260	0.04	0.04	25
Mar-17	5.8	0.05	30	0.04	1.1	23
Apr-17	5.6	0.05	1840	0.04	11.9	52
May-17	5.8	0.05	240	0.1	0.7	72
Jun-17	5.8	0.05	23	0.04	1.4	28
Summary of 2016-2017 results						
Minimum	5.6	0.05	2.5	0.04	0.04	23
Maximum	6.2	1.8	1840	0.15	11.9	72
Median	5.8	0.05	26.5	0.04	0.22	29
Historical statistics (1990-2016)						
Number	285	284	283	95	285	284
Minimum	4.9	0.05	0.5	0.015	0.02	6
Maximum	7.4	25	10000	0.26	40	181
Median	6.1	2.1	5	0.025	0.13	16

Bore 3	Parameter					
	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml	RDP g/m³	NOx g/m³	COD g/m³
Jul-16	5.9	0.05	95	0.04	0.2	77
Aug-16	6.5	0.05	290	0.09	0.1	53
Sep-16	6.3	0.05	57	0.1	0.4	42
Oct-16	6.3	0.05	10	0.09	0.22	48
Nov-16	6.2	0.16	40	0.04	0.24	29
Dec-16	6.1	0.12	20	0.04	0.3	46
Jan-17	6.2	0.47	5	0.04	0.04	44
Feb-17	6.2	0.05	5400	0.04	0.09	27
Mar-17	6.2	0.23	110	0.14	0.5	23
Apr-17	6.2	0.05	880	0.04	0.5	22
May-17	6.2	0.05	770	0.08	0.2	25

Bore 3	Parameter					
	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml	RDP g/m³	NOx g/m³	COD g/m³
Jun-17	6.3	0.05	250	0.08	0.5	85
Summary of 2016-2017 results						
Minimum	5.9	0.05	5	0.04	0.04	22
Maximum	6.5	0.47	5400	0.14	0.5	85
Median	6.2	0.05	102.5	0.06	0.23	43
Historical statistics (1990-2016)						
Number	276	276	276	85	274	275
Minimum	5	0.05	2.5	0.025	0.02	1
Maximum	7.3	198	72000	0.8	64	740
Median	6.3	0.6	5	0.05	0.2	23

Open Drain	Point 2			Point 3		
	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml	pH	Ammoniacal nitrogen g/m³	Faecal coliforms No./100ml
Jul-16	6.6	0.72	140	6.7	4	200
Aug-16	6.6	0.51	40	6.7	5.4	5
Sep-16	6.7	0.49	137	6.6	3.9	663
Oct-16	6.6	0.51	770	6.6	3.2	1160
Nov-16	6.6	0.32	2300	6.6	2.6	6000
Dec-16	6.6	0.56	190	6.7	5.1	440
Jan-17	6.6	0.45	233	6.6	2	480
Feb-17	6.6	0.57	530	6.6	3	1120
Mar-17	6.6	0.54	730	6.6	2.8	810
Apr-17	6.6	0.5	3060	6.7	2.4	7300
May-17	6.8	0.52	135	6.6	3.1	407
Jun-17	6.6	0.47	103	6.7	4.8	120
Summary of 2016-2017 results						
Minimum	6.6	0.32	40	6.6	2	5
Maximum	6.8	0.72	3060	6.7	5.4	7300
Median	6.6	0.51	211.5	6.6	3.15	571.5

Historical statistics (1990-2016)						
Number	280	280	279	279	280	279
Minimum	6	0.005	5	6.4	0.13	5
Maximum	7	7.5	6960	7.1	27	13280
Median	6.6	0.5	80	6.7	4.95	120

Appendix V

Marine ecological survey
2016-2017

Memorandum

To: Science Manager – Hydrology/Biology, Regan Phipps
From: Scientific Officer, Emily Roberts and Technical Officer, Thomas McElroy
File: 1820245
Date: 15 February 2017

New Plymouth Wastewater Treatment Plant Marine Outfall - Marine Ecological Survey January 2017

1. Introduction

The New Plymouth District Council (NPDC) operates the New Plymouth Wastewater Treatment Plant. The plant receives and treats the municipal wastewater from a large proportion of North Taranaki; the major inputs are New Plymouth, Inglewood, Bell Block, Waitara and Oakura. The treated wastewater then discharges through a 450 m 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 11 and 31 January 2017 as part of the 2016-2017 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 five sites: 500 m south west of the outfall on the Waiwhakaiho Reef (SEA902015), 300 m north east of the outfall on the Waiwhakaiho Reef (SEA902010), the Mangati Reef (SEA902005) approximately 2.2 km north east of the outfall and the two control sites at Turangi Reef (SEA900095) approximately 16 km north east of the outfall, and Greenwood Road (SEA903070) approximately 22 km south west of the outfall (Photographs 1-5).

Photograph 1 Potential impact site at 500 m south west of the outfall (SEA902015) 12 Jan 2017

Photograph 2 Potential impact site at 300 m north east of the outfall (SEA902010) 30 Jan 2017

