New Plymouth District Council
New Plymouth Wastewater Treatment Plant
Marine Outfall and Sludge Lagoon
Monitoring Programme
Annual Report
2017-2018

Technical Report 2018-62

This report was initially issued by the Council with an incorrect marine ecological report attached as Appendix IV. This has been corrected as of October 2019

ISSN: 1178-1467 (Online)
Document: 2117776 (Word)
Document: 2181506 (Pdf)

Taranaki Regional Council
Private Bag 713
STRATFORD
March 2019

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 2017 to June 2018 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 six resource consents, which include a total of 72 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, one consent to discharge emissions into the air at the site and one consent to discharge dewatered sludge to land.

During the monitoring period, NPDC demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the year under review included reviewing data supplied by NPDC, three site inspections, three water samples collected for various analyses (including inter-laboratory comparison), a five site marine ecological survey, analysis of mussels for norovirus and heavy metals (two, two site surveys for norovirus and one, three site survey for metals), and additional groundwater monitoring associated with the sludge lagoon.

Norovirus levels in mussels at Waiwhakaiho Reef varied from low to high during the monitoring period. There were no other significant detectable effects in the receiving environment resulting from or potentially associated with authorised discharges from the plant.

The results from a 12 month investigation into the effects of sludge lagoon seepage on ground and surface waters are presented in this report. The investigation found that nutrient and microbial contaminants were relatively confined, due to the attenuation capacity of the groundwater. Elevated levels of contaminants in the adjacent drain, however, warrant further investigation. A recommendation to this effect is provided.

During the year under review there were a total of 17 incidents which resulted in discharges from the wastewater network to waterways. Four of these incidents were related to pipe blockages or breakages, ten were related to high rainfall events and the remaining three events were a result of mechanical faults or technical errors. All incidents were investigated and assessed based on their cause, NPDC's adherence to their Incident Response Plan and the resulting environmental effects. With the exception of one water sampling survey, no further action was considered necessary for any of the incidents. Although the number of incidents that occurred in the 2017-2018 period was still high, the number has continued to decrease from recent years (40 incidents in the 2014-2015 year, 24 in 2015-2016 and 20 in 2016-2017).

For reference, in the 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% 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 2018-2019 year.

Table of contents

List of tables

List of figures

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 2017 to June 2018 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, treated wastewater and sludge leachate, 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 23rd 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 2018-2019 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 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% of the consents, a good level of environmental performance and compliance was achieved.

1.2 Process description

The NPWWTP (Photo 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 m marine outfall offshore of the mouth of the Waiwhakaiho River.

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

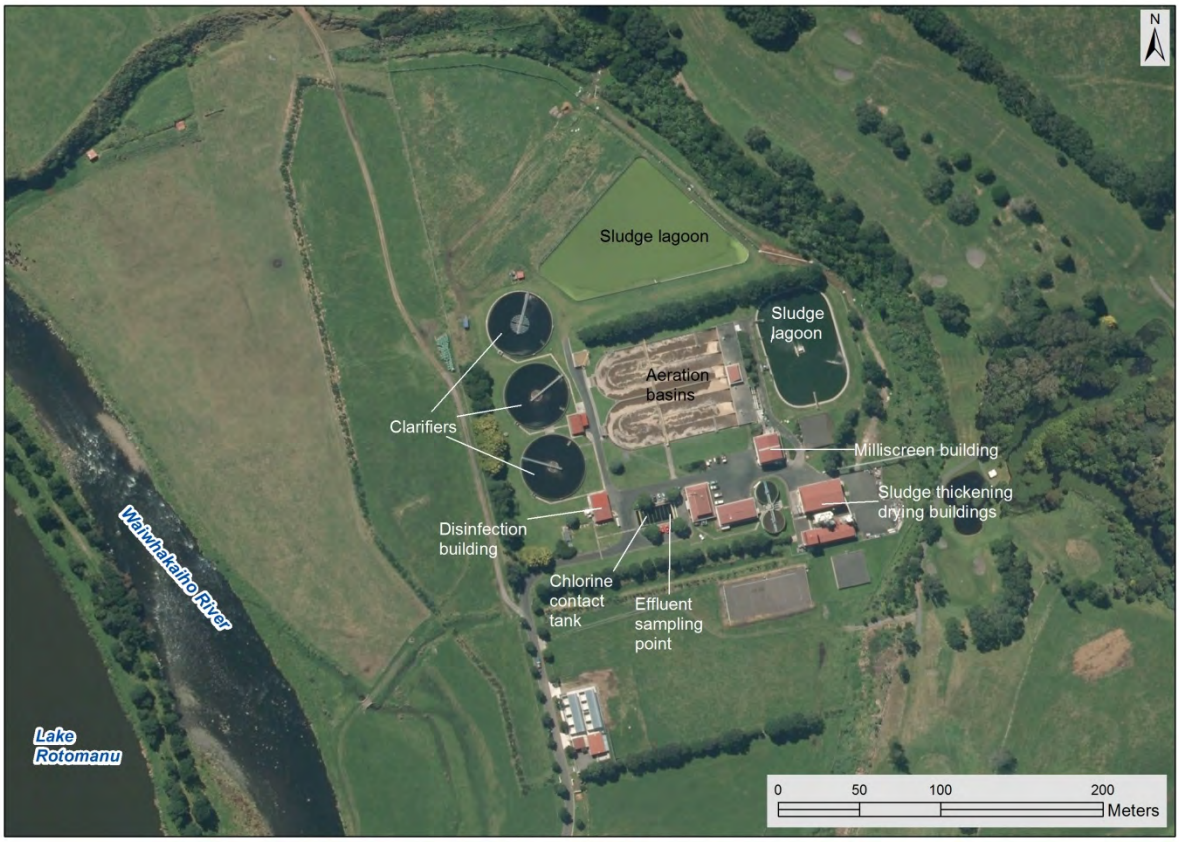


Figure 1 Layout of the New Plymouth Wastewater Treatment Plant

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

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

NPDC holds six resource consents in relation to the NPWWTP; the details of which are summarised in the table below and outlined in sections 1.3.1 to 1.3.4.

Table 1 Resource consent summary

Consent number	Purpose	Granted	Review	Expires
0882-4	To discharge of treated municipal wastewater from the NPWWTP through a marine outfall structure into the Tasman Sea.	13 Dec 2011	1 Jun 2022	1 Jun 2041
2982-4	To discharge of up to 60 m^3/day of leachate from a sludge stabilisation lagoon to groundwater in the vicinity of the Waiwhakaiho River.	17 Oct 2002	No further reviews	1 Jun 2020
4740-2	To discharge contaminants into the air from sludge drying and processing activities at the NPWWTP.	29 May 2008	1 Jun 2020	1 June 2026

Consent number	Purpose	Granted	Review	Expires
4593-3	To erect, place, maintain and use a marine outfall within the coastal marine area as part of the NPWWTP system.	10 Sep 2014	1 Jun 2020	1 June 2041
1826-2	To erect, place and maintain a twin box culvert on the Mangaone Stream for road access purposes.	16 Jan 2002	No further reviews	1 June 2020
9984-1	To discharge contaminants onto and into land and into air at the NPWWTP on a contingency basis	15 Apr 2015	Special condition 23	1 June 2022

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 Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

NPDC holds discharge permit **9984-1** to cover the discharge contaminants onto and into land and into air at the NPWWTP on a contingency basis. This permit was issued by the Council on 15 April 2015 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

There are 23 special conditions attached to the permit.

Condition 1 stipulates the areas in which the discharge of dewatered sludge is authorised.

Condition 2 restricts the discharge of sludge after 1 June 2020.

Condition 3 restricts the circumstances under which the discharge may occur.

Condition 4 requires NPDC to adopt the best practicable option at all times.

Condition 5 requires an environmental monitoring programme to be designed and implemented.

Condition 6 requires groundwater to be sampled from bores as specified by Council.

Condition 7 requires NPDC to collect representative samples of waste prior to discharge for specified analyses.

Condition 8 requires annual provision of routine monitoring data.

Condition 9 prohibits the discharge of sludge if groundwater and freshwater quality is below set limits.

Condition 10 restricts any discharge within set distances of surface water bodies, neighbouring properties or residential buildings.

Condition 11 outlines standards for the sludge application.

Condition 12 requires pastures or crops to be sown as soon as practicable following sludge application.

Condition 13 requires NPDC to maintain soil pH.

Condition 14 states that discharge shall not contribute to offensive or objectionable odours beyond the site boundary.

Condition 15 requires notification at least 2 working days prior to any discharge.

Condition 16 stipulates the records that must be kept in relation to this consent.

Condition 17 specifies limits of heavy metals in soil.

Condition 18 requires the discharge to be undertaken in accordance with NPDC's management plan.

Condition 19 requires the preparation a contingency plan which is to be regularly updated.

Condition 20 outlines the process which is to be followed in the event that archaeological remains are uncovered as a result of works authorised by the consent.

Condition 21 requires an annual meeting with interested parties.

Conditions 22 and 23 deal with consent lapse and review.

The permit is attached to this report in Appendix I.

1.3.4 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 1 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.

1.3.5 Land use consent

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

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

There are eight special conditions attached to the consent.

Condition 1 requires that the structure is maintained.

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

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

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

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

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

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

Condition 8 deals with review provisions.

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 six primary components during the 2017-2018 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 three 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*, and enterococci.

1.4.4.2 Inter-laboratory comparison

One inter-laboratory comparison between the Council and NPDC were performed during the 2017-2018 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), 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. Following a review of the monitoring programme in 2017, the testing frequency for cyanide, phenols, cadmium, chromium, copper, nickel, lead, zinc, and mercury, to assess compliance with condition 3 (resource consent 0882-4), was reduced from monthly to biannual. Approximately three times a week, samples were collected for the analysis of suspended solids and BOD to assess compliance with condition 4 (resource consent 0882-4).

A summary of the influent and effluent composite data is presented in this report.

1.4.5.2 Grab samples

Grab samples were collected and analysed for total available chlorine twice a day, to assess compliance with condition 10 (resource consent 0882-4). 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. Two sets of influent, clarifier composite 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 are collected once a month and analysed for various parameters. The drainage channel is also sampled once a month at two sites, one upstream and the other downstream of the sludge lagoon. Following recommendations set out in the 2015-2016 compliance monitoring report for the site, an additional 12 month groundwater investigation was also completed during the year under review (see Section 2.3).

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 2017-2018 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 three 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. This monitoring was not undertaken in the 2017-2018 period. It is next scheduled to be carried out during the 2018-2019 monitoring period.

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 (including the period under review) and tested for trace metals.

1.4.8.2 Norovirus

Mussels were collected on two occasions and analysed for norovirus GI and GII by ESR. Mussels are usually collected from Waiwhakaiho Reef and Bell Block Reef, however, mussels were only found at Bell Block on one of the surveys.

2 Results

2.1 Water

2.1.1 Inspections

Three scheduled site inspections were carried out at the plant during the monitoring period. These inspections involved a visual assessment of the plant processes and effluent, 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 visual 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.

Grab samples were collected of the final effluent in conjunction with two of the inspections. The samples were analysed for enterococci, *E. coli,* total available chlorine, and free available chlorine (Table 2).

Table 2 Effluent grab samples 2017-2018 (site SWG002002)

Parameter	Unit	Date			Consent Limit
		13 Feb	6 Mar	6 Jun	
Free available chlorine	g/m^3	<0.1	<0.1	0.3	-
Total available chlorine	g/m^3	0.4	0.5	0.6	**0.3 ***
E. coli	cfu/100 ml	13.4	9.7	N/D	**-**
Enterococci	cfu/100 ml	3.1	6.3	N/D	**-**

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

N/D = No Data

The concentration of total available chlorine was compliant with the consent limit during all three inspections.

2.1.2 Effluent monitoring

2.1.2.1 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. One sample was split in order to perform an inter-laboratory comparison. For this comparison, a satisfactory agreement between two samples was reached if they were each within 10% of the resultant mean. Because both NPDC and the Council were sending samples to Hill Laboratories for mercury analysis, an inter-lab comparison was deemed unnecessary for this analyte. All results from 1990 onwards are presented in Appendix II.

Table 3 Summary results of effluent composite samples collected by NPDC (2017-2018)

Parameter	Unit	Consent limit	2017-2018					Previous results	
			5 Dec	6 Jun	6 Jun (TRC inter-lab)	Inter-lab agree	% compliant	Max	No. samples
Cyanide	g/m^3	**0.1**	0.02	<0.02	0.008	√	100	0.1	310
Cadmium	g/m^3	**0.04**	<0.003	<0.02	<0.001	√	100	0.008	315
Chromium	g/m^3	**0.15**	<0.013	<0.1	<0.01	√	100	0.05	315
Copper	g/m^3	**0.1**	<0.013	<0.05	<0.01	√	100	0.05	315
Lead	g/m^3	**0.1**	<0.026	<0.1	<0.002	√	100	0.04	315
Mercury	g/m^3	**0.002**	<0.00008	<0.00008	N/D	N/D	100	0.00105	299
Nickel	g/m^3	**0.15**	<0.011	<0.05	<0.01	√	100	0.07	315
Phenols	g/m^3	**1**	<0.05	<0.05	<0.02	√	100	0.17	307
Zinc	g/m^3	**0.2**	0.04	<0.05	0.02	√	100	0.15	315

√ = satisfactory agreement

* = result within 10 -25 % of the mean

** = result > 25 % from mean

N/D = No Data

During the 2017-2018 monitoring year, all contaminants were within their consent limits, and all results were comparable with those previously recorded. The majority of metals were below detection limits.

The results of the inter-laboratory comparison show that the results obtained were in good agreement.

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.

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 2017-2018 monitoring year which required these limits to be adopted.

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

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

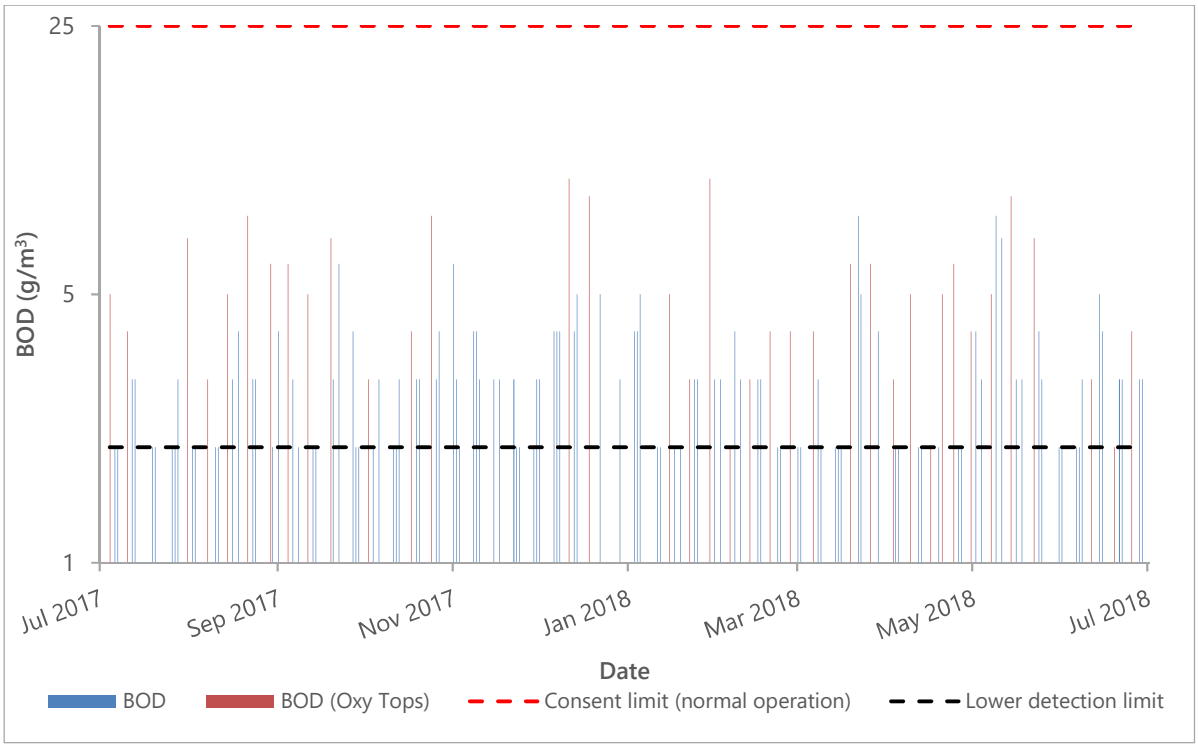


Figure 2 Biochemical oxygen demand results from two different test methods in 24-hour effluent composite samples, presented on a logarithmic scale

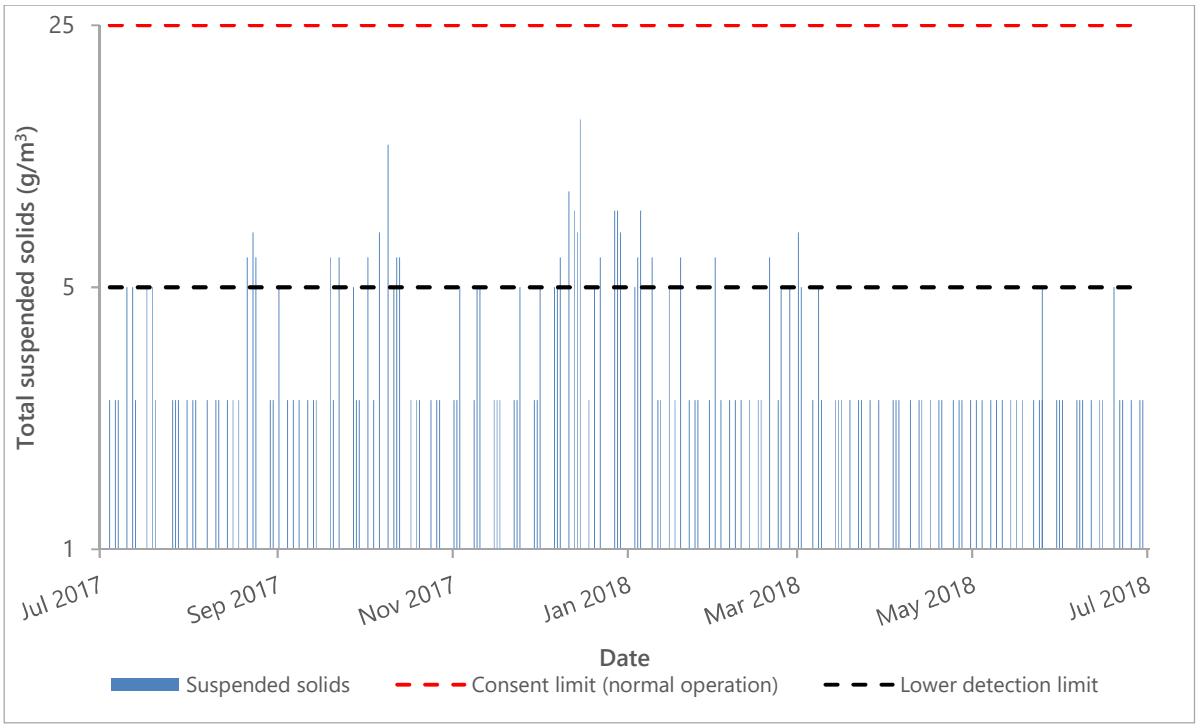


Figure 3 Concentration of total suspended solids in 24-hour effluent composite samples, presented on a logarithmic scale

Table 4 Summary of composite influent and effluent data from the 2017-2018 monitoring period

Parameter	Units	Detection limits	Influent		Effluent	
			Median	Number of samples	Median	Number of samples
pH	pH units	-	7.4	63	7.35	12
Alkalinity as $CaCO_3$	g/m^3	-	185.5	63	62	2
Ammoniacal-N	g/m^3	<0.1	13	3	0.68	1
Oxidised-N	g/m^3	<0.1 / <0.02	0.21	33	7.1	14
Nitrite as N	g/m^3	<0.2 / <0.05	0.06	38	N/D	N/D
Nitrate as N	g/m^3	<0.15	0.14	34	N/D	N/D
DRP as Phosphorus	g/m^3	<0.08 / <0.05	N/D	N/D	0.255	34
Sulphate	g/m^3	-	37.9	55	38.45	28
BOD	g/m^3	<1 / <2	230	40	3	112
BOD (Oxy Tops)	g/m^3	<1	189	19	5	39
COD	g/m^3	-	458	92	22	13
Suspended Solids	g/m^3	<5	287	90	2.5	158
Faecal coliforms	cfu/100 ml	<1	3,200,000	13	Tested with grab samples – see Section 2.1.2.2	

N/D = No Data

2.1.2.2 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 4.