Photograph 3 Potential impact site at the Mangati Reef (SEA 902005) 11 Jan 2017

Photograph 4 Control site at Greenwood Road (SEA903070) 12 Jan 2017

Photograph 5 Control site at Turangi Reef (SEA900095) 31 Jan 2017

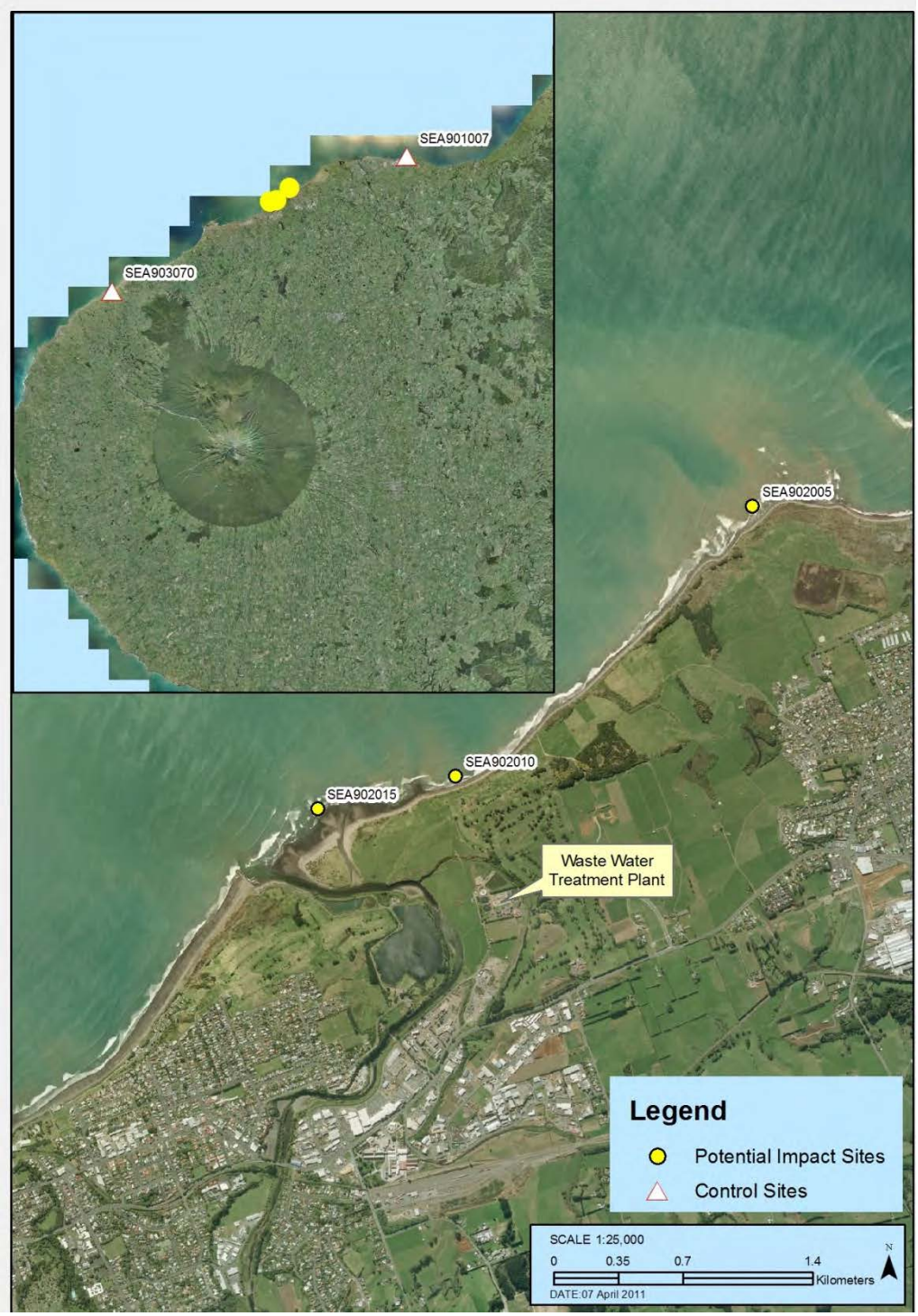


Figure 1 Location of the intertidal survey sites

At each site, a 50 m transect was laid parallel to the shore, approximately 0.6 metres above chart datum. This transect was used to establish five 5 m x 3 m 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 3 mm 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.

Table 1 Summary statistics – Summer 2016/17

Site	Number of quadrats	Mean number of species per quadrat			Mean Shannon-Weiner index per quadrat		
		Algae	Animals	Total Species	Algae	Animals	Total Species
500 m SW	25	2.08	9.20	11.28	0.214	0.525	0.580
300 m NE	25	5.28	11.80	17.08	0.626	0.791	0.941
Mangati Reef	25	5.68	9.24	14.92	0.610	0.684	0.889
Turangi Reef	25	4.84	13.28	18.12	0.511	0.746	0.875
Greenwood Road	25	8.76	8.72	17.48	0.751	0.541	0.792

3.1 Number of Species per Quadrat Data

Figure 2 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.

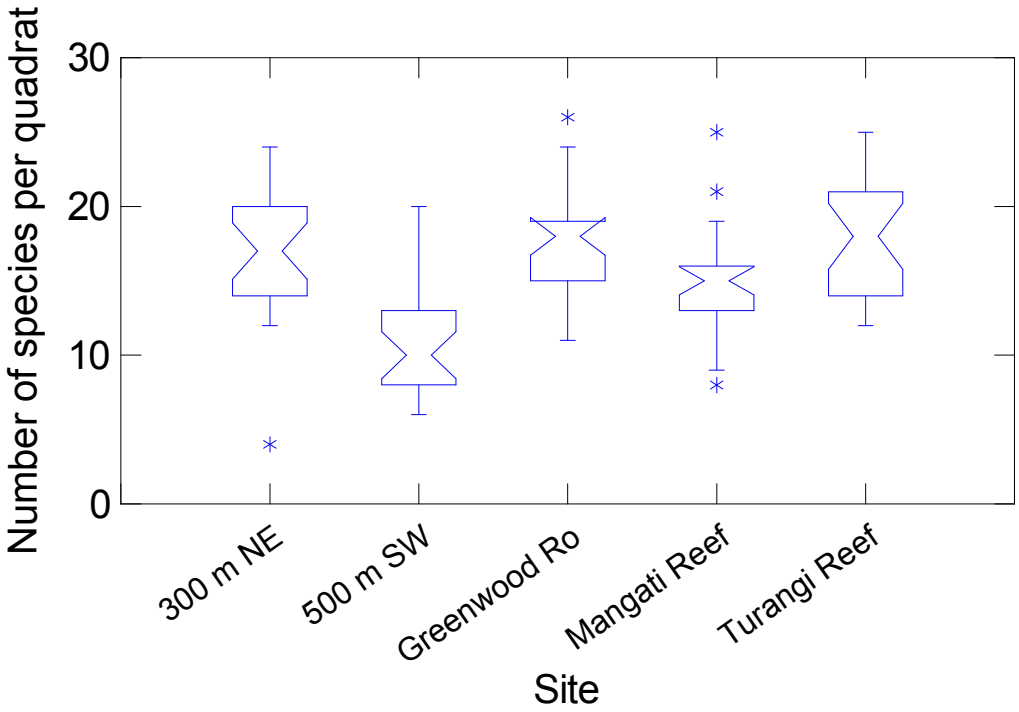


Figure 2 Box and whisker plot of total number of species per quadrat

The data from each site was normally distributed at the 95% confidence level (Lilliefors test, P >0.05). The data exhibited an acceptable level of homoscedasticity

(based on an assessment of the box and whisker plots; Figure 2). Given that the data was normally distributed and that there was even variance across surveys, the necessary assumptions for an ANOVA test had been met.

There was a significant difference in the number of species per quadrat between sites using ANOVA ($F_{4, 120} = 11.99$, $P < 0.001$). The mean number of species per quadrat at each site increased in the following order: 500 m SW, Mangati Reef, 300 m NE, Greenwood Road, Turangi Reef (Table 1). The mean number of species at the site 500 m SW of the outfall was significantly lower than at any of the other sites (Table 2). The mean number of species at Turangi Reef was significantly greater than at Mangati Reef. There were no further significant differences between sites.

Table 2 Tukey test with number of species per quadrat

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

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

3.2 Shannon-Weiner Diversity Index Data

Figure 3 shows the Shannon-Weiner index (SW index) per quadrat at each site as a box and whisker plot.

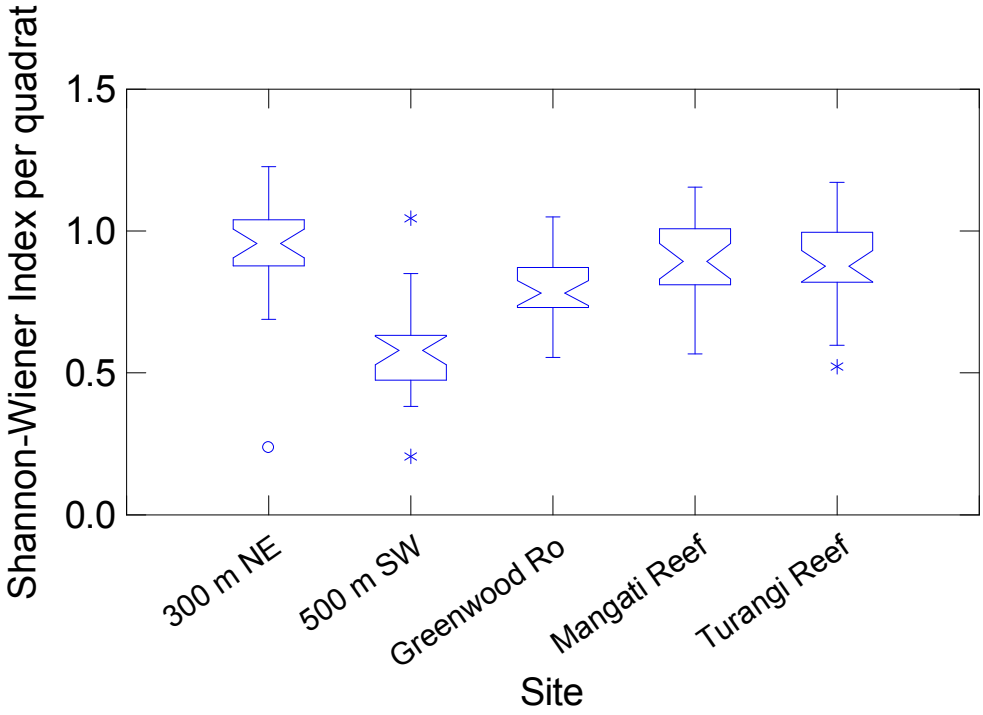


Figure 3 **Box and whisker plot of Shannon-Wiener index per quadrat**

The data from each site was normally distributed at the 95% confidence level (Lilliefors test, P >0.05). The data exhibited an acceptable level of homoscedasticity (based on an assessment of the box and whisker plots; Figure 3). Given that the data was normally distributed and that there was even variance across surveys, the necessary assumptions for an ANOVA test had been met.

There was a significant difference in the number of species per quadrat between sites using ANOVA ($F_{4, 120} = 18.36$, $P < 0.001$). Mean Shannon-Wiener Index increased across the sites from lowest to highest in the following order: 500 m SW, Greenwood Road, Turangi Reef, Mangati Reef, 300 m NE (Table 1). The mean Shannon-Wiener Index at the site 500 m SW of the outfall was significantly lower than at any of the other sites (Table 2).The mean Shannon-Wiener Index at the site 300 m NE of the outfall was significantly higher than at the Greenwood Road site. There were no further significant differences between the sites.

Table 3 Wilcoxon signed ranks test of Shannon-Weiner diversity indices

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

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

3.3 Sand and silt/mud cover

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

Table 4 Mean percentage cover of sand and silt/mud per quadrat at each site

Site	Sand (%)	Silt/mud (%)	Total (%)
500 m SW	8.00	0.00	8.00
300 m NE	7.46	0.08	7.54
Mangati Reef	38.8	0.00	38.8
Turangi Reef	5.73	0.08	5.81
Greenwood Road	20.96	2.72	23.68

Sand cover was relatively low at Turangi Reef and at the sites 500 m SW and 300 NE of the outfall. Sand cover was moderate and high at Greenwood Road and Mangati Reef, respectively. The results from this survey revealed a decrease in sand cover from the previous summer at four of the five sites (Figure 4). Previous studies on intertidal reefs in Taranaki have demonstrated that at 30% cover, sand begins to negatively influence hard shore communities.

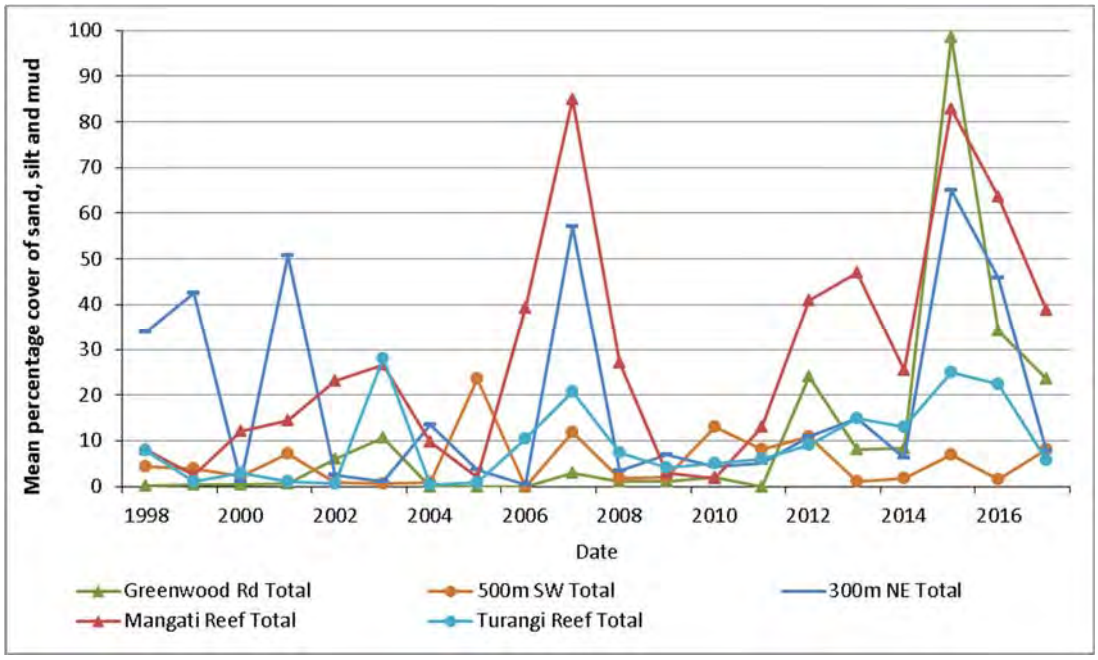


Figure 4 **Mean percentage cover of sand, silt and mud at the five reef sites from 1998 to 2017**

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 2017 are shown in Figures 5 and 6, respectively. The mean number of species increased at the Mangati Reef and 300 m

NE sites from the previous summer. Slight decreases in the mean number of species from the previous summer were seen at the Turangi Reef, Greenwood Road and 500 m SW sites. These changes from the previous survey were reflected in the changes in Shannon-Wiener Indices at all sites. Species richness and diversity show high interannual variability, with no obvious contrasting trends between the impact and control sites (Figures 5 and 6). It is difficult to determine differential trends between sites as much of the variation over time appears to be driven by stochastic events (i.e. sand inundation). The survey records before, during and after the summer of 2015 highlight the acute nature of such events.

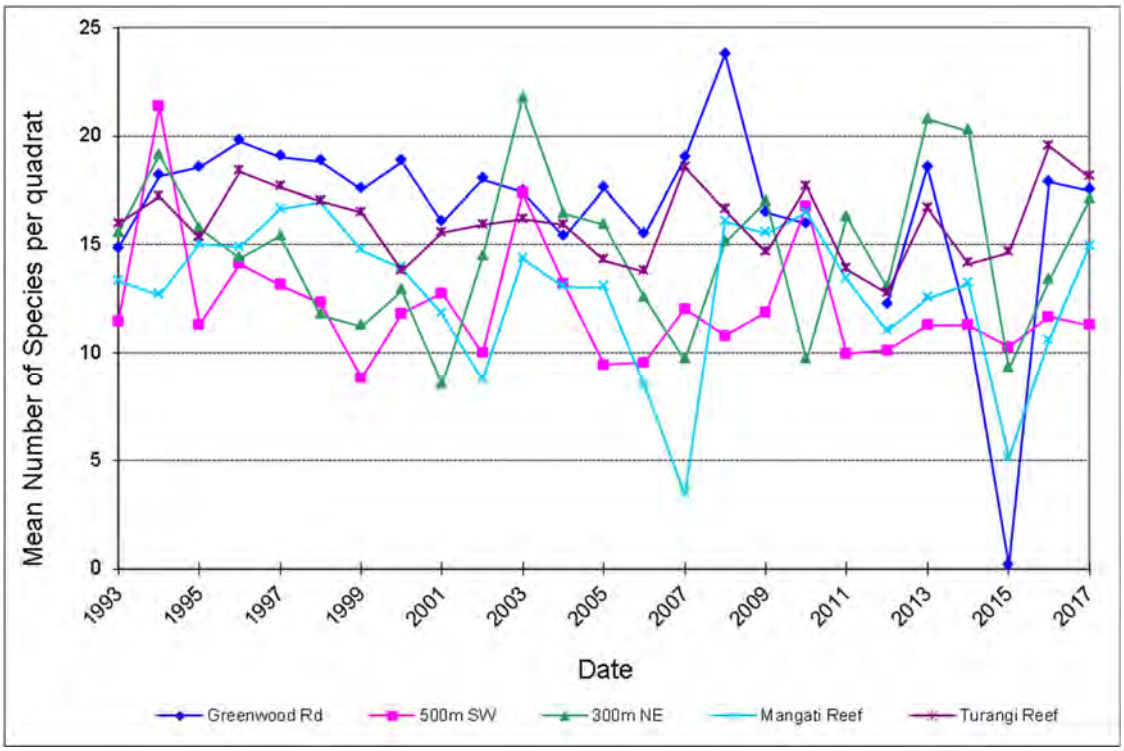


Figure 5 **Mean number of species per quadrat in summer surveys from 1993 to 2017**