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, with a maximum recorded count of 45 cfu/100 ml (Figure 4).

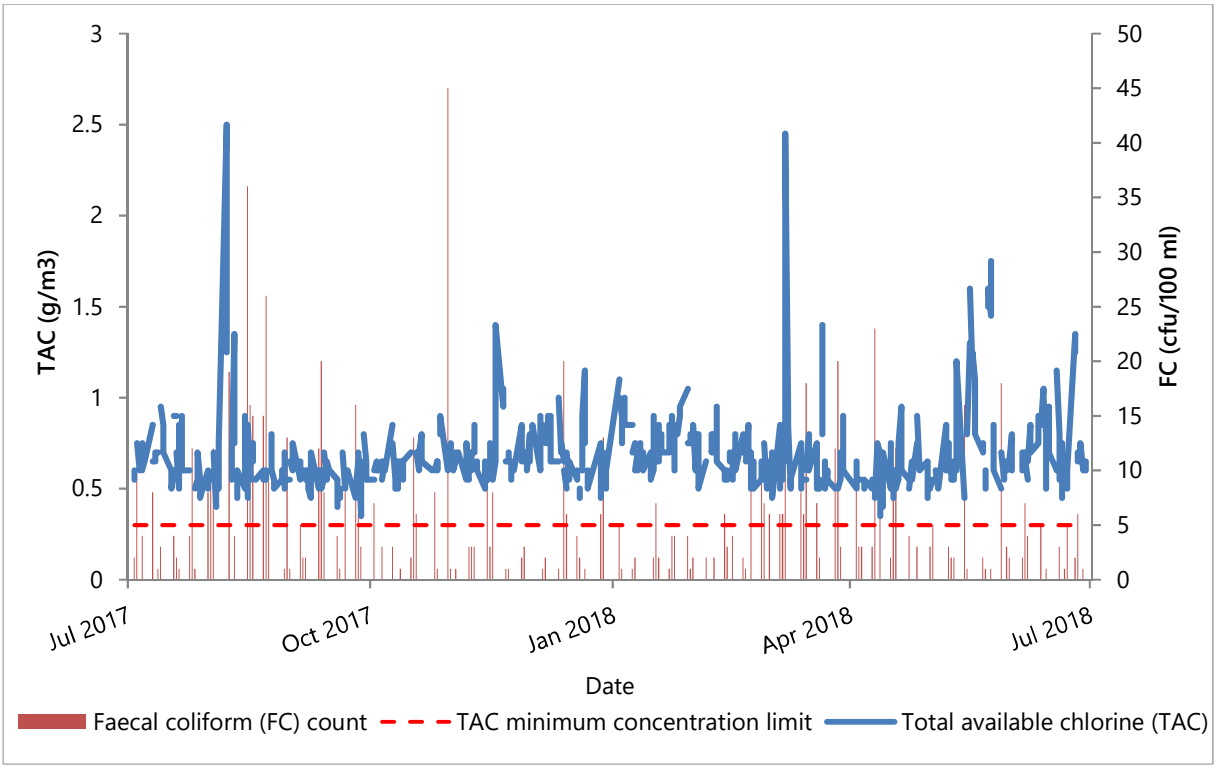


Figure 4 Levels of total available chlorine (TAC) and faecal coliforms (FC), measured in colony forming units (cfu) per 100 ml, in effluent grab samples

2.1.2.3 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). Two sets of samples were collected for analysis during the period under review (although one was collected in July). The results are presented in Table 5. Following recommendations from a peer review of the monitoring programme, the treatment plant performance was reported on a $\log_{10}$ scale, as a $\log_{10}$ reduction (inactivation).

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	$\log_{10}$ inactivation	Influent	Effluent	$\log_{10}$ inactivation
Pre-upgrade	9 October 2012	280,000	100	3.45	470,000	13,000	1.56
Pre-upgrade	16 October 2012	37,000	180	2.31	1,600,000	30,000	1.73
Pre-upgrade	23 October 2012	17,000	460	1.57	28,000,000	21,000	3.12
Upgrade	31 July 2013	35,000	8,200	0.63	1,200,000	140,000	0.93
Post-upgrade	9 June 2014	67,000	200	2.53	480,000	2,300	2.32
Post-upgrade	20 April 2015	4,300	25*	2.24	3,000,000	1,300	3.36
Post-upgrade	11 April 2016	92,000	25*	3.57	1,900,000	770	3.39
Post-upgrade	29 May 2017	7,200	25*	2.46	890,000	25*	4.55
Post-upgrade	7 November 2017	600,000	25*	4.38	750,000	25*	4.48

Operation	Date	Norovirus GI (genome copies/L)			Norovirus GII (genome copies/L)		
		Influent	Effluent	Log_{10} inactivation	Influent	Effluent	Log_{10} inactivation
Post-upgrade	23 July 2018	680	25*	1.43	1,400,000	25*	4.75

* norovirus below limit of quantitation (<50 genome copies/L)

A 1.43 log_{10} inactivation was recorded in July for norovirus GI, which was the lowest recorded inactivation for this genogroup since the plant upgrade in 2013. However, this low result can be attributed to the low numbers of norovirus sampled from the influent, as numbers of norovirus in the effluent were below the quantitation limit. The log_{10} inactivation of 4.75 recorded for norovirus GII in July was the highest level of inactivation recorded to date for either genogroup. On average, the disinfection rate has continued to improve following the upgrade of the wastewater treatment system.

2.1.3 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. Resource consent 2982-4 authorises a discharge of up to 60 m^3/day of sludge lagoon leachate to groundwater. Monitoring results of shallow groundwater bores and surface waters in the vicinity of the lagoon indicate that leakage is occurring.

NPDC collects monthly groundwater and surface water samples from selected sites in the vicinity of the sludge lagoon (Figure 5). Summarized results from the year under review are provided in Figures 6 to 11, along with a summary of previous results from 1990 to 2017. The complete dataset from routine monitoring in 2017-2018 is presented in Appendix III. Findings from an additional groundwater investigation that was completed during 2017-2018 are also presented and discussed in Section 2.3.

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 Bores 2 and 3, as well as the two drain sites, were higher than the respective historical medians. The faecal coliform counts recorded at Bores 1 and 2 were relatively low and within the ranges of historical results, with median counts of 2.5 and

17.5 cfu/100 ml, respectively (Figure 6). The median count of 485 cfu/100 ml recorded at Bore 3 was considerably higher, and this site also recorded the highest maximum count of all of the bores (5,900 cfu/100 ml). Median counts were relatively elevated in the drains, with medians of 280 and 325 cfu/100 ml at the upstream and downstream sites, respectively. It should be noted that fluctuations in drain flow and access by stock and wildlife can affect faecal coliform numbers at these surface water sites to a greater extent.

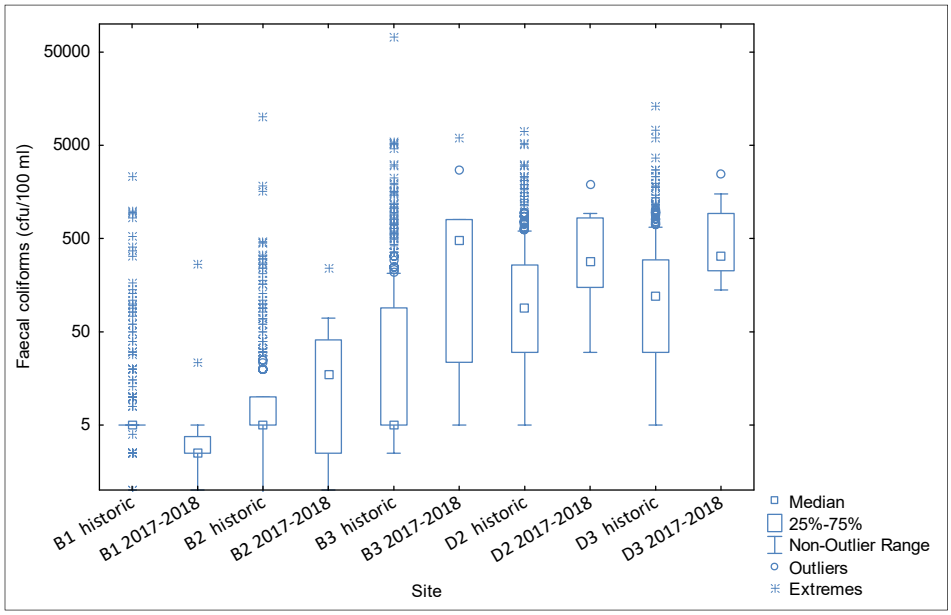


Figure 6 Boxplots of faecal coliform data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2017 (historic) and the current monitoring period (2017-2018) presented on a logarithmic scale

While the median pH values recorded for Bores 1 and 3 and the two drains in 2017-2018 were comparable with historical results, the median pH value recorded for Bore 2 was 0.25 units lower than the historical median (Figure 7).

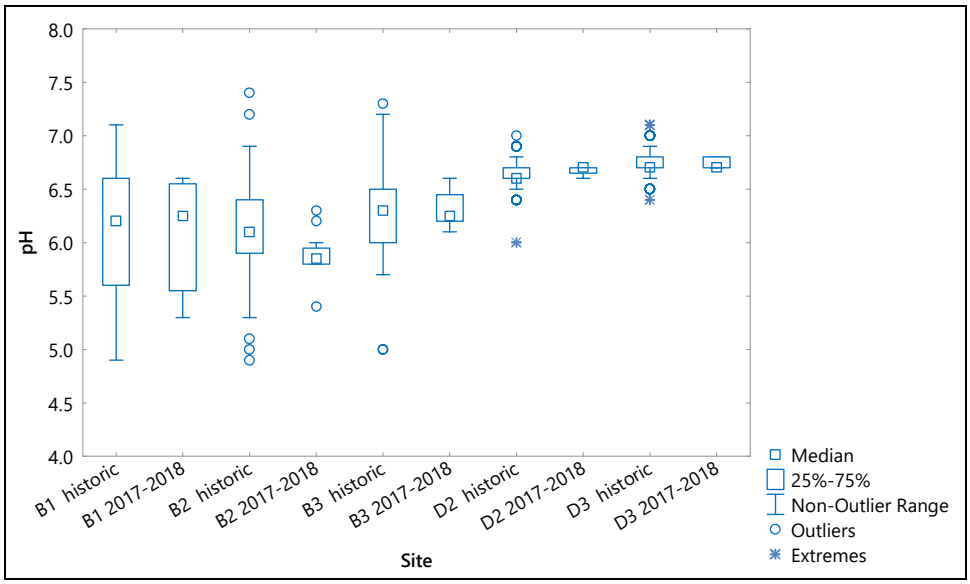


Figure 7 Boxplots of pH data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2017 (historic) and the current monitoring period (2017-2018)

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 III).

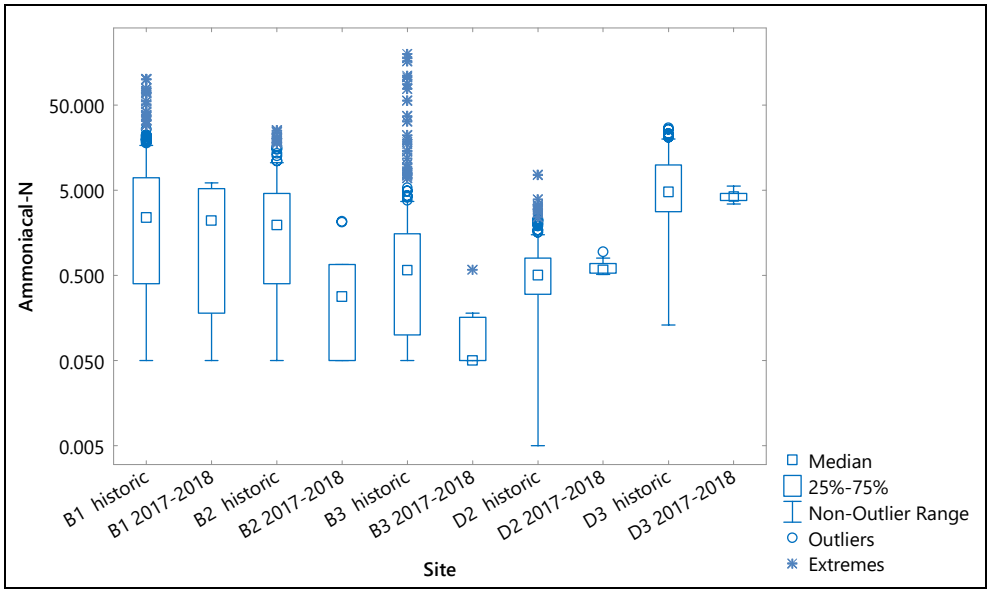


Figure 8 Boxplots of ammoniacal nitrogen data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2017 (historic) and the current monitoring period (2017-2018) presented on a logarithmic scale

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 III).

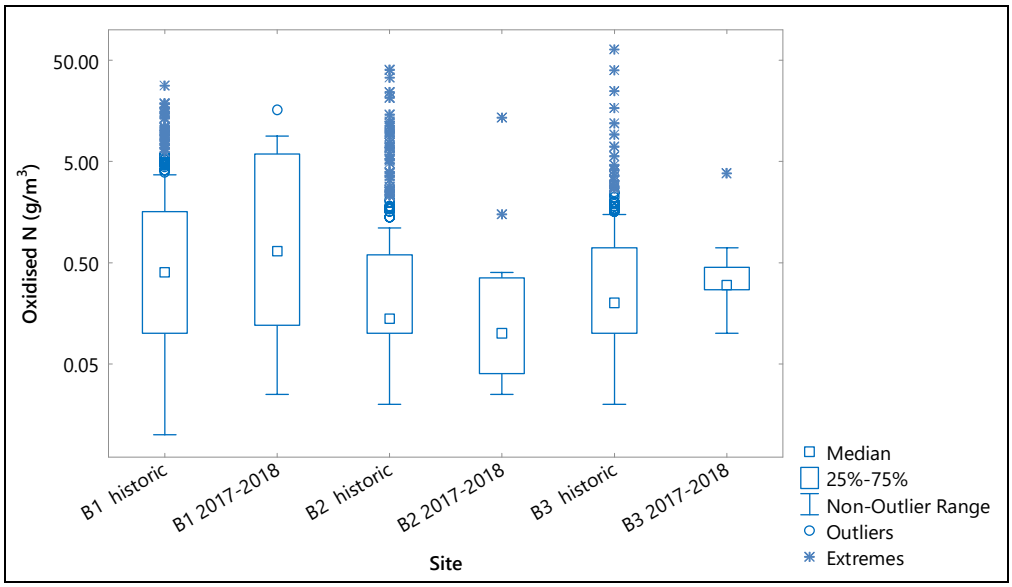


Figure 9 Boxplots of oxidised nitrogen data from the three monitoring bores (B1-3) between 1990 and 2017 (historic) and the current monitoring period (2017-2018) presented on a logarithmic scale

Soluble phosphate is released from the sludge biomass under anaerobic conditions and is therefore the major contributor to dissolved phosphorus levels. In 2017-2018, the concentrations of DRP in the groundwater analysed at all three bores were low and comparable with historical results, although slightly elevated DRP levels were recorded for Bore 1 over the summer months (Figure 10, Appendix III).

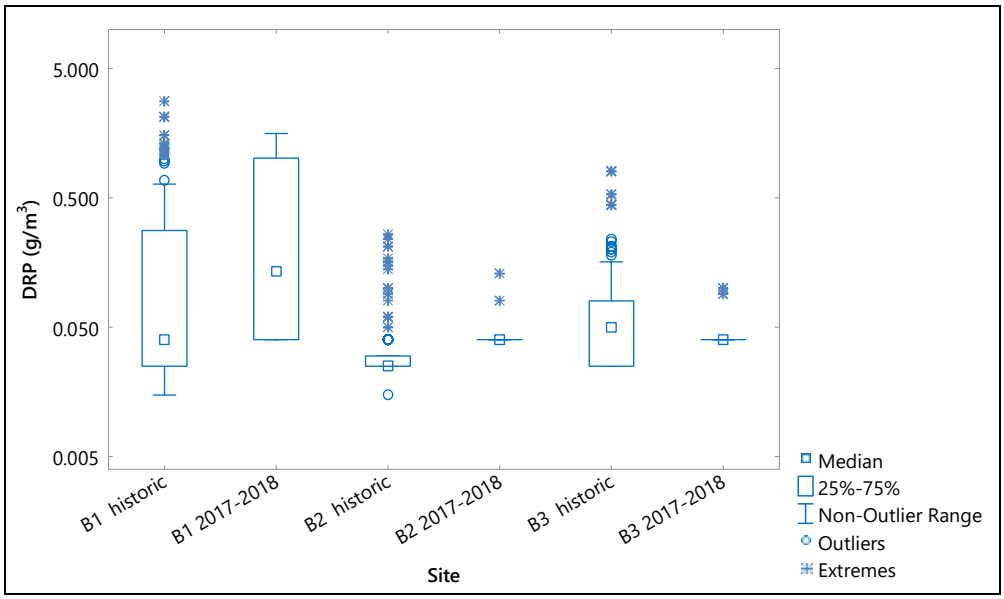


Figure 10 Boxplots of DRP data from the three monitoring bores (B1-3) between 2008 and 2017 (historic) and the current monitoring period (2017-2018)

Median COD levels were elevated at all three bores in 2017-2018, relative to historical results, and were higher at Bores 2 and 3 than at Bore 1 (Figure 11, Appendix III). These elevated COD levels indicate that seepage from the lagoon may still be occurring.