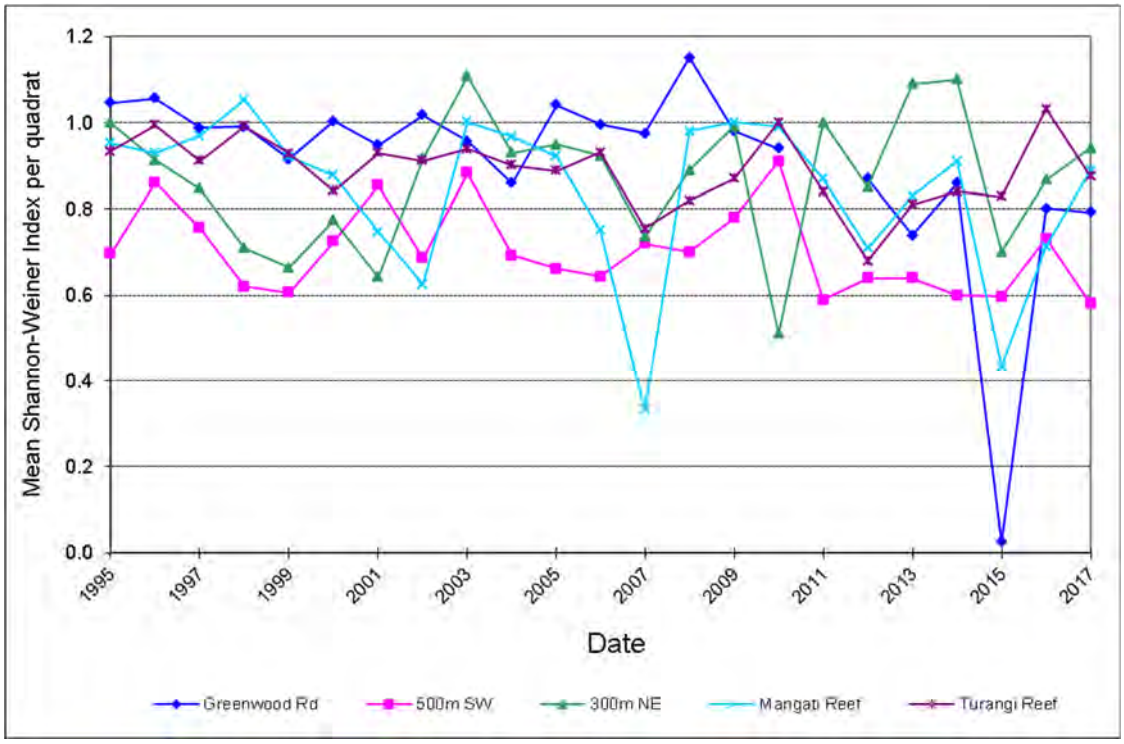


Figure 6 Mean Shannon-Weiner index per quadrat in summer surveys from 1995 to 2017

4. Discussion

An intertidal survey was conducted at five sites between 11 and 31 of January 2017 as part of the 2016-2017 NPWWTP 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 record of species diversity spanning over 20 years from January 1993 to January 2017.

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2017 survey. Apart from the site 500 m SW of the outfall, comparable numbers of species and Shannon-Wiener Indices were generally seen between the potential impact and control sites. In addition, over the long term record, there has been no obvious decline in species richness or diversity at the potential impact sites relative to the control sites.

Spatial and temporal 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 have typically been classified as major drivers of diversity. In Taranaki, mid to high shore sand inundation can be the product of a series of factors. Erosion events on Mt. Taranaki are considered to be the source of much of the sandy material that is deposited around Taranaki's coast. The material is carried down the Stony River and into the coastal waters, where it is then naturally transported around the coastline. Sustained

calm weather conditions in conjunction with high period swell can cause sand to be pushed upshore and onto the intertidal zone (Mr P McComb 2015, pers. comm.). Historically, the Mangati Reef site has been prone to sand accumulation. Years of high sand accumulation at this site have resulted in reduced diversity within the intertidal community (e.g. 2006, 2007, 2012 2013 and 2015). This response 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 also result in reduced diversity due to sand scour of the biota, reduced water movement between rocks and temporary burial. Results from the last two summer surveys demonstrate two important aspects of intertidal sand inundation. Firstly, the sand is not static; it continues to shift. Reefs that were inundated in the summer of 2015 were found with a fraction of the coverage in the summer of 2017 (Figure 4). Secondly, reef communities have the innate capacity to recover from sand inundation events. This is demonstrated particularly well at the Greenwood Road site, where the intertidal community is now nearly as diverse as it was prior to its burial in 2015 (Figures 5 and 6).

Historically, Mangati Reef has supported the growth of coralline turf algae more so than the other two impact sites (Figure 7). Although this reef has been periodically inundated with sand, the sheltered conditions have proved more favourable for coralline algae growth. In turn, the relatively high percentage cover of coralline turf can provide an ideal habitat for juvenile cat's-eyes *Turbo smaragdus* (Figure 8), which are known to feed on the small epiphytes present on the calcified surface of the coralline algae (Morton, 2004). However, in 2015, the extent of sand inundation at the Mangati Reef resulted in extremely low coralline turf cover and *T.smaragdus* densities at the site. A similar result, albeit at a smaller scale, was observed at the 300 m NE site (Figures 4 and 7). There has been a notable increase in turf cover observed at the Mangati Reef and 300 m NE sites over last three surveys. As the sand cover decreases at these sites it would be expected that the coralline turf cover, and subsequently *T.smaragdus* abundance, would continue to increase.

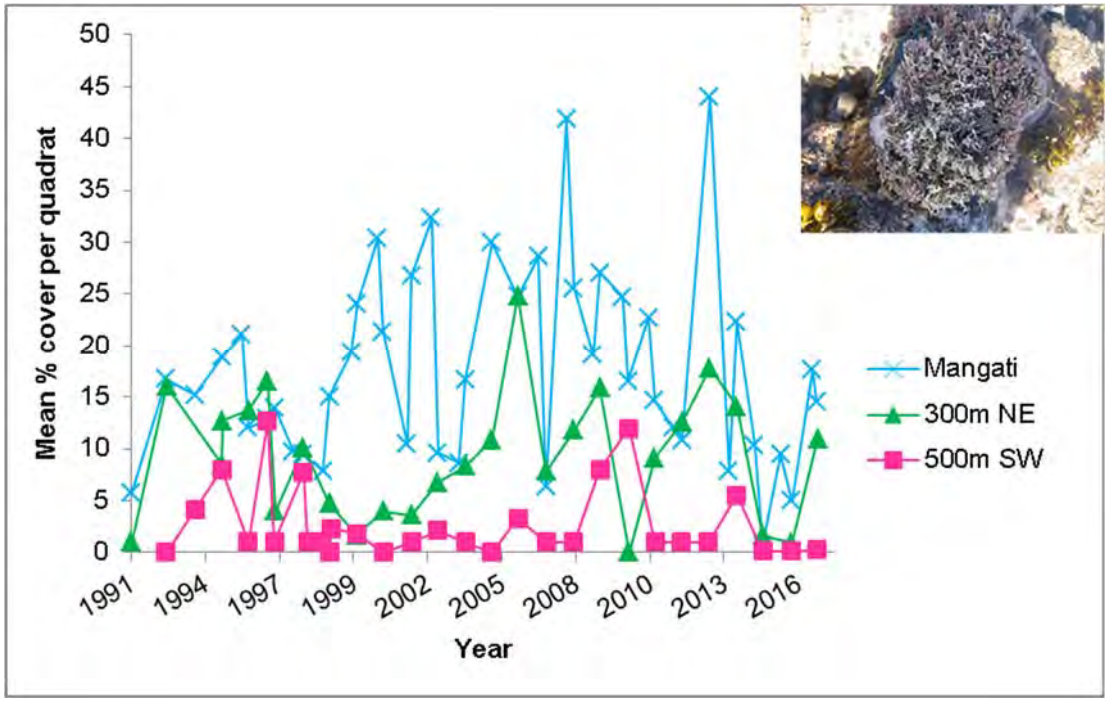


Figure 7 Percentage cover of coralline turf *Corallina officinalis* at the three potential impact sites from 1991 to 2017

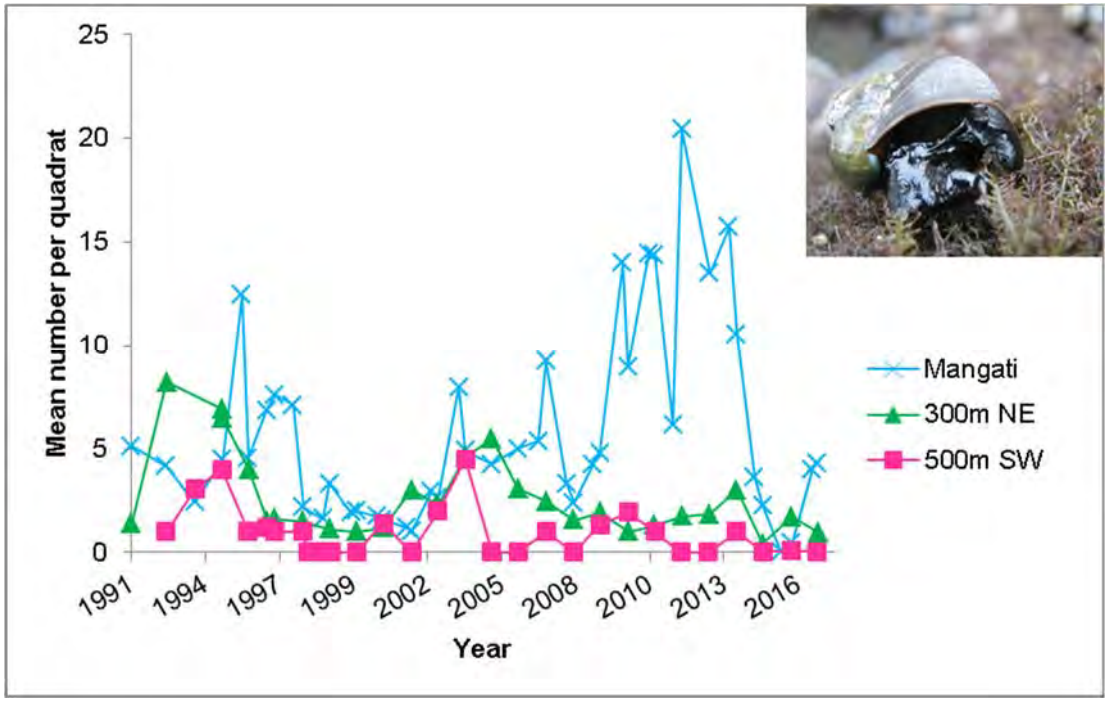


Figure 8 Abundance of cat's-eye *Turbo smaragdus* at the three potential impact sites from 1991 to 2017

The site 500 m SW of the outfall is a unique in its substrate composition, whilst also a characteristic example of Taranaki's dynamic coastline. The reef is predominantly composed of relatively uniform, small, rounded rocks/cobbles (Photograph 1). 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 prevents many

species, in particular macroalgae, from establishing (Table 1). This may explain the low cover of coralline turf relative to the other two impact sites over the past 20 years (Figure 7). The porcelain crab *Petrolisthes elongates* is one of the few animals able to thrive at this site (Figure 9). 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). High densities of *P. elongatesis* are often recorded at this site. Although their numbers were lower in the two most recent surveys they still comparable with previous results (e.g. 2005-2006, 2009-2010; Figure 9).

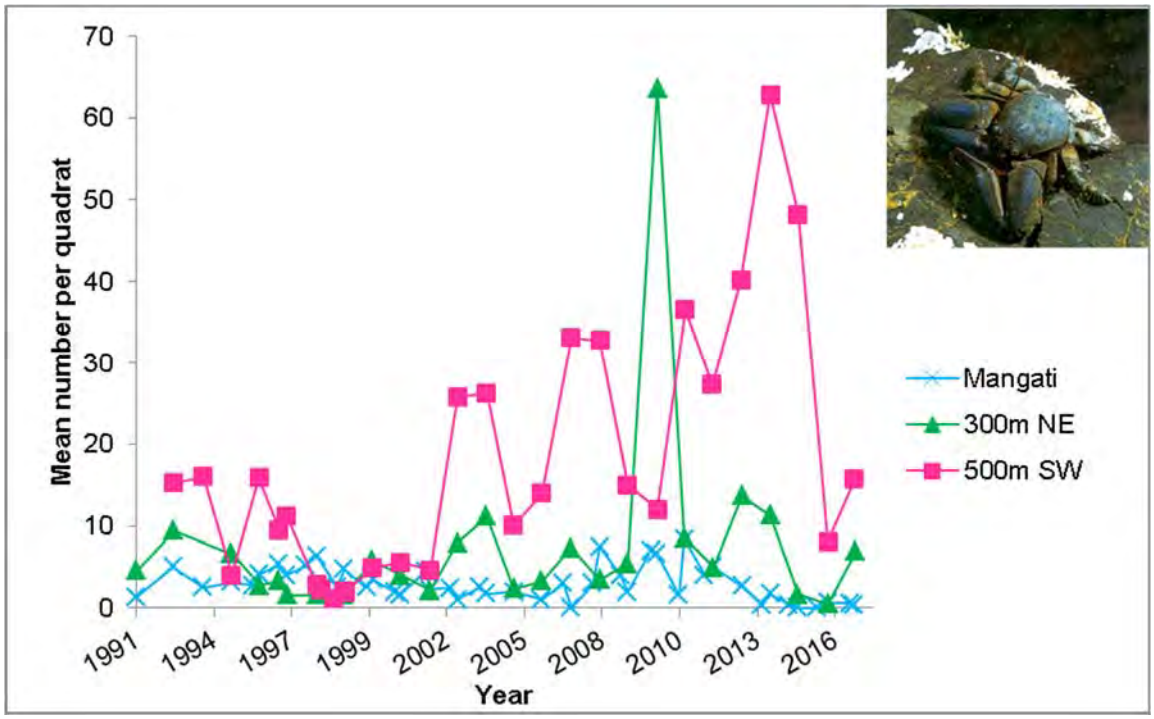


Figure 9 Abundance of Porcelain crab *Petrolisthes elongates* at the three potential impact sites from 1991 to 2017

The site 300 m NE of the outfall provides an intermediate substrate composition relative to the two other potential impact sites, offering more shelter/stability than 500 m SW and less sand accumulation than Mangati Reef. The substrate complexity provides a range of habitats/ecological niches. Recent surveys have revealed that *Neosabellaria kaiparaensis* is becoming a dominant species at the 300 m NE site (Figure 10). As this tubeworm is a strong competitor for hard substrate (suitable habitat) in the intertidal zone, its presence could already be limiting the ecological diversity on the reef.