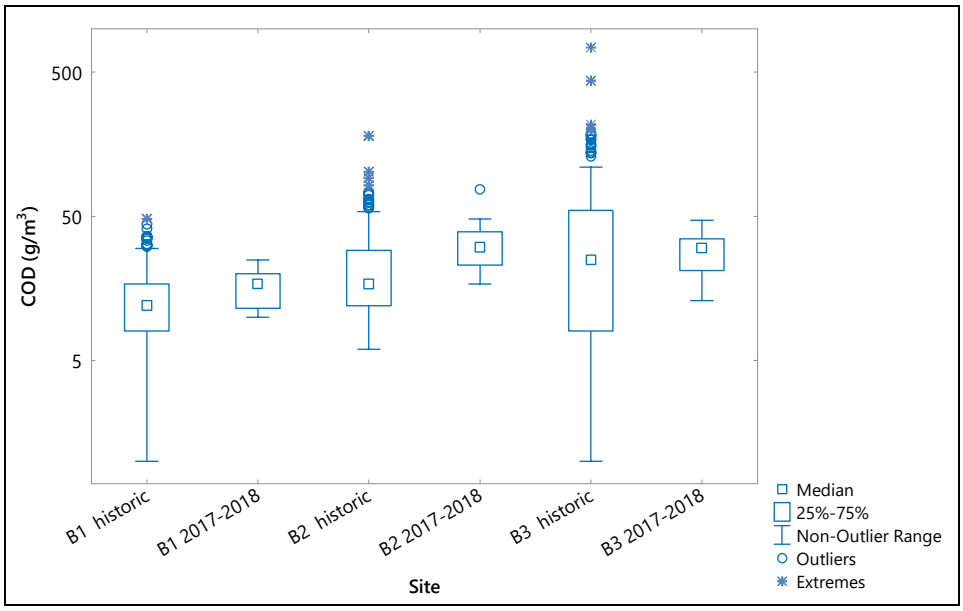


Figure 11 Boxplots of COD data from the three monitoring bores (B1-3) between 1990 and 2017 (historic) and the current monitoring period (2017-2018) presented on a logarithmic scale

2.1.4 Marine ecological surveys

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, ecological surveys were conducted between January and March 2018 at five sites (Figure 12). 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.

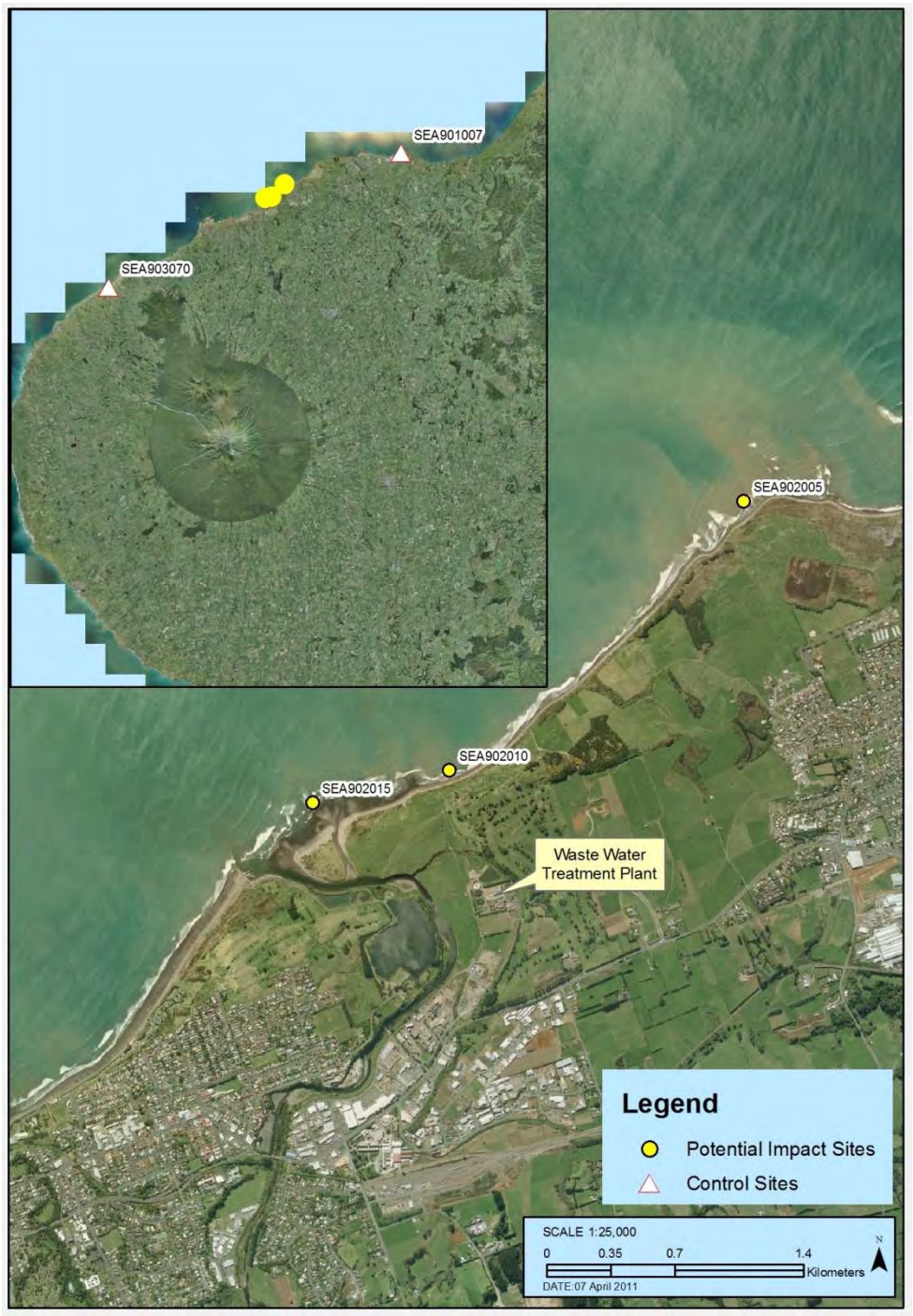


Figure 12 Marine ecological survey sites for NPWWTP

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2017-2018 survey. Apart from the site 500 m SW of the outfall, comparable or higher numbers of species and Shannon-Wiener Indices were generally seen between the potential impact and 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 13-15).

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.

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

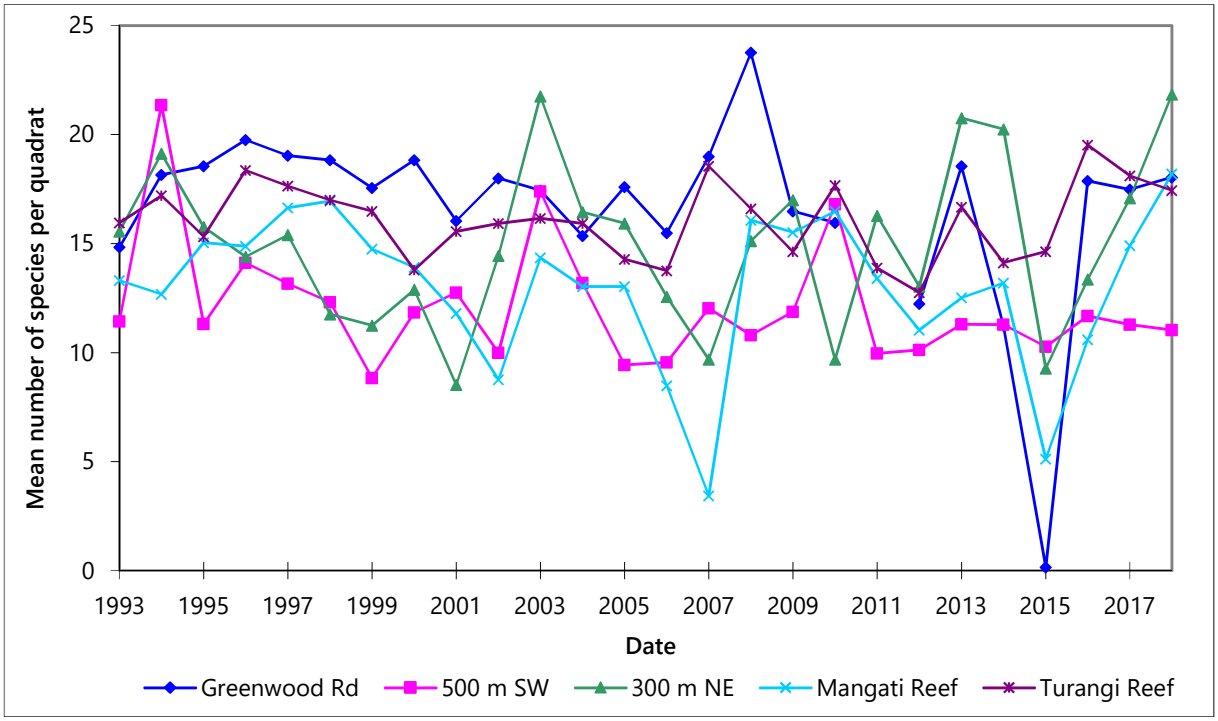


Figure 13 Mean number of species per quadrat from 1993 to 2018

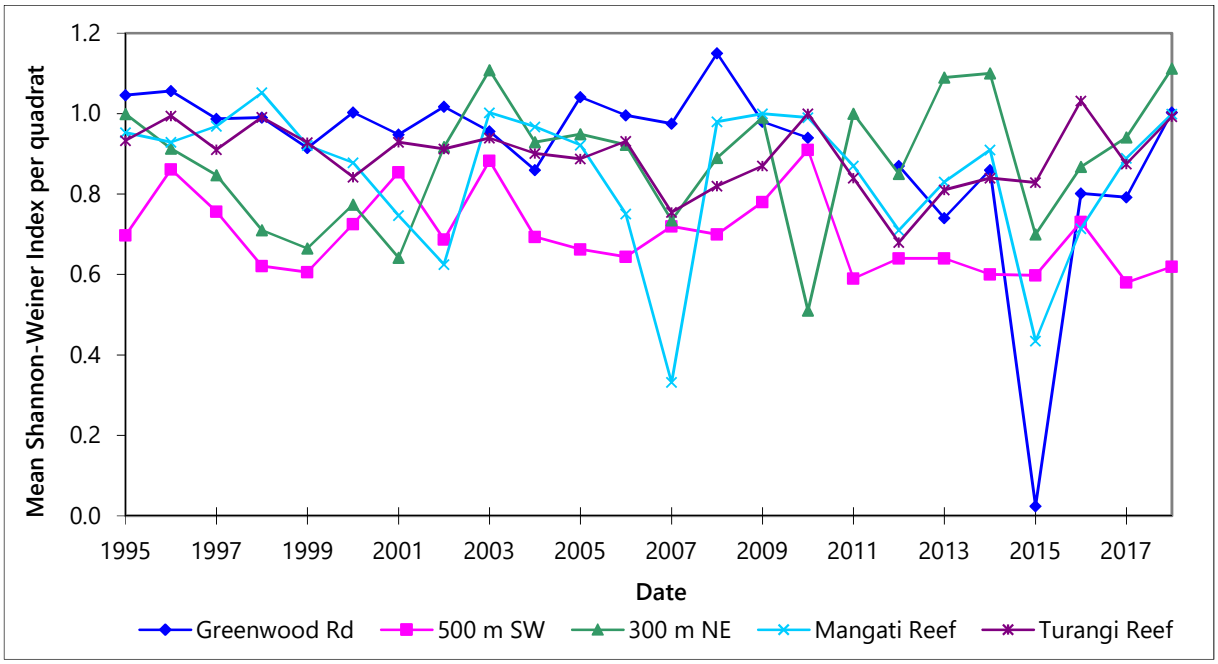


Figure 14 Mean Shannon-Weiner index per quadrat from 1995 to 2018

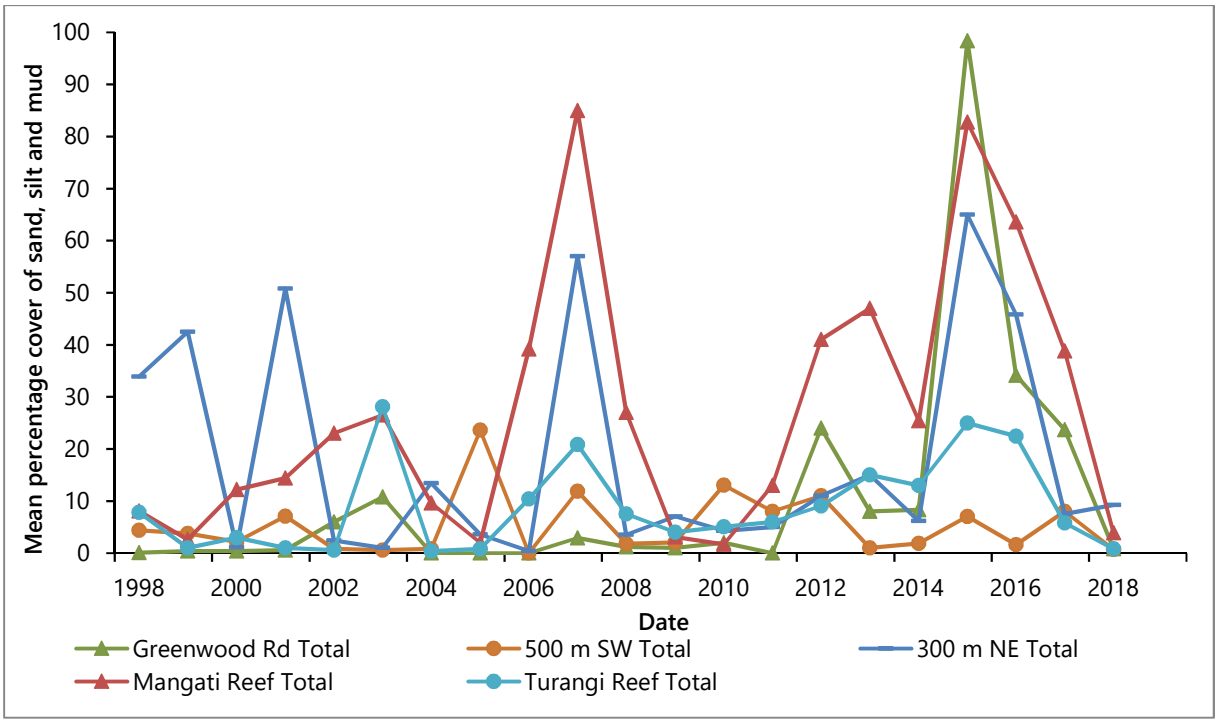


Figure 15 Mean percentage cover of sand, silt and mud at the five reef sites from 1998 to 2018

2.1.5 Shellfish monitoring

2.1.5.1 Metals in mussel flesh

Green lipped mussels (and other filter feeding shellfish) can accumulate contaminants in their tissues over time. As a consequence, they can be used as bio-monitors to assess the contaminant load at a particular site. Naturally occurring green lipped mussel were collected from three low shore sites. In order of influence from the NPWWTP outfall discharge, the sites sampled were: Waiwhakaiho Reef (SEA902015), Bell Block (SEA902001) and Arakaitai Reef (SEA902040). All sites supported scattered mussel populations. The concentrations of heavy metals in the mussel tissue and guideline values are presented in Table 6.

Table 6 Heavy metal contaminants in green lipped mussel flesh, 16 May 2018

Parameter	Units	Site			Shellfish guideline maximum limit*
		Arakaitai Reef	Waiwhakaiho Reef	Bell Block	
Silver	mg/kg	<0.01	<0.01	<0.01	-
Cadmium	mg/kg	0.042	0.036	0.029	**2.0**
Chromium	mg/kg	0.11	0.13	0.12	-
Copper	mg/kg	1.01	0.84	1.38	-
Mercury	mg/kg	0.014	0.016	0.015	**0.5**
Nickel	mg/kg	0.21	0.29	0.52	-
Lead	mg/kg	0.082	0.066	0.1	**2.0**
Zinc	mg/kg	12.8	11.5	15.4	-

**Australia New Zealand Food Standards Code, 2016*

Mussels are usually depurated (placed in filtered seawater for a period of time to allow the elimination of waste products from the gut) prior to analysis for heavy metals. Depuration was not carried out on this occasion; an omission which could potentially lead to higher than normal metal concentrations.

Mercury, cadmium and lead concentrations in mussel flesh from all three sites (Table 6) were well below Australia New Zealand Food Standards Code guidelines (2016). Although no guidelines exist for the remaining metals, these results are within the range of previous concentrations found during NPWWTP shellfish surveys (Appendix IV). The two metals found in highest concentrations at all three sites were zinc and copper (Figures 16 and 17).

The results collected since 1993 (Appendix IV) indicate that, over the long term, median concentrations of cadmium, copper, nickel, lead and zinc in mussel flesh are the greatest at the site closest to the outfall; Waiwhakaiho Reef. However, the differences in concentrations between sites have typically been minor.

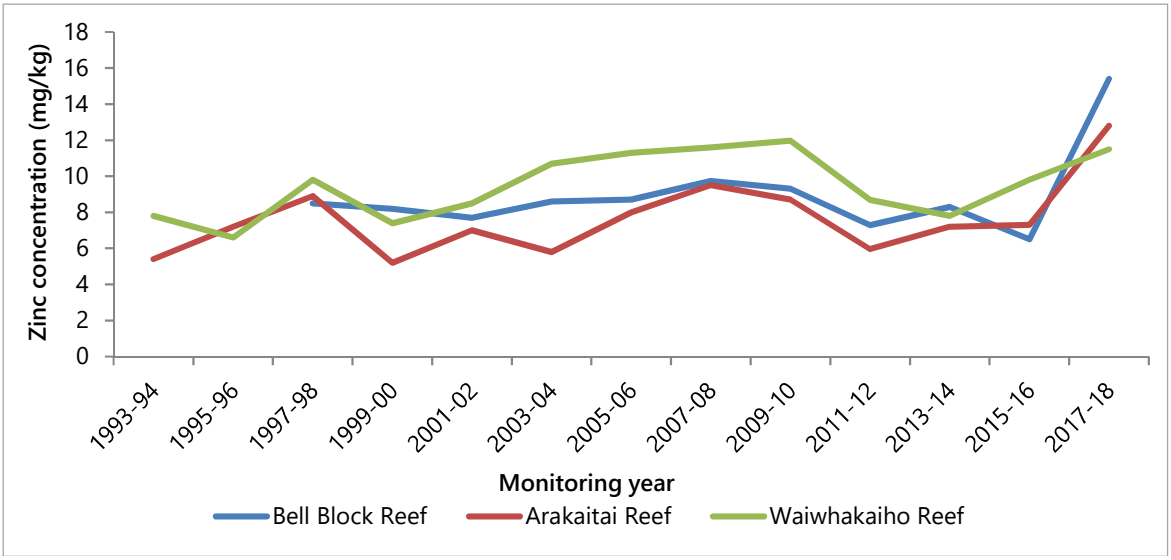


Figure 16 Concentrations of zinc in mussel tissues collected from the three reef sites

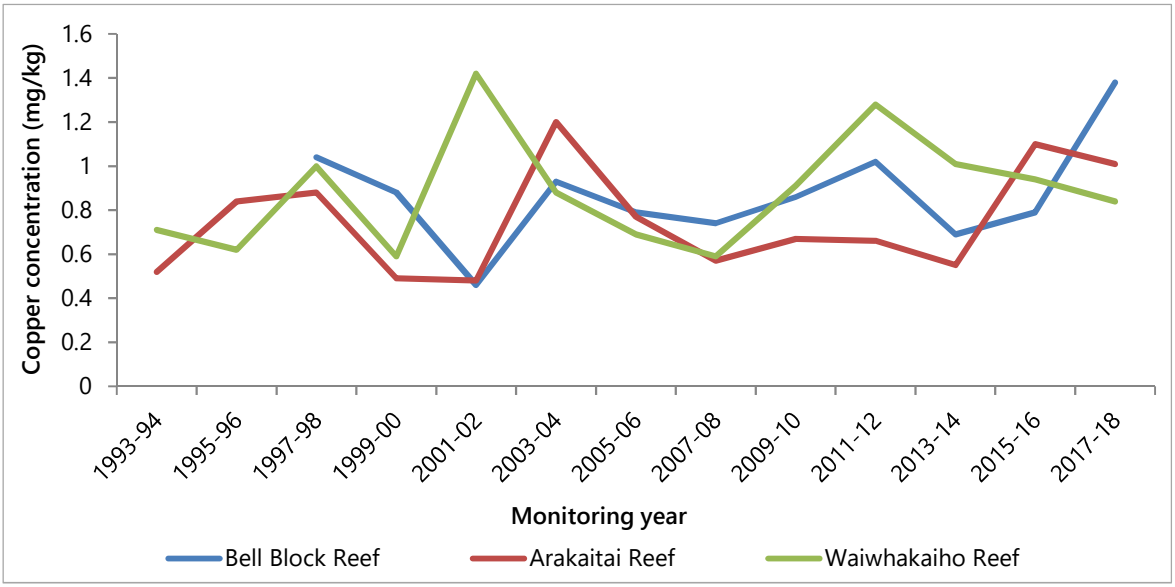


Figure 17 Concentration of copper in mussel tissues collected from the three reef sites

2.1.5.2 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 2.1.2.3).

Table 7 Mussel flesh norovirus 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
	7 Nov 2017*	Waiwhakaiho Reef	Negative	Low
	16 May 2018	Waiwhakaiho Reef	Low	High
		Bell Block	Negative	Negative

*No mussels were found at the Bell Block site on 7 November 2017

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 mostly low or below detection limits. A high norovirus result was recorded at Waiwhakaiho Reef on 16 May 2018, 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 (Photos 2 & 3).

Photo 2 Shellfish health warning sign at the Waiwhakaiho River mouth (left), green lipped mussels at bell Block (right)

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-strong 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 2017-2018 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 17 incidents which resulted in discharges from the wastewater network to waterways. Four of these incidents were related to pipe blockages or breakages, ten were related to high rainfall events and the remaining three events were a result of mechanical faults or technical errors. Although the number of incidents that occurred in the 2017-2018 period was still high, the number has continued to decrease from recent years (40 incidents in the 2014-2015 year, 24 in 2015-2016 and 20 in 2016-2017).

Incidents are investigated and assessed based on the cause of incident, NPDC's adherence to their Incident Response Plan and the resulting environmental effects. 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

One incident was reported from the NPWWTP during the 2017-2018 year (Table 8). The incident resulted from an equipment failure which meant that the minimum chlorine concentration in the effluent (0.3 g/m^3) could not be met. Corrective actions were taken by NPDC and the Council was not required to take any further action (Table 8).

Table 8 Summary of incidents at the NPWWTP during the 2017-2018 monitoring year

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
28/08/2017	Unauthorised discharge	Chlorine disinfection system failure caused the chlorine to fall below required limit in the discharged effluent.	Manual override of the system initiated to ensure chlorine level was above required limits.	No action required

2.3.2 Sewage pump station incidents

There were eight unauthorised discharges from sewage pump stations reported during the 2017-2018 monitoring year, summarised in Table 9. 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 2017-2018 year

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
16/05/2018	Waitara Outfall SPS – to Outfall	High rainfall event causing overflow. Combined with limited pumping capacity due to mechanical failure.	Replacement pumps hired.	Seawater samples collected. No further action required
18/03/2018	Connett Road SPS	High rainfall event causing wastewater overflow from the pump station.	Checked site and reset pumps.	No action required
07/03/2018	Mangati SPS	Electrical fault resulting in equipment failure causing wastewater overflow.	Fault found and equipment reset.	No action required
20/02/2018	Connett Road SPS	High rainfall event causing wastewater overflow from the pump station.	Checked site and reset pumps.	No action required
28/08/2017	Connett Road SPS	High rainfall event causing wastewater overflow from the pump station	Checked site and reset pumps.	No action required
28/08/2017	Ashmore Drive SPS	High rainfall event causing wastewater overflow from the pump station	Checked site and reset pumps.	No action required
28/08/2017	Ngamotu Beach SPS	High rainfall event causing wastewater overflow from the pump station.	Checked site and reset pumps.	No action required.

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
05/07/2017	Te Whena Place SPS	High rainfall event causing wastewater overflow from the pump station.	Checked site and pumps, all working correctly.	No action required

2.3.3 Reticulation overflow incidents

Eight unauthorised discharges occurred due to blockages and/or damage 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. Two events occurred due to other factors. One was third party damage to piping with another being a mechanical issue with a rubber gasket failing. All incidents were responded to as defined in the Incident Response Plan. No further enforcement action was required.

Table 10 Summary of reticulation overflows during the 2017-2018 year

Date	Incident type	Incident details	Corrective actions taken by NPDC	Council action
15/05/2018	30 Hudson Road, Bell Block	Overflow caused by third party damage due to pipe damage.	Pipe repaired.	No action required
21/03/2018	174 Lemon Street, New Plymouth	High rainfall event causing wastewater overflow from a manhole.	Blockage cleared, site cleaned and sanitised.	No action required
30/12/2018	137 Pioneer Road, New Plymouth	Sewer line blockage from fat caused an overflow of wastewater from manhole.	Blockage cleared, site cleaned and sanitised.	No action required
11/12/2017	45 Pioneer Road, New Plymouth	Sewer line blockage from tree roots caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No action required
21/11/2017	974 South Road, New Plymouth	Rubber gasket on flange to air release valve blew out filling chamber with sewage. Flooded and discharged to ground (no water ways affected)	Site cleaned and sanitised, repairs made.	No action required
09/10/2017	224 Devon Street West, New Plymouth	Sewer line blockage caused an overflow of wastewater from a manhole.	Blockage cleared, site cleaned and sanitised.	No action required
28/08/2017	2 Carrington Street, New Plymouth	High rainfall event causing wastewater overflow from a manhole	Blockage cleared, site cleaned and sanitised.	No action required
28/08/2017	107A Seaview Road, New Plymouth	High rainfall event causing wastewater overflow from a manhole	Blockage cleared, site cleaned and sanitised.	No action required

2.3.4 Sludge lagoon investigation

2.3.4.1 Background

Following analysis of routine monitoring data from the 2015-2016 period, the Council determined that seepage was occurring from the sludge lagoon to groundwater and an adjacent drainage channel. However, there was insufficient information available to adequately assess the environmental effect of this seepage. As such, it was recommended in the 2015-2016 Annual Monitoring Report that additional monitoring be undertaken in order to gather evidence that would inform an appropriate management response. Specifically, the aims of the additional monitoring were to:

1. Understand the preferential flow paths of the seepage (sludge lagoon leachate).
2. Assess the potential for natural attenuation of the leachate contaminants in groundwater (and in doing so, understand the potential extent and longevity of environmental contamination).
3. Determine whether the seepage was contaminating the adjacent ground and surface waters with further contaminants specific to the nature of the sludge (i.e. metals).

In order to gain an improved understanding of leachate flow paths, an elevation survey was undertaken. This involved measuring the elevations of all monitoring bores and relevant points of reference. With this information, groundwater levels obtained during sampling can then be referenced against a common datum; providing an indication of gradients and likely directions of groundwater flow.

Low-flow groundwater sampling methodology was required to assess the potential for natural attenuation of leachate contaminants in groundwater. This methodology involves drawing water out of a monitoring bore in a way which ensures that the surrounding groundwater is being sampled, rather than stagnant bore water. Using a peristaltic pump, the groundwater can be sampled without atmospheric interaction and with minimal disturbance/aeration, providing a quasi *in-situ* reading of critical parameters including dissolved oxygen (DO), reduction potential (redox) and pH. These parameters provide a strong indication of the contaminant attenuation capacity of a given groundwater system. Generally speaking microbial communities in groundwater preferentially utilise oxygen for respiration, however, under reducing conditions (low DO concentrations) microbes are forced to utilise alternative compounds. One such compound is nitrate (NO_3-N). Therefore, under reducing conditions, microbes can reduce nitrogen content in groundwater; a process referred to as denitrification. Groundwater dynamics such as these can exhibit significant seasonal variation; low-flow sampling was therefore employed on four occasions throughout the year to capture this.

Routine monitoring sample analyses included faecal coliforms, pH, ammoniacal-N (NH_4-N), oxidised-N, DRP and COD. However, given the nature of effluent that is received by the NPWWTP, including industrial trade waste, it was deemed necessary to determine whether any heavy metals had leached into the adjacent ground and surface waters. Additional samples were collected and analysed for this purpose.

The additional work outlined above was implemented from March 2017 to March 2018. During this time, NPDC's routine monthly groundwater sampling was extended from Bores 1-3 and Drain Sites 2-3, to Bores 1-5 and Drain Sites 2-4 (Figure 18). Low flow groundwater sampling was undertaken by the Council on a quarterly basis (March, June, September and December). NPDC also collected extra ground and surface water samples on a seasonal basis for metals analyses. Later in 2018, NPDC provided the Council with surveyed elevation data from the sludge lagoon area.

The results from the sludge lagoon investigation are presented here.

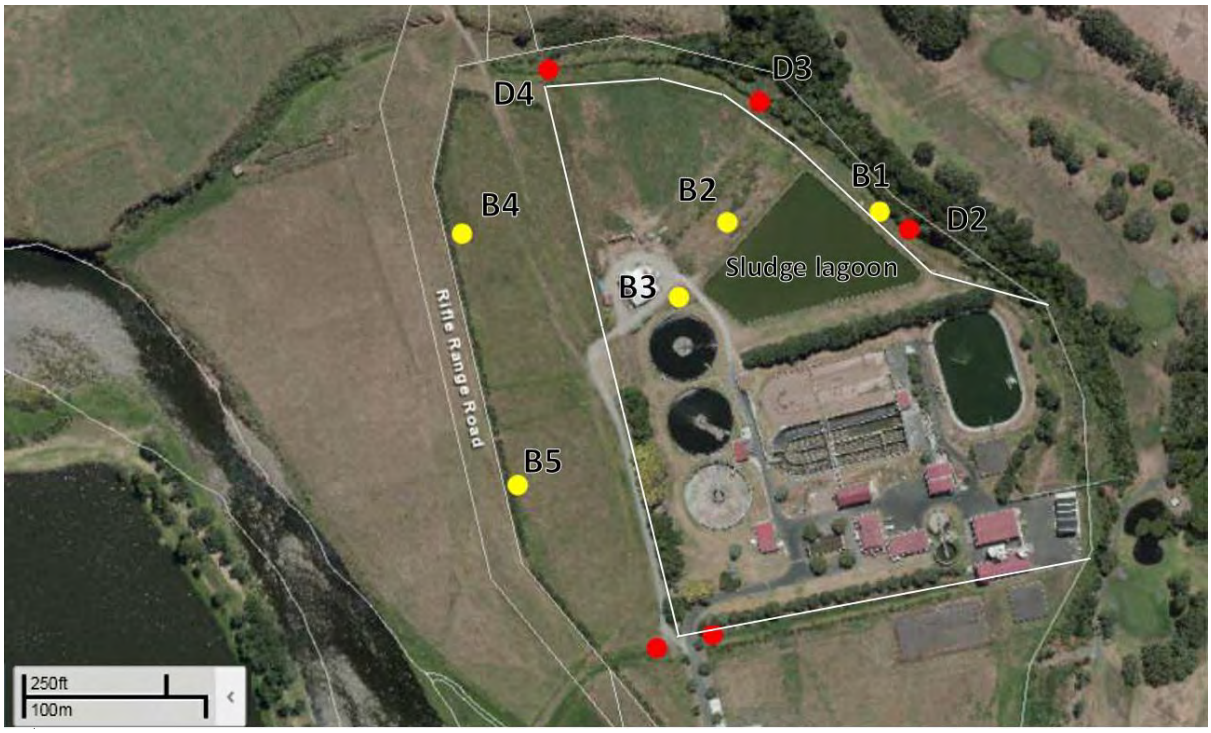


Figure 18 NPWWTP sludge lagoon and adjacent monitoring sites (groundwater sites shown in red and surface water sites shown in yellow)

2.3.4.2 Groundwater results

Groundwater samples were collected from five bores located in the vicinity of the sludge lagoon (Figure 18). Three of the bores (1-3) are positioned adjacent to the sludge lagoon and are routinely sampled on a monthly basis by NPDC. Bore 1 is located midway along the north eastern edge of the lagoon, next to the drain. Bore 2 is located midway along the north western edge of the lagoon. Bore 3 is positioned next to the western corner of the lagoon. Bores 4 and 5 were installed more recently for other consent purposes, but are useful for the purposes of this investigation, given their distance from the lagoon. Bores 4 and 5 are positioned approximately 140 and 160 m from the sludge lagoon, respectively. The distance between Bores 1-3 and edge of the lagoon ranges from approximately 10 to 15 m.

The resolution of groundwater flow direction mapping was limited by the small number of groundwater sites for which data is available. The lack of groundwater depth measurements on the day the elevation survey was undertaken also meant that elevation data from other surface water features couldn't be incorporated into the flow modelling. Shallow groundwater flow generally follows a subdued reflection of surface topography however, so some general inferences can be made regarding flow directions. The generalised direction of groundwater flow beneath the site will be toward the Waiwhakaiho River. There will also be localised areas of groundwater flow toward the surface drain that bounds the site, particularly toward the east of the lagoon, where a steep hydraulic gradient exists.

Over the period of investigation, peak nitrate (NO_3-N) concentrations of 16 and 13.5 g/m^3 were recorded at Bores 1 and 2, respectively (Figure 19). NO_3-N Concentrations at both sites were highly variable throughout the year however, with average concentrations of 4.9 and 7.4 g/m^3. Minimum NO_3-N concentrations recorded at both sites were < 1 g/m^3. The fluctuations in NO_3-N concentrations at each site generally track seasonal changes in groundwater redox state. Peak NO_3-N concentrations were recorded during winter when groundwater was more oxidised as a result of rainwater recharge to the aquifer, as evidenced by increased dissolved oxygen (DO) concentrations. Conversely, minimum NO_3-N concentrations were recorded during drier months, when groundwater was anoxic (low DO).

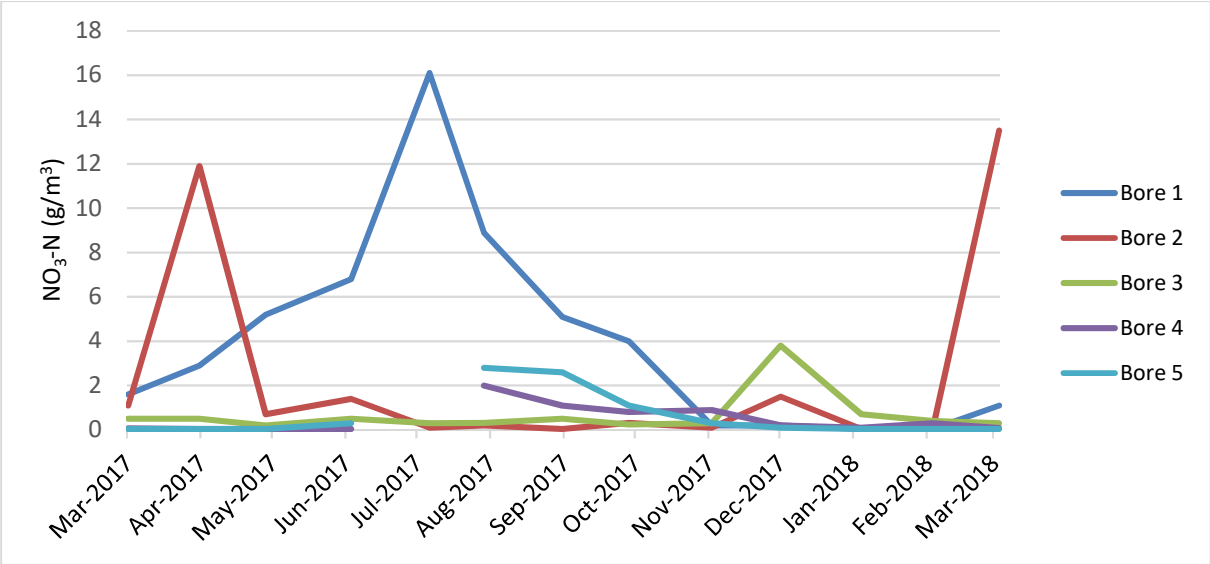


Figure 19 Concentrations of NO_3-N in samples from the five monitoring bores during the investigation

More distant sites (Bore 4 and Bore 5) show similar seasonal patterns in redox state and NO_3-N fluctuations, although NO_3-N concentrations in Bore 5 are generally higher than are seen in Bore 4 (Figure 19). Maximum NO_3-N concentrations were again recorded during winter and early spring, when groundwater was more oxidised. Peak concentrations of 2.0 and 5.1 g/m3-N were measured. Anoxic groundwater conditions were found to predominate over large periods of the year, resulting in low measured NO_3-N concentrations. Over the period of investigation average NO_3-N concentrations at Bore 4 and Bore 5 were 0.8 and 1.8 g/m3-N, respectively.

Ammoniacal-N (NH_4-N) concentrations show a similar, but opposite pattern to those described above for NO_3-N (Figure 20). This is to be expected under a pattern of seasonal redox change where, under oxidised conditions, nitrogen will be present in the form of NO_3-N and as NH_4-N under anoxic conditions. As a result, there are seasonal shifts between the predominant nitrogen species present in monitored groundwater, with NO_3-N predominating during winter and spring, and NH_4-N during summer and autumn.