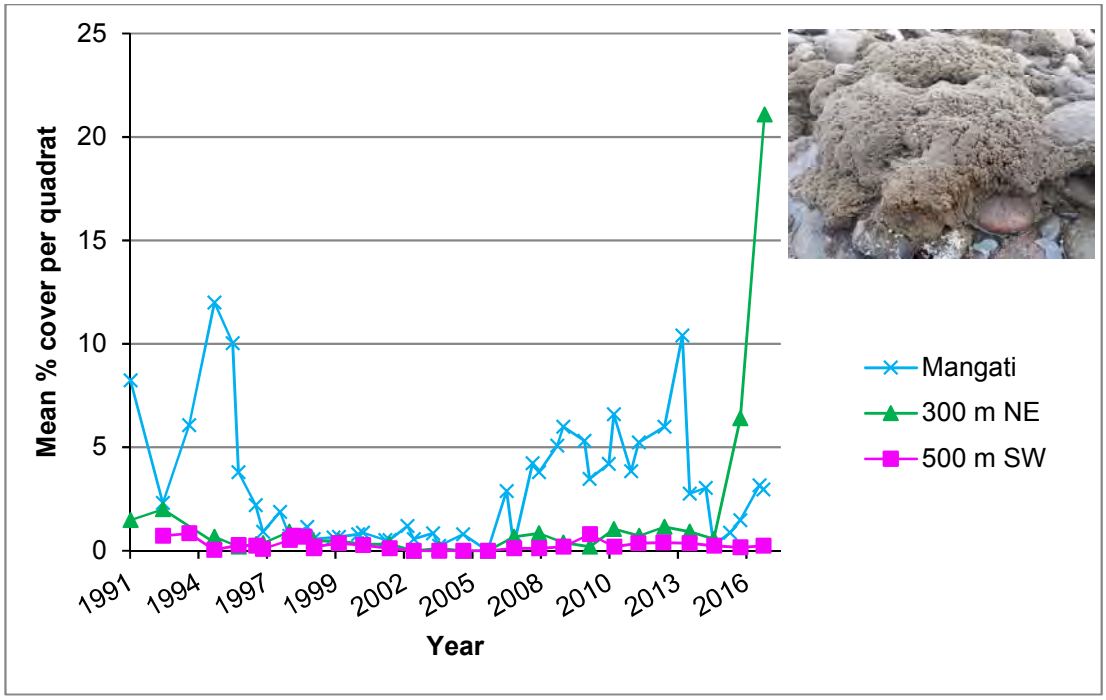


Figure 10 Percentage cover of *Neosabellaria kaiparaensis* at the three potential impact sites from 1991 to 2017

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 has tended to recover quickly once the sand has been removed. During the most recent survey it appeared that the Greenwood Road site was receiving an increased nutrient load from the Waiaua Stream. Due to a large volume of sand having been deposited at the top of the beach, the stream had meandered in front of the survey site before being enclosed. As a result, the stream was seeping through the sand bank and over the reef. Signs of nutrient enrichment included the increased cover of *Chaetomorpha* and brown mats (Photo 6).

Photo 6 Elevated cover of Chaetomorpha and brown mats at the Greenwood Road site (13 January 2017)

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 2017 at five sites. These surveys included three potential impact sites and two control sites, north and south of the outfall. It was expected that 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.

There was no distinguishable shift in species richness or diversity at the potential impact sites compared with the control sites in this year's survey. 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

Thomas McElroy
Technical Officer

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Appendix VI

Shoreline bacteriological water quality report 2016-2017

To	Science Manager – Hydrology/Biology, Regan Phipps
From	Scientific Officer Emily Roberts and Technical Officer Angela Smith
Document	1921419
Date	24 Aug 2017

Bathing beach water quality survey: New Plymouth Wastewater Treatment Plant marine discharge monitoring – November 2016 to April 2017

Introduction

Faecal indicator bacteria (FIB) have been monitored every second spring/summer since 1996-1997, at five sampling sites around the New Plymouth Waste Water Treatment Plant (NPWWTP) outfall. This report presents the results of the 11th survey to monitor shoreline FIB in relation to this wastewater discharge.

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 summarised 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 *Escherichia coli* as the preferred indicator (Table 1).

Table 1 Guidelines for Recreational Water Quality (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

Methods

Bacteriological water quality was monitored at four coastal sites near the marine outfall, with two sites located either side of the outfall, during the summer months of 2016-2017 (Photos 1-4). The coastal sites were monitored to assess whether the discharge from the marine outfall was adversely affecting coastal bathing water quality. A site located in the lower reaches of the Waiwhakaiho River was also monitored, in order to assess the potential influence of the river on coastal water quality (Photo 5). The locations of the five sites monitored in the 2016-2017 period are presented in Figure 1 and Table 2.

Figure 1 Coastal and riverine bacteriological water quality sampling sites, in relation to the New Plymouth Wastewater Treatment Plant

Table 2 Locations of bacteriological water quality sampling sites

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

The Mangati, 300 m northeast (NE) and 500 m southwest (SW) sites are not commonly used for recreational bathing, due to limited accessibility. 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 500 m SW site. The close proximity of this site to the Waiwhakaiho River means that bacterial contamination from freshwater may occur, especially after floods. On the other hand, 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 sampling site, and can occasionally contribute significant amounts of freshwater during floods. Faecal contamination at the Waiwhakaiho River site can affect nearby coastal sites surrounding the river mouth, particularly the 500 m SW site.

The site located 300 m northeast (NE) of the outfall is in line with the prevailing north-easterly current and is a potentially high impact site with regards to discharges from the outfall.

Photo 1 The Mangati site, looking SW towards the outfall

Photo 2 The site located 300 m NE of the outfall

Photo 3 The 500 m SW site

Photo 4 The site located at Fitzroy

Photo 5 Gulls upstream of the Waiwhakaiho River site

Thirteen samples were collected at each site, during dry weather conditions, and analysed for FIB (enterococci, faecal coliforms and *E. coli*) and conductivity. Water samples were collected immediately beneath the water surface, at a minimum of calf depth (Photo 6).

Photo 6 A bacteriological water quality sample being collected at the Fitzroy site (August 2016)

Results

FIB counts have been monitored at the five bacteriological water quality sampling sites near the NPWWTP outfall since 1996. The median enterococci counts recorded at the sites, since monitoring began, are presented in Figure 2.