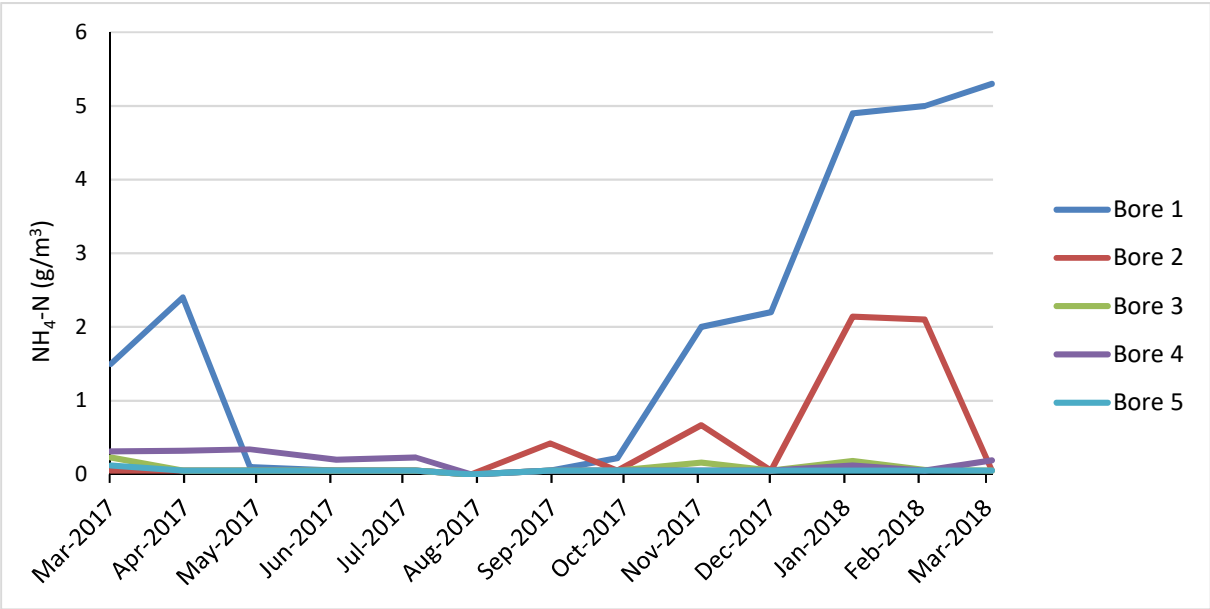


Figure 20 Concentrations of NH_4-N in samples from the five monitoring bores during the investigation

Faecal coliforms (FC) were detected at all sites monitored during the investigation period. Median concentrations over this period were less than the laboratory detection limit at Bores 1, 4 and 5. The median

concentration at Bore 2 was 22 cfu/100 mL. Bore 3 registered consistently high counts across the year, with a median concentration of 510 cfu/100 mL, and a peak concentration of 5,900 cfu/100 mL.

The consistently elevated FC counts recorded at Bore 3 differed from other sites, where lower counts were recorded on a more intermittent basis. FC counts in Bore 3 generally tracked measured water levels, with higher counts corresponding with higher water level elevations. DO concentrations measured at Bore 3 were also the highest of any site monitored, with oxic conditions over large periods of the year. These results may be indicative of an integrity issue with this particular bore, with results potentially being influenced by the ingress of surface runoff. Alternatively, there may be an additional source of FC located in the vicinity of the bore. While NO_3-N concentrations were found to be low at this site, which would not be expected under oxidising conditions, it is possible that denitrification is occurring in more anoxic areas of the groundwater system up gradient of the bore.

Cadmium and chromium were below analytical detection limits in all samples from all bores. Copper was intermittently present in samples collected from bores 2 and 3 at concentrations below the Ministry of Health (2008) drinking water standards. Zinc was also intermittently present in bores 2 and 3 at low concentrations. Nickel was present in bore 2 on a single occasion (at a concentration below drinking water standards), as was lead. The concentration of lead in this sample was over ten times the drinking water standard. In contrast to the majority of the metals, concentrations of iron and manganese were present in all five bores. The presence of these metals in groundwater is associated with reducing conditions. Under these conditions (with low DO), iron and manganese exist in their more soluble forms meaning higher concentrations are typically found in groundwater samples. The opposite occurs under oxidised conditions.

2.3.4.3 Surface water results

Surface water samples were taken from the drain that runs immediately east of the sludge lagoon (Figure 18). Three locations were sampled, two of which have been sampled regularly as part of the compliance monitoring programme for the site. Drain Site 2 is located immediately adjacent to the upper eastern end of the sludge lagoon. Drain Site 3 located approximately 90 m downstream of Drain Site 2. An additional site, Drain Site 4, was established as part of the additional site investigation being reported and is located approximately 130 m downstream of Drain Site 3.

Based on the topographical survey of the site, the water level within the sludge lagoon is estimated to be up to 3 m higher than the base of the drain. The lagoon therefore provides significant hydraulic pressure and there is a substantial hydraulic gradient in the direction of the drain.

The median concentrations of NH_4-N measured at the three drain sites ranged from 0.6 g/m3 at Drain Site 2 to 4.0 g/m3 at Drain Sites 3 and 4. The median NH_4-N values at Drain Sites 3 and 4 significantly exceeded the NPS-FM national bottom line for fish toxicity (1.3 g/m3). Concentrations of NH_4-N were found to increase significantly between Drain Site 2 and Drain Site 3, indicating a discharge source exists between these points (Figure 21).

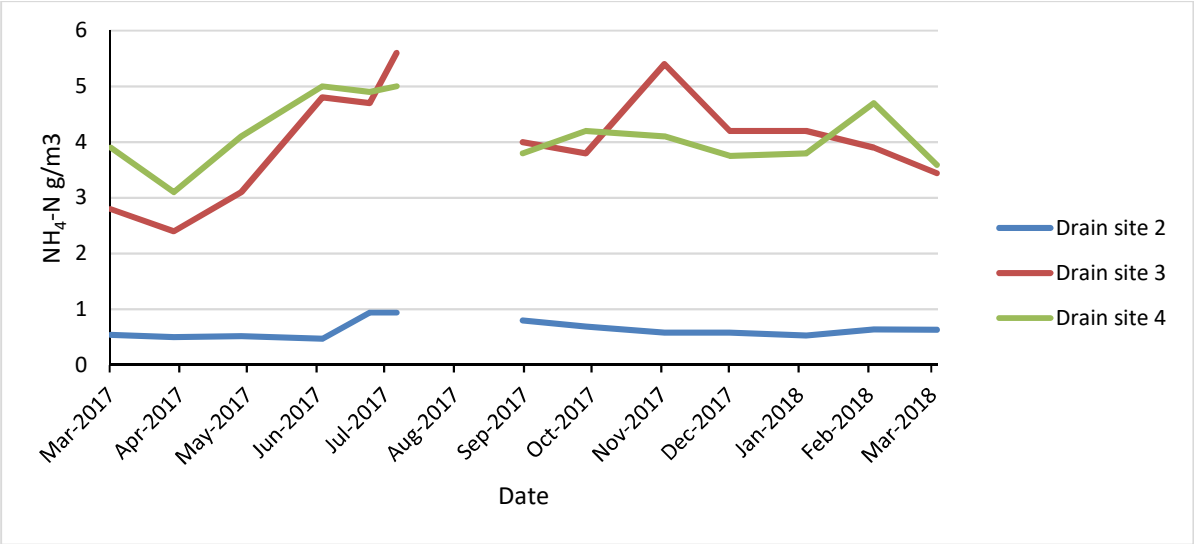


Figure 21 Concentrations of NH_4-N in the three drain sites sample during the investigation

An assessment of the NH_4-N data shows that that concentration are consistently elevated across the year. This suggests that a relatively direct flow path exists between the areas of lagoon seepage and the receiving drain. If seepage from the lagoon was retained within the groundwater system for any length of time, it would be anticipated that there would be evidence of cycling in N species in response to groundwater redox change, as is seen in groundwater sampling results. Given that this is not observed, a more direct flow path/point source is thought to be the likely source of NH_4-N found in the drain samples.

The FC results demonstrate similar downstream patterns to what is seen with the NH_4-N data. FC counts are considerably elevated at the downstream sampling locations (Figure 22). However, unlike NH_4-N, FC counts were often higher at Drain Site 4 than Drain Site 3. Although this may still provide supporting evidence for the NH_4-N trend, these result should be interpreted with caution as there could be a number of contributing sources. Stock access, wild fowl and even decaying plant matter can influence surface water FC counts.

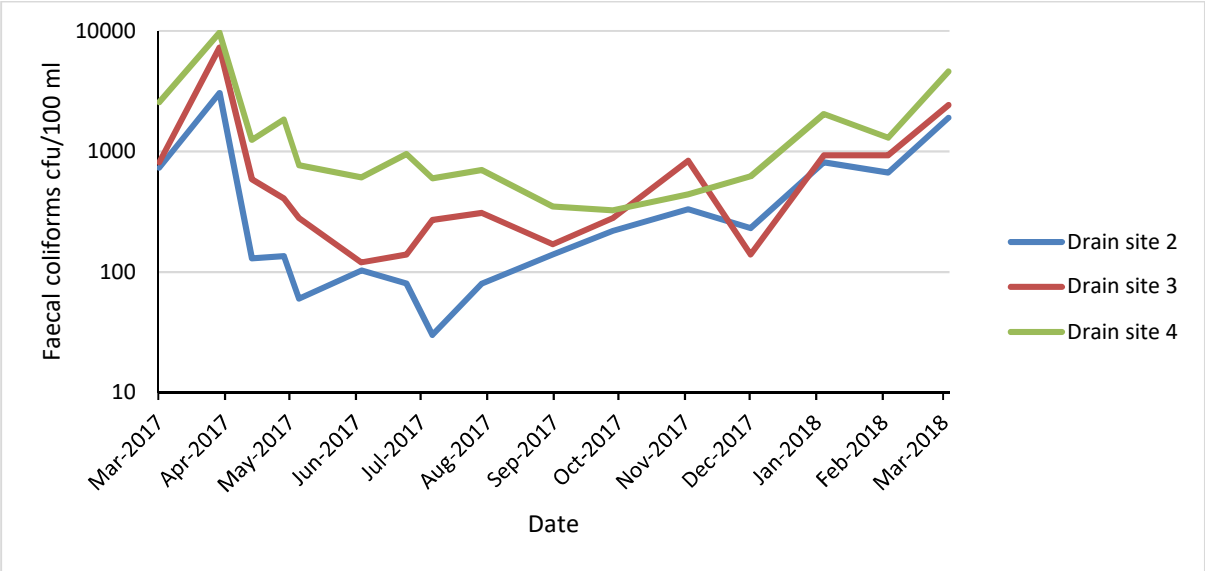


Figure 22 FC counts in the three drain sites sample during the investigation (presented on a logarithmic axis)

As with the groundwater results, concentrations of iron and manganese were found at all drain sites. With the exception of copper which was present in a concentration equivalent to the limit of detection in one sample from Drain Site 2, no other metals were found at any of the drain sites.

2.3.4.4 Summary

Seepage is a source of nutrients and microbial contaminants in the groundwater system downgradient of the sludge lagoon. The investigation completed has found that measured concentrations of nutrients and metals are not of significant concern in terms of their environmental impact. Sampling of groundwater using low flow methodology has enabled an assessment of groundwater redox state. This assessment has found the groundwater system downgradient of the lagoon to be highly reducing in nature and thus it has significant capacity to attenuate N species. As a result any adverse effects resulting from the discharge on groundwater are likely to occur within close proximity of the lagoon itself and are unlikely to extend outside of the boundaries of the site.

Consistent with previous monitoring, the investigation found elevated concentrations of NH_4-N at the two downstream sampling sites in the open drain. These concentrations significantly exceeded the NPS-FM national bottom line for fish toxicity. FC counts also increased at the downstream sites. Due to its limited flow, the drain is only a minor contributor to downstream receptors, i.e. the Waiwhakaiho River. Therefore, the overall environmental impact of the drain is reduced.

The Council is satisfied that this investigation has achieved its aims and addressed any potential concerns regarding seepage from the sludge lagoon into the surrounding environment. However, the pronounced increase in NH_4-N concentrations and FC counts within the drain remain of concern. It is recommended that NPDC liaise with Council to design a targeted drain sampling programme to identify the location of any potential preferential flow path or point source discharges between Drain Sites 2 and 3. The following, additional recommendations are also made in light of the results of this investigation:

1. NPDC to continue with monthly groundwater and drain sampling at all sites.
2. No further quarterly low flow sampling or metals analyses are required.
3. That the plans for decommissioning and reinstating the sludge lagoon are continued; keeping the Council informed as the project progresses.

3 Discussion

3.1 Discussion of plant performance

Significant activities that occurred during the 2017-2018 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 plans to upgrade the thermal drying facility. 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 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 next review is due by 31 March 2022.

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 2017-2018 was received on 30 July 2018.

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 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 12 October 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 2017-2018 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. Compliance with condition 10, regarding the minimum required effluent chlorine concentration, is assessed using results from grab samples. All grab samples were compliant with this condition throughout the monitoring period. A dosing equipment failure led to the temporary reduction of chlorine concentrations below the consent limit on a single occasion. However, this issue was corrected in a prompt and effective manner. With regards to norovirus, inactivation has continued to improve following the upgrade of the wastewater treatment system. Norovirus numbers

were below the limit of quantitation in all effluent samples. Overall, monitoring results indicated that the effluent discharge from the NPWWTP to the Tasman Sea was of a high quality during the 2017-2018 year.

Monitoring of effects on the receiving environment consisted of an intertidal marine ecological survey and the analysis of metals and norovirus in green lipped mussel tissue. GI and GII norovirus concentrations in mussel tissue at Waiwhakaiho Reef varied from negative and low, respectively, on 7 November, to low and high on 16 May. Because this site is close to the outfall discharge, the risk of pathogen contamination in shellfish remains significant. As such, permanent health warning signage remains in place. Apart from this, there were no other significant detectable effects in the receiving environment resulting from authorised NPWWTP discharges during the 2017-2018 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 2017-2018 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 full investigation is reported in Section 2.3.4., however, the key findings regarding the environmental effects of the sludge lagoon are presented below.

Seepage is a source of nutrients and microbial contaminants in the groundwater system downgradient of the sludge lagoon. The investigation completed has found that measured concentrations of nutrients and metals are not of significant concern in terms of their environmental impact. Sampling of groundwater using low flow methodology has enabled an assessment of groundwater redox state. This assessment has found the groundwater system downgradient of the lagoon to be highly reducing in nature and thus it has significant capacity to attenuate N species. As a result any adverse effects resulting from the discharge on groundwater are likely to occur within close proximity of the lagoon itself and are unlikely to extend outside of the boundaries of the site.

Consistent with previous monitoring, the investigation found elevated concentrations of NH_4-N at the two downstream sampling sites in the open drain. These concentrations significantly exceeded the NPS-FM national bottom line for fish toxicity. FC counts also increased at the downstream sites. Due to its limited flow, the drain is only a minor contributor to downstream receptors, i.e. the Waiwhakaiho River. Therefore, the overall environmental impact of the drain is reduced. However, further investigation is still required to locate any potential pathways which are resulting in contamination of the drain.

3.2.3 Air discharge

NPDC holds consent 4740-2 that allows the discharge of contaminants into the air from sludge processing activities.

Assessments of the odour performance of the milliscreen and sludge filter buildings made during inspections at the NPWWTP did not detect odours 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	No exercised during 2017-2018	N/A
6. Public notification prior to taking aeration basin off-line	No exercised during 2017-2018	N/A
7. Minimum duration off-line to achieve purpose	No exercised during 2017-2018	N/A
8. Notification to Council prior to taking aeration basins off-line	No exercised during 2017-2018	N/A
9. Consent holder to erect signage during off-line periods	No exercised during 2017-2018	N/A
10. Total available chlorine at least 0.3 gm^{-3} in effluent	Analysis of grab samples collected by NPDC and Council.	Yes
11. Effluent through 3 mm screen	Inspections, consultation with consent holder	Yes
12. Consent holder to undertake monitoring	Monitoring undertaken and results supplied	Yes
13. Consent holder to submit a QMRA	QMRA revised February 2017	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

Purpose: *To discharge wastewater to the Tasman Sea*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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	Report received July 2018	Yes
21. Maintain Contingency Plan	IRP reviewed December 2017	Yes
22. Annual meeting with Council, iwi and others	Meeting held October 2027	Yes
23. Meeting to include future management of wastewater	Next scheduled in 2027	N/A
24. Review of consent	Next scheduled in June 2022	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 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

Purpose: *To erect, place and maintain a culvert*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
8. Review of consent conditions	No further provision for review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

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
4. No adverse effects upon ground or surface waters	Inspections and results of monitoring	No Minor, relatively localised effects on groundwater downstream of the 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		**Good**
Overall assessment of administrative performance in respect of this consent		**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

Purpose: *To erect, place, maintain and use a marine outfall*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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		**N/A**
Overall assessment of administrative performance in respect of this consent		**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		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 16 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2010	0882		1		
	2982	1			
	4740	1			
	4593	1			
	1826	1			
2011	0882		1		
	2982	1			
	4740	1			
	4593	1			
	1826	1			
2012	0882		1		
	2982	1			
	4740	1			
	4593	1			
	1826	1			
2014	0882				1
	2982	1			
	4740	1			
	4593	1			
	1826	1			
2015	0882		1		
	2982	1			
	4740	1			
	4593	1			
	1826	1			
2016	0882		1		
	2982			1	
	4740		1		
	4593		1		
	1826		1		
2017	0882	1			
	2982			1	
	4740	1			
	4593				
	1826	1			

Year	Consent no	High	Good	Improvement req	Poor
2018	0882	1			
	2982		1		
	4740	1			
	4593				
	1826	1			
	9984	1			
Totals		27	9	2	1

During the year, NPDC demonstrated an overall high level of environmental and administrative compliance and performance with the resource consents as defined in Section 1.1.4. The number of incidents which resulted in discharges from the wastewater network to waterways has continued to decrease over recent years. The quality of treated effluent discharged from the wastewater treatment plant was high during 2017-2018. However, norovirus numbers in green-lipped mussels were elevated in the vicinity of the outfall. An investigation into the effects of sludge lagoon seepage was undertaken and found that the groundwater impacts were relatively confined, although further investigation of the adjacent drain is warranted.

3.4 Recommendations from the 2016-2017 Annual Report

In the 2016-2017 Annual Report, it was recommended:

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.

These recommendations were implemented during the 2017-2018 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.

It is proposed that for 2018-2019 that the monitoring programme largely remains the same as that implemented in the 2017-2018 year. However, with regards to the sludge lagoon investigation it is recommended that the extended groundwater sampling regime, as specified in the 2015-2016 NPWWTP compliance monitoring report, is discontinued and that the standard sampling regime is reinstated. It is also recommended that NPDC liaise with Council to design a targeted drain sampling programme to identify the location of a potential preferential flow path or point source discharge between Drain Sites 2 and 3.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site 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 2018-2019.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the NPWWTP in the 2018-2019 year continue at the same level as in 2017-2018.
2. THAT should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT NPDC liaise with Council to design a targeted drain sampling programme to identify the location of a potential preferential flow path or point source discharge between Drain Sites 2 and 3.
4. THAT the plans for decommissioning and reinstating the sludge lagoon are continued; keeping the Council informed as the project progresses.

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 (g/m3). 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.
Quantitation limit	A quantitation limit is the smallest value of a given parameter that can be reliably quantified by a specified analytical procedure. Below this limit, the parameter in question may still be present, though the test method is not accurate enough to reliably quantify it.
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 a Science Services Manager.

Bibliography and references

Food Standards Australia New Zealand 2016: New Zealand (Australia New Zealand Food Standards Code) Food Standards 2016. Standard 1.4.1 'Contaminants and natural toxicants'.

McBride, G. 2012: An assessment of human health effects for a quantitative approach based on Norovirus, prepared for the New Plymouth District Council. NIWA Client Report HAM2012-150.

New Plymouth District Council 2013: New Plymouth wastewater discharge consent 0882-4 annual report 1 July 2012 to 30 June 2013.

New Plymouth District Council 2014: New Plymouth wastewater discharge consent 0882-4 annual report 1 July 2013 to 30 June 2014.

Taranaki Regional Council 1993: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1992/93. TRC Technical Report 93-30.

Taranaki Regional Council 1994: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1993-94. TRC Technical Report 94-17.

Taranaki Regional Council 1995: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1994-95. TRC Technical Report 95-42.

Taranaki Regional Council 1996: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1995-96. TRC Technical Report 96-44.

Taranaki Regional Council 1997: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1996-97. TRC Technical Report 97-55.

Taranaki Regional Council 1998: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1997-98. TRC Technical Report 98-23.

Taranaki Regional Council 1999: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1998-1999. TRC Technical Report 99-67.

Taranaki Regional Council 2000: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 1999-2000. TRC Technical Report 00-35.

Taranaki Regional Council 2001: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2000-01. TRC Technical Report 01-62.

Taranaki Regional Council 2002: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2001-02. TRC Technical Report 02-44.

Taranaki Regional Council 2003: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2002-2003. TRC Technical Report 03-19.

Taranaki Regional Council 2004: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2003-2004. TRC Technical Report 04-57.

Taranaki Regional Council 2005: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2004-2005. TRC Technical Report 05-30.

Taranaki Regional Council 2006: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2005-2006. TRC Technical Report 2006-62.

Taranaki Regional Council 2007: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2006-2007. TRC Technical Report 2007-41.

Taranaki Regional Council 2008: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2007-2008. TRC Technical Report 2008-11.

Taranaki Regional Council 2009: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2008-2009. TRC Technical Report 2009-19.

Taranaki Regional Council 2010: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2009-2010. TRC Technical Report 2010-84.

Taranaki Regional Council 2011: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2010-2011. TRC Technical Report 2011-28.

Taranaki Regional Council 2012: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon annual report 2011-2012. TRC Technical Report 2012-45.

Taranaki Regional Council 2014: New Plymouth District Council New Plymouth Wastewater Treatment Plant marine outfall and sludge lagoon biennial report 2012-2014. TRC Technical Report 2014-122.

Taranaki Regional Council 2015: New Plymouth District Council Waitara Waste Water Treatment Plant and Marine Outfall monitoring programme report 2014-2015. TRC Technical Report 2015-70.

Taranaki Regional Council 2015: New Plymouth District Council New Plymouth Wastewater Treatment Plant Marine Outfall and Sludge Lagoon Annual Report 2014-2015. TRC Technical Report 15-112.

Taranaki Regional Council 2016: New Plymouth District Council New Plymouth Wastewater Treatment Plant Marine Outfall and Sludge Lagoon Annual Report 2015-2016. TRC Technical Report 16-43.

Taranaki Regional Council 2017: New Plymouth District Council New Plymouth Wastewater Treatment Plant Marine Outfall and Sludge Lagoon Annual Report 2016-2017. TRC Technical Report 17-80.

Appendix I

Resource consents held by NPDC

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

Consent number	Purpose	Granted	Review	Expires
0882-4	To discharge of treated municipal wastewater from the NPWWTP through a marine outfall structure into the Tasman Sea.	13 Dec 2011	1 Jun 2022	1 Jun 2041
1826-2	To erect, place and maintain a twin box culvert on the Mangaone Stream for road access purposes.	16 Jan 2002	No further reviews	1 June 2020
2982-4	To discharge of up to 60 m^3/day of leachate from a sludge stabilisation lagoon to groundwater in the vicinity of the Waiwhakaiho River.	17 Oct 2002	No further reviews	1 Jun 2020
4593-3	To erect, place, maintain and use a marine outfall within the coastal marine area as part of the NPWWTP system.	10 Sep 2014	1 Jun 2020	1 June 2041
4740-2	To discharge contaminants into the air from sludge drying and processing activities at the NPWWTP.	29 May 2008	1 Jun 2020	1 June 2026
9984-1	To discharge contaminants onto and into land and into air at the NPWWTP on a contingency basis	15 Apr 2015	Special condition 23	1 June 2022

Coastal Permit

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

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

Conditions of Consent

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

General condition

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

Special conditions

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

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

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

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

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

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

5. During:

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

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

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

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

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

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

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

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

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

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

   - Fitzroy Beach; and
   - Bell Block Beach.

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

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

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

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

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

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

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

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

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

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

    As a minimum, the Monitoring Plan will require:

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

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

    (e) Monitoring of microbiological contamination within shellfish.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Signed at Stratford on 13 December 2011

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

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

Consent 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

_____

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

_____

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

_____

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

_____

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
Decision Date:	23 March 2015
Commencement Date:	15 April 2015

Conditions of Consent

Consent Granted:	To discharge contaminants onto and into land and into air at the New Plymouth Wastewater Treatment Plant on a contingency basis
Expiry Date:	1 June 2022
Review Date(s):	June 2016, June 2018 and in accordance with special condition 23
Site Location:	Rifle Range Road, New Plymouth
Legal Description:	Secs 5-6 SO 314271 Pt Sec 224 Hua Dist Blk II Paritutu SD
Grid Reference (NZTM)	1696928E-5678368N
Catchment:	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 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 only authorises the discharge of dewatered sludge from the New Plymouth Waste Water Treatment Plant on to the areas marked, 'B' and 'C' on Figure 1 (attached).

2. There shall be no discharge of sludge after 1 June 2020.

3. The discharge may occur only in the following circumstances:
   (a) the Thermal Drying Facility is not operational due to an unforeseen breakdown; or
   (b) the Thermal Drying Facility is operating as normal but sludge volume exceeds its operational capacity because:
   - of a significant temporary increase in sludge production and no onsite storage is available: or
   - process issues resulting in reduced ability to process sludge.

4. 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 discharge of contaminants from the site.

5. The consent holder shall undertake a programme of sampling and testing that monitors the effects of the exercise of this consent on fresh water, groundwater and soil properties to assess compliance with this consent (the 'Monitoring Programme'). The Monitoring Programme shall be submitted to the Chief Executive, Taranaki Regional Council ('the Chief Executive') for approval, acting in a certification capacity, within 60 days of this consent commencing, and shall detail the specific parameters to be analysed pursuant to conditions 7 and 8.

6. The Monitoring Programme shall include sampling of groundwater from bores installed in accordance with NZS 4411:2001. The bores shall be of a depth, location and design determined after consultation with the Chief Executive, Taranaki Regional Council.

7. The consent holder shall take representative samples of the waste before each discharge event and have it analysed for:
   (a) Heavy metals;
   (b) Pathogens; and
   (c) Nitrogen, potassium and sodium.

8. Before 31 July each year the consent holder shall also forward routine monitoring data of dewatered sludge and dried biosolids for the 12 month period ending on 30 June, or the most recent analysis if this is greater than 12 months:

   a) Heavy metals;
   b) Dioxin;
   c) Organochlorides;
   d) Pathogens; and
   e) Nitrogen, potassium and sodium.

9. No discharge of sludge shall occur at any time when any of the contaminants in the following table exceed the concentration indicated in any groundwater down gradient of the sludge disposal area or in either of the two unnamed tributaries of the Waiwhakaiho River immediately to the north and south of the treatment plant.

Contaminant	Concentration
Ammonia (NH_3)	10 g/m^3
Oxidised Nitrogen (NO_3)	50 g/m^3
Faecal Coliforms	1000 per 100 ml

10. No discharge shall occur within:

    (a) 20 metres of a surface water body;
    (b) 10 metres of a neighbouring property; or
    (c) 150 metres of a residential building.

11. Any discharged sludge shall be spread evenly as practicable over the disposal area at a rate not exceeding 1000 tonnes per hectare in any single application and incorporated into the top 150 mm as soon as practicable but no later than midnight on the day of application.

12. As soon as practicable following the discharge of dewatered sludge, areas shall be sown into pasture or crop. The consent holder shall monitor revegetation and if adequate establishment is not achieved within two months of sowing, shall provide a report to the Chief Executive, Taranaki Regional Council detailing a programme for stabilising the soil and preventing visible dust from blowing off the disposal area.

13. As soon as practicable after this consent commences the consent holder shall ensure that the pH of the receiving soil is no lower than 5.8, and at all times after that remains higher than 5.8.

14. The discharge, either by itself or in combination with discharges to air from other sources on the site of the New Plymouth Waste Water Treatment Plant, shall not cause an odour beyond the boundary of the site that is offensive or objectionable.

Note: For the purposes of this condition:

(i) The consent holder's site is defined as Secs 5-6 SO 314271 Pt Sec 224 Hua Dist Blk II Paritutu SD; and

(ii) Assessment under this condition shall be in accordance with the Good Practice Guide for Assessing and Managing Odour in New Zealand, Air Quality Report 36, Ministry for the Environment, 2003.

15. On each occasion that a discharge occurs the consent holder shall notify the Chief Executive, Taranaki Regional Council, at least 2 working days beforehand. Notification shall be emailed to worknotification@trc.govt.nz. Notification shall include the following information:

(a) the consent number;
(b) the expected volume to be discharged;
(c) the specific circumstances that have resulted in the need to discharge;
(d) the specific area over which the waste will be discharged; and
(e) the likely duration of the discharge.

16. The consent holder shall keep records of the following:

(a) volumes of material disposed;
(b) disposal area[s], including a map showing individual disposal areas with GPS co-ordinates;
(c) dates of commencement and completion disposal events;
(d) results of the sampling required by conditions 7 and 8;
(e) dates that sowing disposal areas occurred;
(f) details of monitoring, including sampling locations, sampling methods and the results of analysis.

and shall provide the records to the Chief Executive, Taranaki Regional Council on request or by 31 August of each year, a report on all records required to be kept in accordance with this condition, for the 12 month period ending on the previous 30 June.

17. The concentration of heavy metals in the soil shall not exceed the values in the following table:

Constituent	**Standard [mg/kg dry weight]**
Arsenic	20
Cadmium	1
Chromium	600
Copper	100
Lead	300
Mercury	1
Nickel	60
Zinc	300

18. The discharge shall be undertaken in accordance with a 'Management Plan' prepared by the consent holder and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall detail how the discharge will be managed to achieve compliance with the conditions of this consent and shall include but not be limited to:

    (a) The situations when the consent maybe exercised;
    (b) A detailed map of the discharge site;
    (c) The process of notifying interested parties;
    (d) Steps undertaken to prepare the site;
    (e) Steps to be taken to ensure that the soil pH in the discharge areas are at a minimum of 5.8 and remains above 5.8;
    (f) Methods to ensure the generation of dust is avoided;
    (g) How the sludge will be disposed;
    (h) Details of how the disposal of sludge is to be managed to ensure no over runoff occurs;
    (i) Details of how records will be kept; and
    (j) How the site will be reinstated.

    The Management Plan shall be submitted to the Chief Executive, Taranaki Regional Council for approval within 90 days of this consent commencing.

19. Before exercising this consent, the consent holder shall prepare and thereafter regularly update a 'Contingency Plan' that details measures and procedures that will be undertaken in the event of odour beyond the boundary of the site that is offensive or objectionable . The plan shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity as being adequate to avoid, remedy or mitigate the environmental effects of such an event.

20. In the event that any archaeological remains are discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council. Such advice shall be given after the Chief Executive has considered: tangata whenua interest and values, the consent holder's interests, the interests of the public generally, and any archaeological or scientific evidence. The New Zealand Police, Coroner, and Historic Places Trust shall also be contacted as appropriate, and the work shall not recommence in the affected area until any necessary statutory authorisations or consents have been obtained.

21. At least once every year, the consent holder shall convene a meeting with representatives of the Taranaki Regional Council, interested submitters on the application for this consent and adjacent landowners or occupiers. The meetings shall be for the purpose of reporting on and discussing matters relating to the exercise of this consent including, but not limited to:

    (a) Consent monitoring;
    (b) Consent compliance; and
    (c) Details of the proposed upgrade to the Thermal Drying Facility, including timing.

    This meeting may be held in conjunction with the annual meeting required by condition 22 of coastal permit 0882-4.

22. This consent shall lapse on 1 June 2020, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

23. 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:

    (a) 60 days immediately following the date that any discharge event commences; and
    (b) the months of June 2016 and/or June 2018;

    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 15 April 2015

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

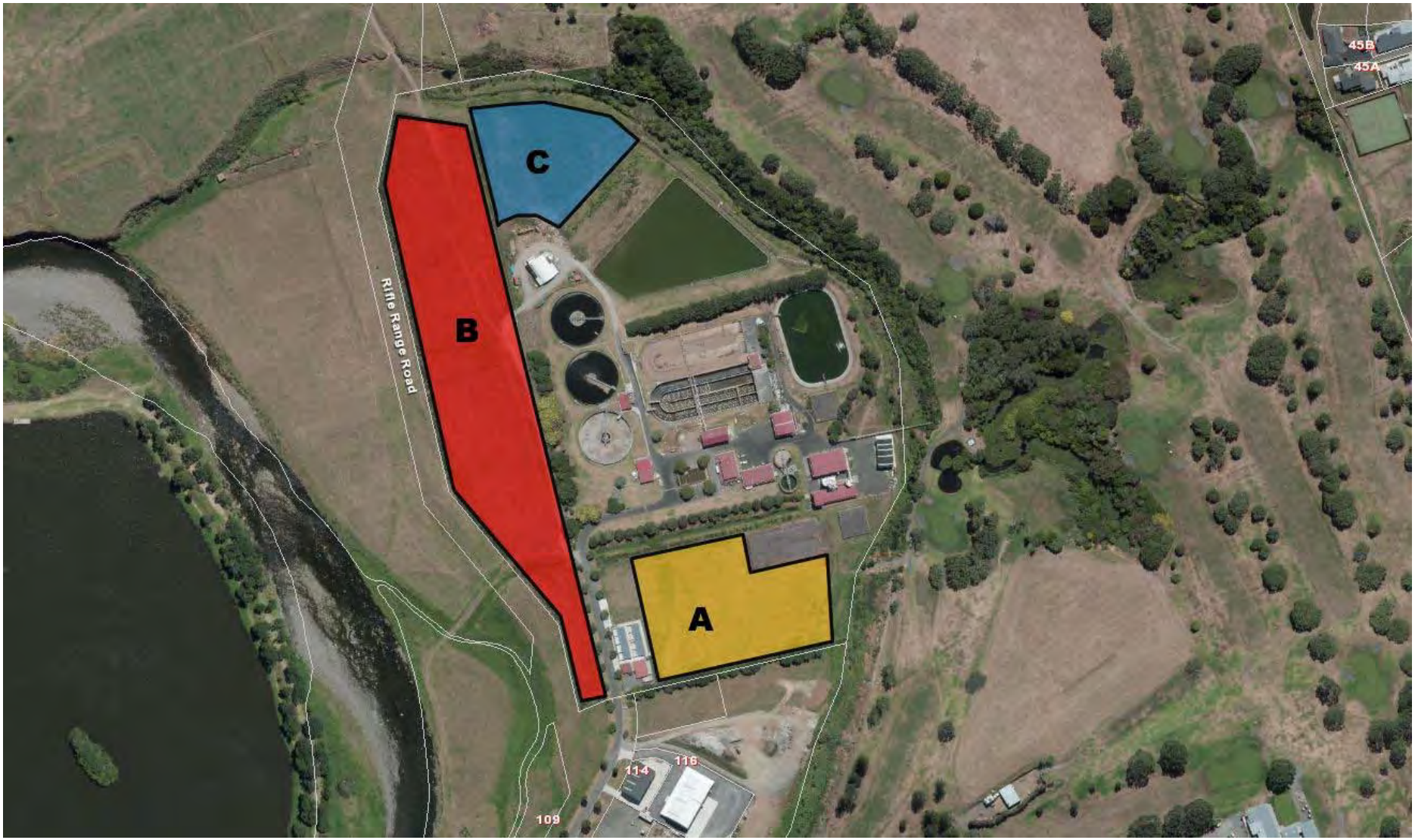


Figure 1: New Plymouth Wastewater Treatment Plant site layout

Appendix II

Graphical results of monthly composite effluent monitoring 1990-2018

Appendix IV

Marine ecological survey
2017-2018

To	Science Manager – Hydrology/Biology, Regan Phipps
From	Scientific Officer, Thomas McElroy and Technical Officer, Angela Smith
Document	2020686
Date	26 March 2018

New Plymouth Wastewater Treatment Plant Marine Outfall - Marine Ecological Survey January 2018

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 30 January and 2 March 2018 as part of the 2017-2018 monitoring programme. The objective of the survey was to assess any change in intertidal diversity attributable to the wastewater discharge.

Methods

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).

Photo 1 Potential impact site at 500 m south west of the outfall (SEA902015), 1 March 2018

Photo 2 Potential impact site at 300 m north east of the outfall (SEA902010), 2 March 2018

Photo 3 Potential impact site at the Mangati Reef (SEA 902005), 28 February 2018

Photo 4 Control site at Greenwood Road (SEA903070), 31 January 2018

Photo 4 Control site at Turangi Reef (SEA900095), 30 January 2018

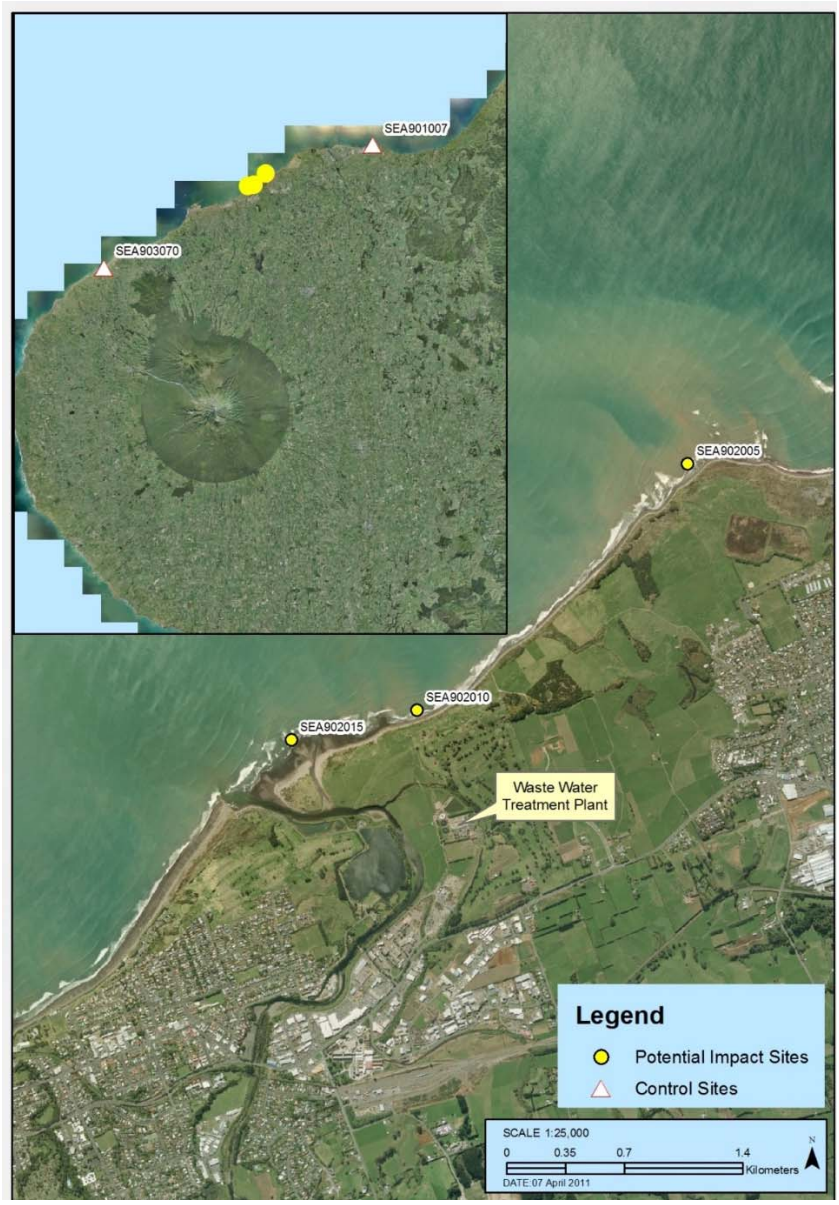


Figure 1 Location of the intertidal survey sites

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 m^2 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.