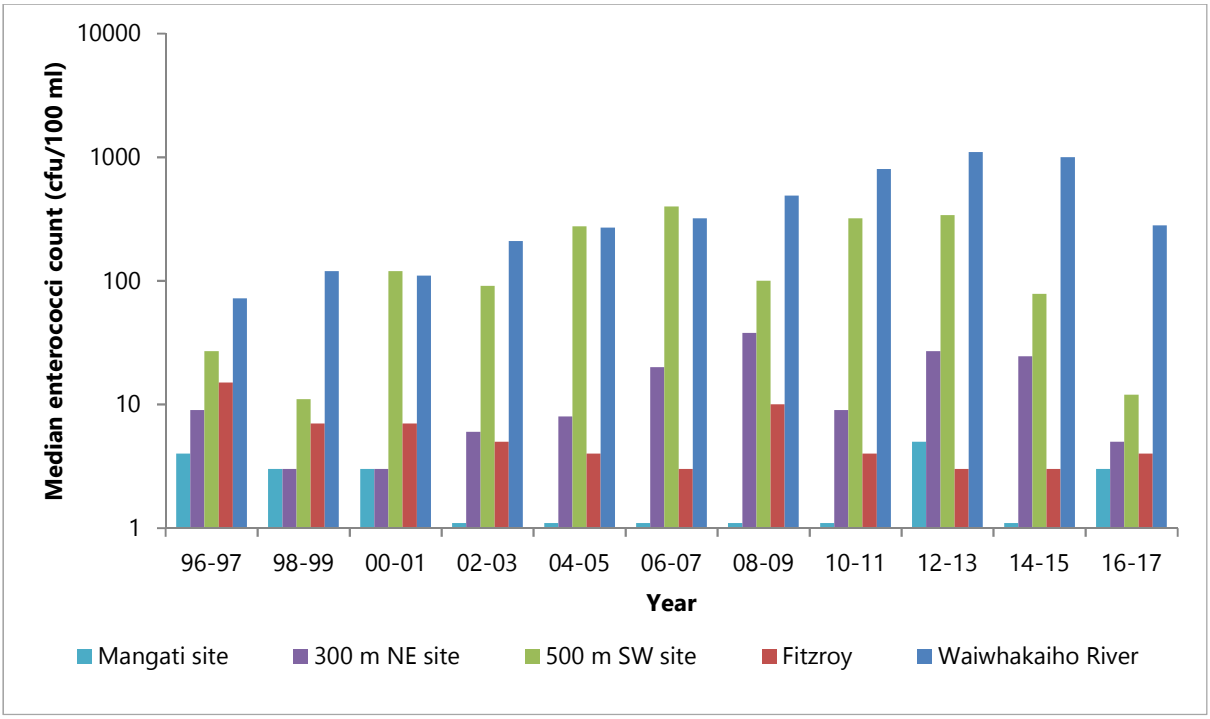

Figure 2 Median enterococci counts recorded at each sampling site over the past eleven surveys, on a logarithmic scale (1996-2017). *Escherichia coli* counts are shown for the Waiwhakaiho River site

Median FIB counts were comparatively higher at the Waiwhakaiho River site than at the four coastal sites in the year under review, a trend that has been observed in most previous monitoring rounds. Compared with the previous monitoring year, median counts decreased at the Waiwhakaiho River, 500 m SW and 300 m NE sites in 2016-2017, and only slight increases were recorded for the Mangati and Fitzroy sites. FIB counts appear to have been decreasing at the 500 m SW site in recent years, while counts at the remaining three coastal sites have been consistently low. An overall improvement in water quality was observed in 2016-2017, compared with the previous monitoring period, although FIB counts remained elevated at the Waiwhakaiho River site.

Performance with the Guidelines for Recreational Water Quality was assessed at each of the five sampling sites (Table 1). A summary of this assessment is presented in Table 3.

Table 3 Summary of bacterial guidelines performance at the five sampling sites (MfE, 2003)

Site	Number of exceedances of enterococci guidelines [% of 13 samples]		
	Surveillance	Alert	Action
Mangati	13 [100]	0 [0]	0 [0]

300m NE	13 [100]	0 [0]	0 [0]
500m SW	13 [100]	0 [0]	0 [0]
Fitzroy Beach	13 [100]	0 [0]	0 [0]
Waiwhakaiho River	3 [23] *	2 [15] *	8 [62] *

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

In 2016-2017, the FIB counts of samples collected at the Waiwhakaiho River site exceeded the MfE (2003) 'Alert' or 'Action' guidelines for 77% of all samples. In contrast, the four coastal sites remained in surveillance mode for the duration of the monitoring period, with no exceedances recorded.

The bacteriological water quality results for each sampling site are presented below.

Mangati

The results for the Mangati site are presented in Table 4, including a statistical summary of results.

Table 4 Bacteriological water quality results for the Mangati site (2016-2017)

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01 Nov 2016	08:35	4530	<1	<1	<1	15.0
30 Nov 2016	11:25	4430	8	3	8	15.4
05 Dec 2016	14:15	4240	1	<1	1	19.2
12 Jan 2017	09:50	4410	8	3	8	18.5
30 Jan 2017	11:30	4630	<1	3	<1	19.5
01 Feb 2017	12:45	4500	7	4	7	18.4
10 Feb 2017	08:00	4680	4	8	4	17.0
16 Feb 2017	13:25	4700	<1	<1	<1	18.9
27 Feb 2017	11:40	4740	3	<1	3	19.6
02 Mar 2017	13:20	4590	11	5	11	20.0
17 Mar 2017	13:05	4670	<1	1	<1	20.2
02 Apr 2017	13:50	4630	5	110	5	19.4

11 Apr 2017	10:55	4460	4	83	4	18.9
Statistical summary (2016-2017)						
Number of samples		13	13	13	13	13
Minimum		4240	0.5	0.5	0.5	15
Maximum		4740	11	110	11	20.2
Median		4590	4	3	4	18.9

Low enterococci counts were recorded at the Mangati site throughout the season, with median and maximum counts of 3 and 110 cfu/100ml, respectively.

East of the outfall

Results from the site located 300 m NE of the outfall are presented in Table 5, including a statistical summary of results.

Table 5 Bacteriological water quality results for the site located 300 m NE of the outfall (2016-2017)

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-16	9:20	4490	1	1	1	14.9
30-Nov-16	12:45	4390	9	4	9	15.2
05-Dec-16	11:05	4460	<1	<1	<1	20.9
12-Jan-17	12:00	4550	29	28	29	19.1
30-Jan-17	13:45	4510	8	6	8	19.3
01-Feb-17	9:55	4180	9	8	9	18.6
10-Feb-17	11:10	4700	40	140	40	17.8
16-Feb-17	11:10	4590	<1	<1	<1	18.8
27-Feb-17	12:00	4760	11	4	11	19.7
02-Mar-17	10:10	4600	1	5	1	19.3
17-Mar-17	10:30	4610	<1	5	<1	19.9

02-Apr-17	9:00	4500	13	5	15	18.9
11-Apr-17	12:40	4480	7	16	8	19.1
Statistical summary (2016-2017)						
Number of samples		13	13	13	13	13
Minimum		4180	0.5	0.5	0.5	14.9
Maximum		4760	40	140	40	20.9
Median		4510	8	5	8	19.1

FIB counts were low at the site located 300 m NE of the outfall during the 2016-2017 monitoring period, with a median of 5 and maximum of 140 cfu/100 ml.

West of the outfall

Data from the site located 500 m SW of the outfall are presented in Table 6, including a statistical summary of results.