Results

Summary statistics

Summary statistics, including the mean number of species per quadrat and the mean Shannon-Weiner indices, are shown in Table 1. The 300 m NE site had the highest mean number of total species per quadrat, as well as the highest mean Shannon-Weiner indices per quadrat, followed by the Mangati Reef, Greenwood Road, Turangi Reef and 500 m SW sites.

Table 1 Summary statistics for the summer 2018 survey

Site	No. of quadrats	Mean number of species per quadrat			Mean Shannon-Weiner indices per quadrat		
		Algae	Animals	Total Species	Algae	Animals	Total Species
500 m SW	25	1.36	9.68	11.04	0.16	0.60	0.62
300 m NE	25	5.88	15.96	21.84	0.65	1.00	1.11
Mangati Reef	25	5.48	12.72	18.20	0.58	0.85	1.00
Turangi Reef	25	5.32	12.12	17.44	0.58	0.85	0.99
Greenwood Road	25	7.20	10.84	18.04	0.60	0.84	1.00

Number of species per quadrat

Figure 2 shows the total number of species per quadrat as a box and whisker plot.

The median value for the number of species per quadrat was considerably lower for the 500 m SW site than the remaining four sites, with no overlap with the boxes for the other sites. Four higher, outlying values were recorded for this site, however. Similar medians and distributions were found for the Turangi Reef and Mangati Reef sites. A similar median was also found for Greenwood Road, although this site had the greatest spread of the sites analysed, including the highest maximum value (31 species per quadrat). The 300 m NE site had the highest recorded median, and an even distribution.

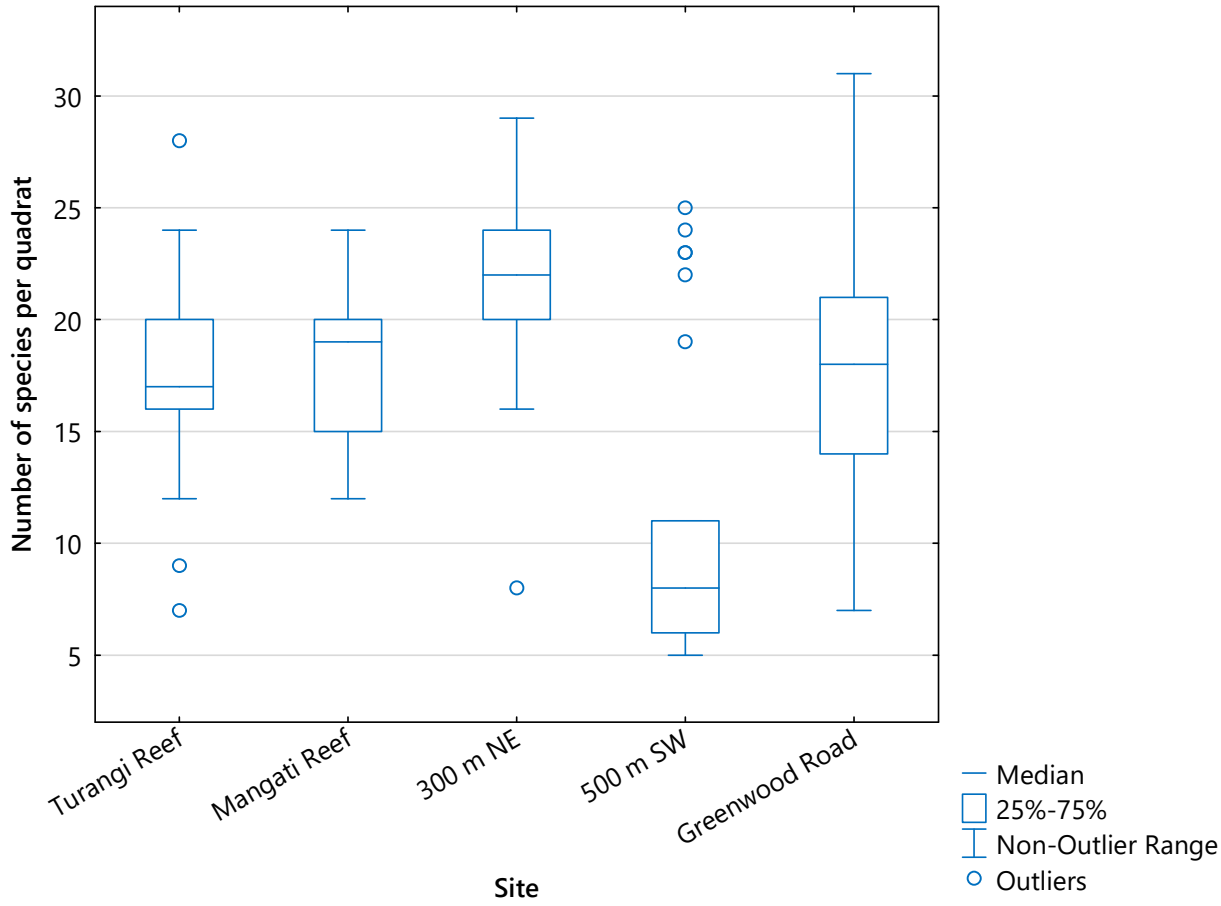


Figure 2 Box and whisker plots of the number of species per quadrat

The data obtained from Turangi Reef, Mangati Reef, 300 m NE and Greenwood Road conformed to the assumption of normal distribution. However, data from the 500 m SW site significantly deviated from the normal distribution at the 95% confidence level (Lilliefors test, n=25, P<0.05). Accordingly, a natural logarithmic transformation was applied to the data. Only data obtained from Mangati Reef and Greenwood Road conformed to the assumption of normal distribution following this transformation. The data from the remaining three sites significantly deviated from the normal distribution at the 95% confidence (Lilliefors test, n=25, P<0.05). As the ANOVA assumptions could not be met, the remaining analyses were conducted using the raw data with non-parametric tests.

There was a significant difference in the number of species per quadrat between sites (Kruskal-Wallis, H=33.79, degrees of freedom (df)=4, P<0.05)[1]. Significant differences between sites were determined using the Wilcoxon signed-ranks test, and are presented in Table 2. The mean number of species per quadrat at each site increased in the following order: 500 m SW, Turangi Reef, Greenwood Road, Mangati Reef, 300 m NE. The mean number of species was significantly higher at the 300 m NE site when compared with the two control sites (Greenwood Road and Turangi Reef), while the mean number of species was significantly lower at the 500 m SW site when compared with the control sites (Table 2). The scores were not significantly different between the Mangati Reef potential impact site and the control sites (Table 2).

[1] The Kruskal-Wallis and Wilcoxon signed ranks tests are both non-parametric tests. This means they are not testing for differences in sample means (or medians) but rather they are testing for differences in the locations of sample distributions.

Table 2 Wilcoxon signed ranks test of number of species per quadrat

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

Key: SIG = significant difference at 95% confidence level

NS = no significant difference

Shannon-Weiner Diversity Index Data

Figure 5 shows the distribution of Shannon-Weiner Indices recorded at each site as box and whisker plots. These plots support the trends identified for the box and whisker plots of the number of species per quadrat, with the 300 m NE also identified as having the greatest median, followed by the Mangati Reef, Greenwood Road, Turangi Reef and 500 m SW sites respectively (Figures 2 & 3).

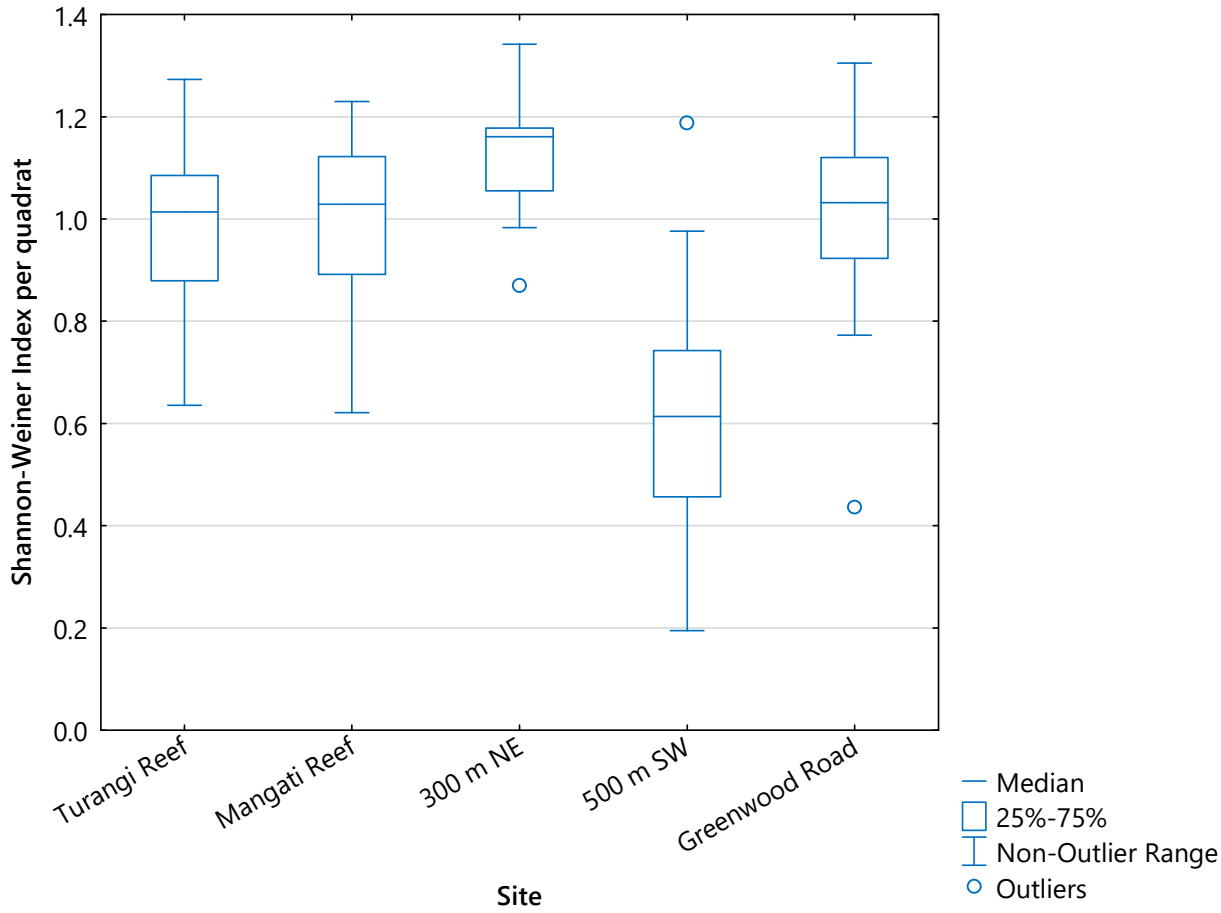


Figure 3 Box and whisker plots of Shannon-Weiner diversity indices

The data obtained from four of the sites conformed to the assumption of normal distribution. However, the 300 m NE site showed a significant deviation from normal distribution at the 95% confidence level (Lilliefors test, n=25, P<0.01). Accordingly, a natural logarithmic transformation was applied to the data. Only data obtained from Turangi Reef, Mangati Reef and the 500 m SW site conformed to the assumption of normal distribution following this logarithmic transformation. The data from the two remaining sites significantly deviated from the normal distribution at the 95% confidence level (300 m NE and Greenwood Road;

Lilliefors test, n=25, P<0.05). As the ANOVA assumptions could not be met, the remaining analyses were conducted using the raw data with non-parametric tests.

There was a significant difference in the Shannon-Wiener Indices between sites (Kruskal-Wallis, H=47.466, df=4, P<0.05). Significant differences between sites were determined using the Wilcoxon signed-ranks test, and are presented in Table 3. The mean Shannon-Wiener Index for each site increased in the following order: 500 m NW of the outfall, Turangi Reef, Mangati Reef, Greenwood Road Road, 300 m SW of the outfall.

The mean Shannon-Wiener Index was significantly higher at the 300 m NE site when compared with all other sites, while the mean Shannon-Wiener Index was significantly lower at the 500 m SW site when compared with the control sites (Table 3). The scores were not significantly different between the Mangati Reef potential impact sites and the control sites (Table 3).

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

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

Key: SIG = significant difference at 95% confidence level

NS = no significant difference

Sand and silt/mud cover

The percentage covers of sand, silt and mud were recorded because high levels of sediment cover can significantly impact marine communities. Previous studies on intertidal reefs in Taranaki have demonstrated that at 30% cover, sand begins to negatively influence hard shore communities.

Mean silt and mud cover was found to be low (<5%) at all sites in the current survey (Table 4). Mean sand cover was also low at all sites (<10%), although a slightly elevated coverage was found at the site located 300 m NE of the outfall (Table 4).

Table 4 Mean percentage cover of sand and silt/mud per quadrat at each site in 2017-2018

Site	Mean coverage per quadrat (%)		
	Sand	Silt/mud	Total
500 m SW	0.68	0.04	0.72
300 m NE	9.24	0.00	9.24
Mangati Reef	3.88	0.04	3.92
Turangi Reef	0.64	0.16	0.80
Greenwood Road	0.24	0.60	0.84

The results from this survey again revealed a decrease in total sediment cover from the previous summer at four of the five sites, with substantial decreases recorded for the Mangati Reef and Greenwood Road sites (Figure 4). Since the extensive sand inundation event of 2015, there has been an overall decreasing trend in

the mean percentage cover of sediment at the three impacted sites (Greenwood Road, Mangati Reef and 300 m NE; Figure 4). A slight increase in sediment cover was detected at the 300 m NE site for this survey, compared with the previous summer, indicating that sediment cover has since stabilised at this site (Figure 4). The mean percentage covers of sediment recorded at the 500 m SW and Turangi Reef sites were negligible and were comparable with previous results (Figure 4).

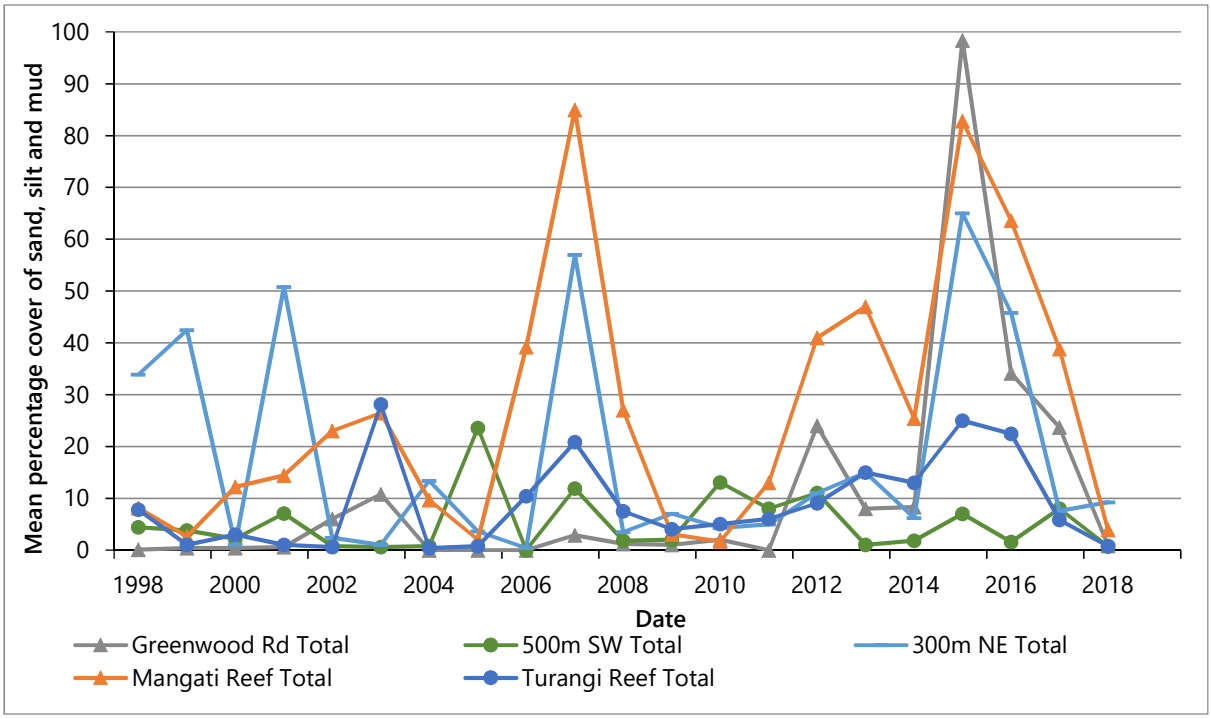


Figure 4 Mean total percentage of sand, silt and mud cover by site from 1998 to 2018

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 2018 are shown in Figures 5 and 6, respectively. The mean number of species increased at the Mangati Reef, 300 m NE and Greenwood Road sites from the previous summer. Slight decreases in the mean number of species from the previous summer were seen at the Turangi Reef and 500 m SW sites. These changes from the previous survey were not reflected in the changes in Shannon-Wiener Indices at all sites. The results indicate that both species richness and evenness were almost identical in this survey for the two control sites, as well as the Mangati Reef site. The 300 m NE site had the highest mean number of species and Shannon-Wiener Index per quadrat, indicating the greatest species richness and evenness of the sites, while the 500 m SW site had the lowest species richness and evenness.

Species richness and diversity show high interannual variability, with no obvious contrasting trends between the impact and control sites (Figures 5 & 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.