Table 6 Bacteriological water quality results for the site located 500 m SW of the outfall (2016-2017)

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-16	9:05	4380	<2	2	<2	17.1
30-Nov-16	12:30	4330	14	10	14	15.4
05-Dec-16	10:55	4310	1	<1	1	20.7
12-Jan-17	11:50	4490	4	12	4	20
30-Jan-17	13:40	4440	6	16	6	19.3
01-Feb-17	9:40	4210	9	1	9	18.5
10-Feb-17	11:00	4730	40	64	42	18.1
16-Feb-17	11:00	4500	8	21	8	20.1
27-Feb-17	11:45	4730	55	72	59	19.6

02-Mar-17	9:55	4710	40	49	45	21.9
17-Mar-17	10:15	4560	3	5	3	22.7
02-Apr-17	9:20	4310	11	5	11	19.2
11-Apr-17	12:45	4500	24	39	24	19.4
Statistical summary (2016-2017)						
Number of samples		13	13	13	13	13
Minimum		4210	1	0.5	1	15.4
Maximum		4730	55	72	59	22.7
Median		4490	9	12	9	19.4

The initial trend of declining water quality at the 500 m SW site appears to have levelled off in recent years, with results from this year again showing a notable improvement in enterococci counts (Figure 2). The FIB medians and maxima recorded for the site were low in 2016-2017, and were amongst the lowest ever recorded at the site (Figure 2).

Water quality at the 500 m SW site appeared to be similar to that at the site located 300 m NE of the outfall, with similarly low medians and maxima (Tables 5 & 6). It is expected that FIB counts would be relatively higher at the 300 m NE site than at the 500 m SW site, if the discharge from the outfall was affecting local water quality, due to the predominant north-easterly water flow (Figure 1).

High bacterial counts in the Waiwhakaiho River have previously been found to influence water quality at the 500 m SW site, due to the close proximity of the sampling site to the river (Figure 1). However, conductivity data indicates that only minor freshwater influence occurred at the 500 m SW site during the 2016-2017 summer season (Table 6). Faecal source tracking has also previously linked gulls, which have been observed in high numbers on the cobbles and sand banks of the Waiwhakaiho Reef, at the river mouth and immediately upstream of the riverine sampling site, to poor water quality at the 500 m SW (Photos 5 & 7).

Photo 7 Gulls at the site located 500 m SW of the outfall

Fitzroy Beach

The results for this site are presented in Table 7, including a statistical summary of results.

Table 7 Bacteriological water quality results for Fitzroy Beach (2016-2017)

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-16	9:50	4510	1	11	1	15.2
30-Nov-16	11:45	4550	11	4	12	15.4
05-Dec-16	11:30	4440	<1	<1	<1	18.9
12-Jan-17	11:05	4460	12	4	12	18.2
30-Jan-17	12:50	4420	5	7	5	18.4
01-Feb-17	13:35	4340	8	3	8	18.4
10-Feb-17	10:15	4730	89	92	99	17.9
16-Feb-17	11:35	4740	<1	<1	<1	18.8

27-Feb-17	11:15	4730	39	4	40	18.8
02-Mar-17	10:40	4690	1	4	1	18.8
17-Mar-17	10:55	4620	7	5	7	19.5
02-Apr-17	13:55	4670	1	5	1	19.7
11-Apr-17	11:15	4560	27	12	27	19.2
Statistical summary (2016-2017)						
Number of samples		13	13	13	13	13
Minimum		4340	0.5	0.5	0.5	15.2
Maximum		4740	89	92	99	19.7
Median		4560	7	4	7	18.8

Bacteriological water quality at Fitzroy Beach was good throughout the 2016-2017 monitoring season, with low median counts for all FIB. The median enterococci count (4 cfu/100ml) was consistent with previously low medians (Figure 2).

Waiwhakaiho River

The data for the Waiwhakaiho River site are presented in Table 8, including a statistical summary of results.

Table 8 Bacteriological results for the Waiwhakaiho River site (2016-2017)

Date	Time (NZST)	Conductivity @ 20°C (mS/m)	Bacteria			Temp (°C)
			E . coli (cfu/100ml)	Enterococci (cfu/100ml)	Faecal coliforms (cfu/100ml)	
01-Nov-16	8:40	10.6	200	28	200	14.2
30-Nov-16	12:15	10.2	250	130	260	14.4
05-Dec-16	10:35	11.2	250	77	250	18.6
12-Jan-17	11:30	12.2	560	270	740	21.4
30-Jan-17	13:20	11.7	1100	500	1100	18
01-Feb-17	9:20	12	470	280	480	17.6
10-Feb-17	10:45	11.7	750	710	780	16.3

16-Feb-17	10:25	11.5	1600	1400	1700	17.3
27-Feb-17	12:30	12.9	1900	1700	2500	20.1
02-Mar-17	9:35	13.9	900	500	970	19.8
17-Mar-17	10:00	11.2	1900	480	1900	16.6
02-Apr-17	9:50	12.8	270	100	290	17.5
11-Apr-17	11:45	11.6	610	200	620	15.8
Statistical summary (2016-2017)						
Number of samples		13	13	13	13	0
Minimum		10.2	200	28	200	14.2
Maximum		13.9	1900	1700	2500	21.4
Median		11.7	610	280	740	17.5

FIB minima, maxima and medians were very high at the riverine site in the 2016-2017 monitoring period. Although these results indicate that water quality remains poor in the lower reaches of the Waiwhakaiho River, the median and maximum *E. coli* counts were considerably lower than they have been in recent years (Figure 2).

Previous faecal source tracking indicated that gulls are a primary source of contamination in this stretch of the river (Photo 3). The lower counts observed in 2016-2017 may be due to gulls being deterred from the river as a result of the higher water flows caused by higher than average summer rainfall.

Samples exceeded the 'Alert' level twice and exceeded the 'Action' level on 8 out of 13 sampling occasions, reflecting the poor water quality of the Waiwhakaiho River at this site (Table 3).

Summary

Bacteriological water quality was monitored at four coastal sites in the vicinity of the marine outfall (Figure 1) during the summer months of 2016-2017 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.

During the 2016-2017 summer season, bacteriological water quality was generally good at the Fitzroy, Mangati, 300 m NE and 500 m SW sites. Water quality was relatively poor at the Waiwhakaiho River sampling site, although the FIB counts at this site were considerably lower in 2016-2017 than in the previous monitoring period. This improvement in water quality may be attributed to seagulls, previously identified as being a primary contributor to faecal contamination in the river, being deterred from the river by high water flows.

All four coastal sites were in surveillance mode for the duration of the summer season, with no 'Alert' or 'Action' levels exceeded (Tables 1 & 3). However, the majority of the 13 samples collected at the Waiwhakaiho River site exceeded the 'Action' level for *E. coli* (Tables 1 & 3).

Enterococci counts have typically been higher at the 500 m SW site, relative to the other three coastal sites, since monitoring began in 1996 (Figure 2). This trend was not found in the current monitoring year, with relatively low FIB counts recorded at all four coastal sites (Figure 2). Previous faecal source tracking investigations have indicated that gulls are likely to be the main source of faecal contamination at the 500 m SW and Waiwhakaio River sites, with these findings supported by frequent observations of high numbers of gulls at the Waiwhakaiho River and the Waiwhakaiho Reef.

Given the prevailing north-easterly flow, elevated FIB counts would have been expected at the 300 m NE site if wastewater discharge from the outfall was adversely affecting coastal water quality. The absence of such a pattern and the overall low FIB counts recorded at all coastal sampling sites in 2016-2017 suggest that the outfall did not affect coastal water quality in the year under review. Ongoing monitoring will continue to shed light on the factors influencing bacteriological water quality at the sampling sites around the NPWWTP outfall.

Recommendations

As a result of the 2016-2017 summer marine contact recreation bacteriological survey, it is recommended that:

1. THAT the 2018-2019 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.