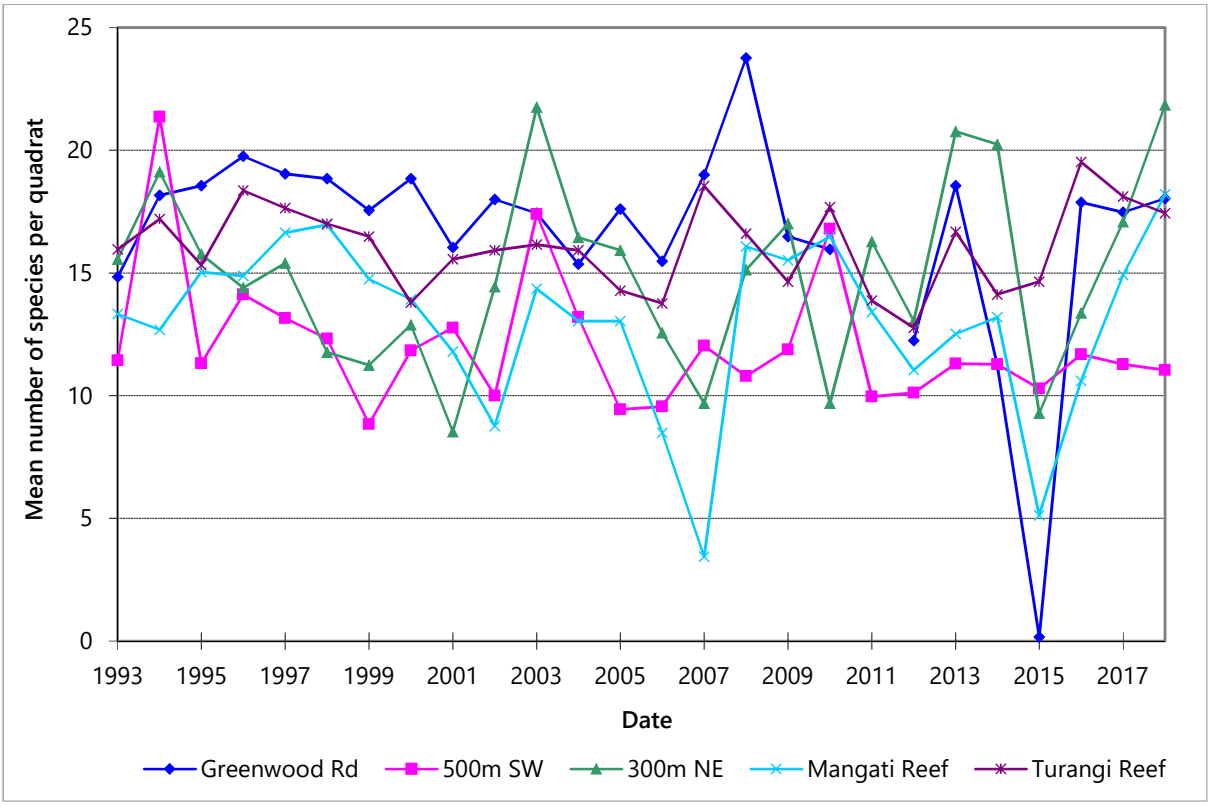


Figure 5 Mean number of species per quadrat in summer surveys from 1993 to 2018

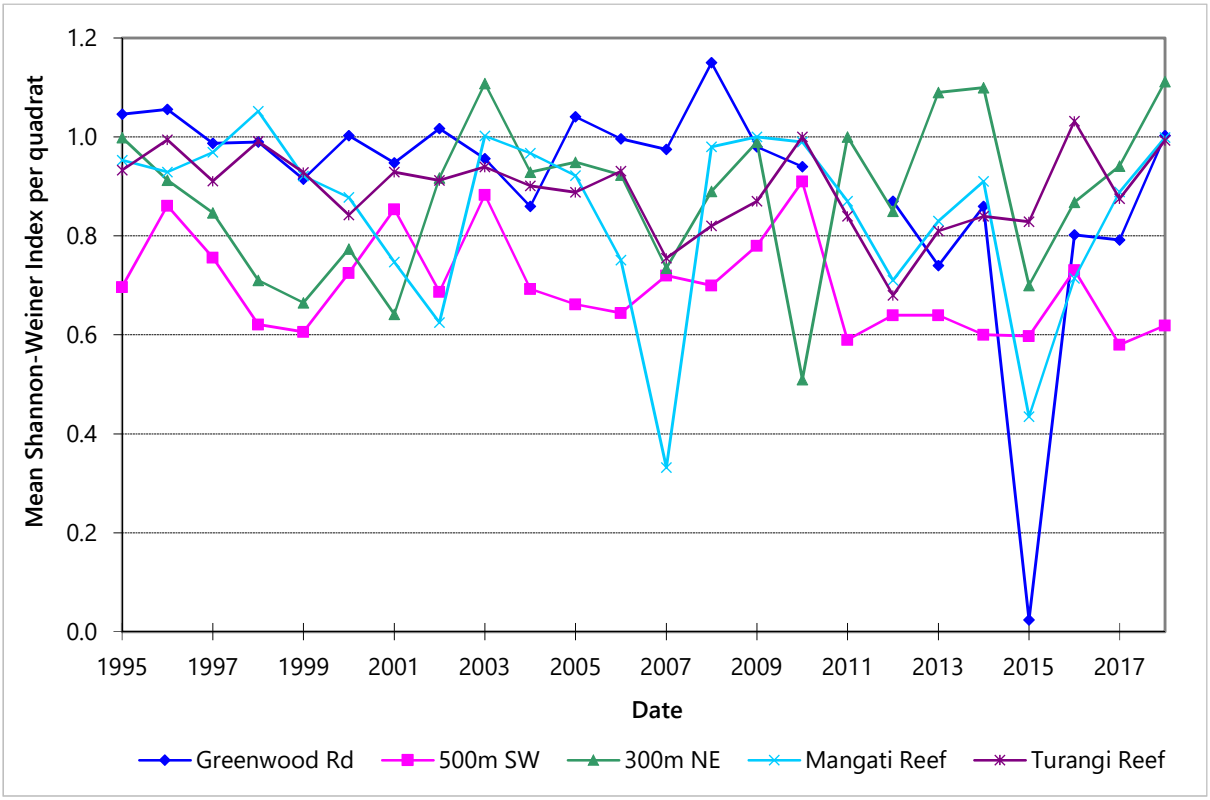


Figure 6 Mean Shannon-Weiner index per quadrat in summer surveys from 1995 to 2018

Discussion and conclusions

An intertidal survey was conducted at five sites between 30 January and 2 March 2018 as part of the 2017-2018 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 March 2018.

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2017-2018 survey. Apart from the site 500 m SW of the outfall, comparable or higher 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 Mount 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 (Dr 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 recent summer surveys demonstrate two important aspects of intertidal sand inundation. Firstly, the sand is not static; it continues to shift. Sand cover continues to decrease at reefs that were inundated in the summer of 2015 (Figure 4). Secondly, reef communities have the innate capacity to recover from sand inundation events. Species diversity has recovered at the inundated reefs, with species diversity at the 300 m NE site now even greater than it was prior to its partial burial in 2015 (Figures 5 & 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 cats'-eye *Lunella 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 *L. smaragdus* densities at the site (Figures 4 & 7-8). A similar result, albeit at a smaller scale, was observed at the 300 m NE site (Figures 4 & 7-8). There has been a notable increase in turf cover observed at the Mangati Reef and 300 m NE sites in recent years, with sand cover found to be decreasing since the sand inundation of 2015 (Figures 4 & 7). As expected, this has led to a considerable increase in *L. smaragdus* abundance (Figure 8).

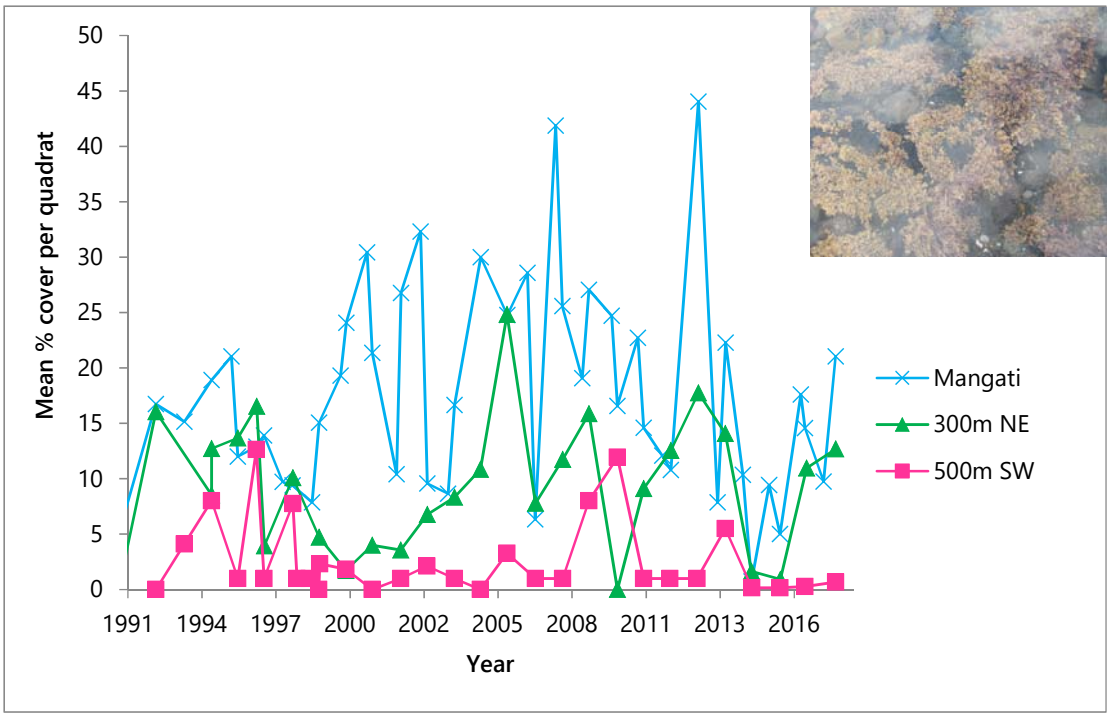


Figure 7 Percentage cover of coralline turf *Corallina officinalis* at the three potential impact sites from 1991 to 2018

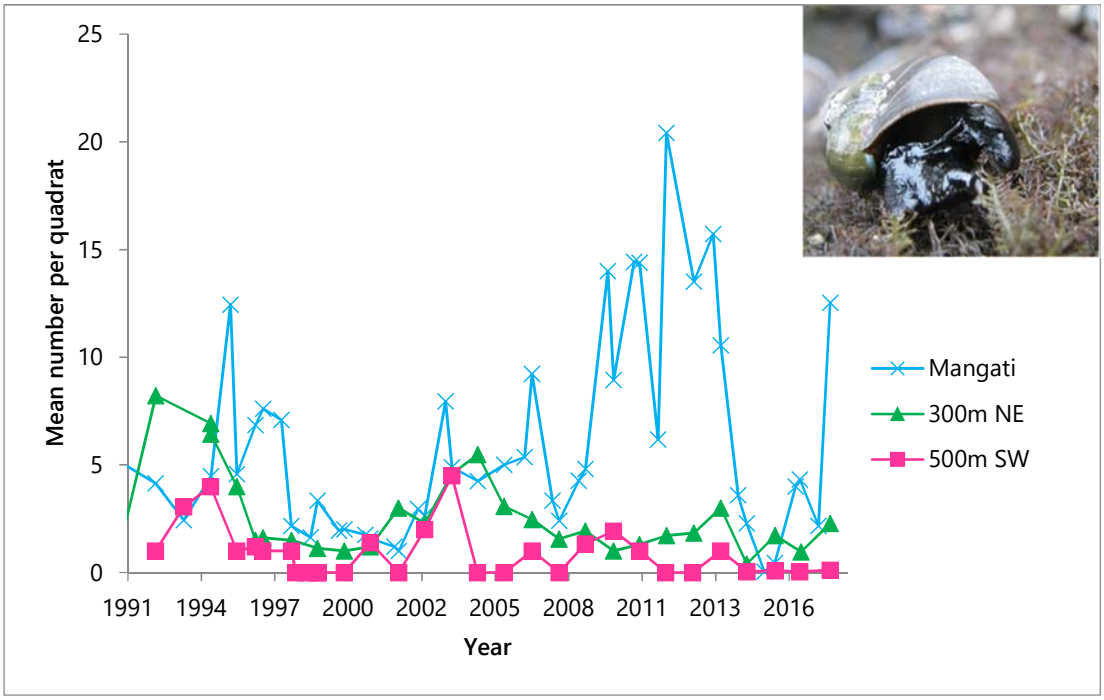


Figure 8 Abundance of cat's-eye *Lunella smaragdus* at the three potential impact sites from 1991 to 2018

The site 500 m SW of the outfall is 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 (Photo 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 elongatus* 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. elongatus* are often recorded at this site. Although their numbers were lower in the three most recent surveys, they are still comparable with previous results (e.g. 2005-2006, 2009-2010; Figure 9).

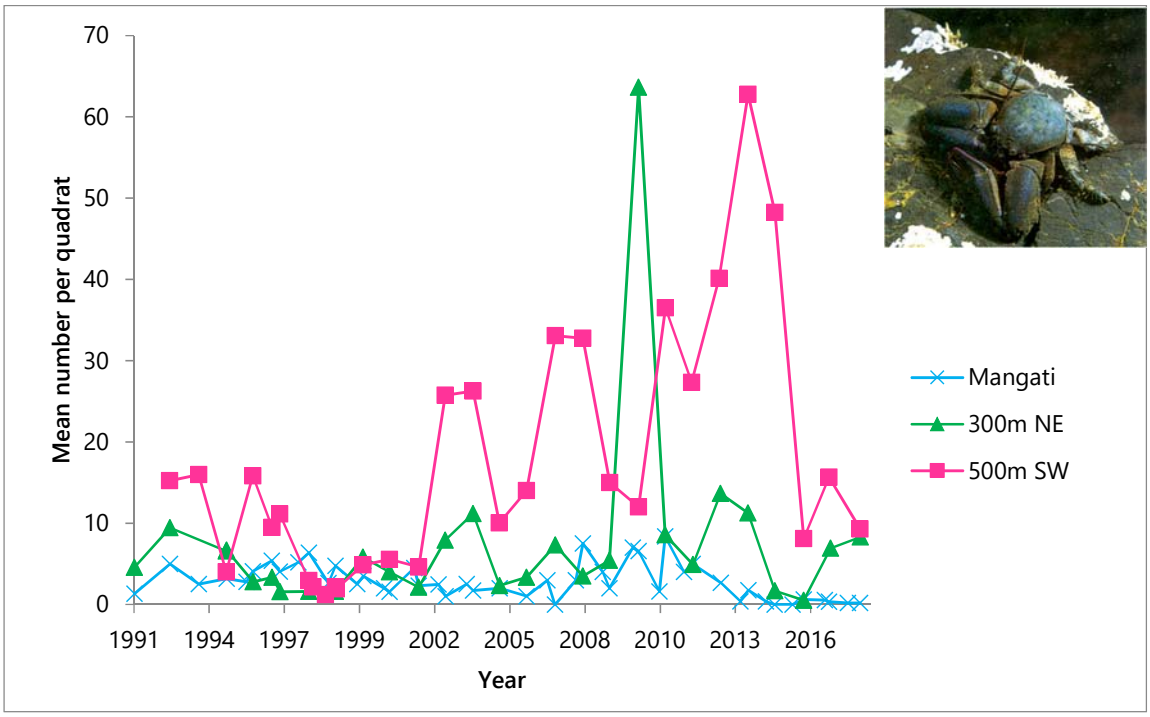


Figure 9 Abundance of Porcelain crab *Petrolisthes elongatus* at the three potential impact sites from 1991 to 2018

The site 300 m NE of the outfall provides an intermediate substrate composition relative to the two other potential impact sites, offering more shelter and stability than the 500 m SW site and less potential for sand accumulation than Mangati Reef. The substrate complexity provides a range of habitats and ecological niches. Elevated *Neosabellaria kaiparaensis* cover in recent surveys indicated that the tubeworm species was 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 limit the ecological diversity on the reef. However, the mean *N. kaiparaensis* cover recorded in the 2017-2018 survey was 0.88%, a considerable decrease from the mean cover of 21.08% recorded in the previous summer survey (Figure 10). Dramatic changes in the extension of sabellariid reefs, which rely on a source of sand, have been partially attributed to changes in sedimentological regimes in the literature (Hendrick & Foster-Smith, 2006). This is also the most likely cause for the shift in *N. kaiparaensis* dominance at the 300 m NE site, with the decrease in sabellariid cover tracking a decrease in sand cover on the reef since January 2015 (Figures 4 & 10).

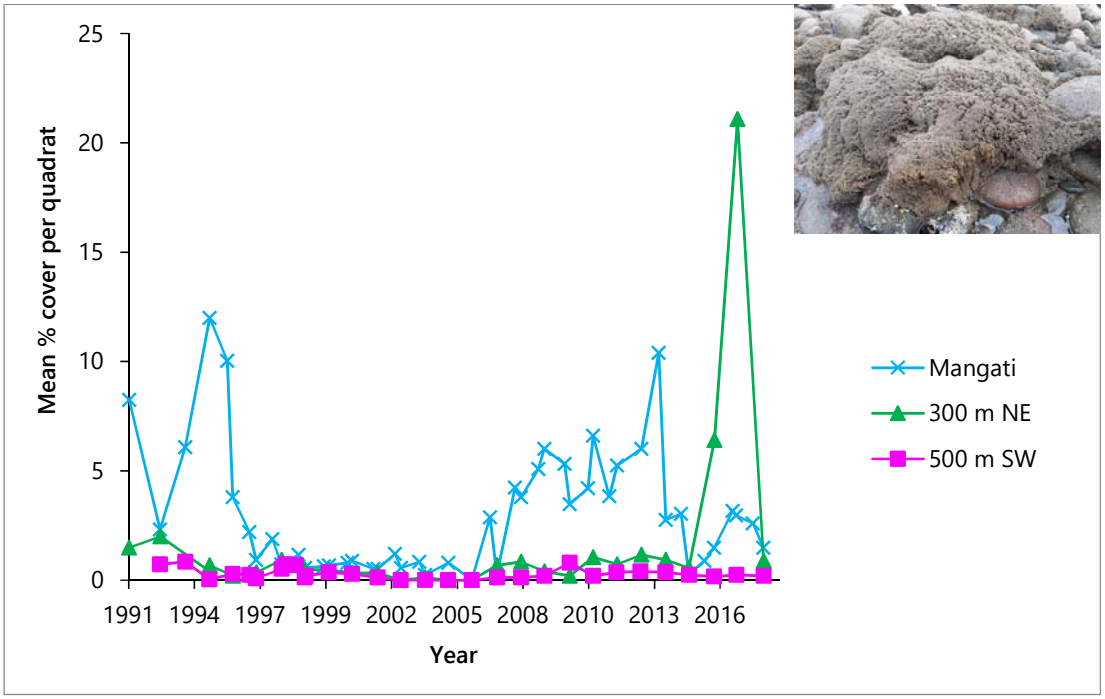


Figure 10 Percentage cover of *Neosabellaria kaiparaensis* at the three potential impact sites from 1991 to 2018

The control sites at Turangi Reef and Greenwood Road typically have 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. This has clearly been identified at the Greenwood Road site since the unprecedented sand inundation observed during the January 2015 survey. Species abundance and diversity at the site appear to have recovered since the decrease in mean sand cover to below 30% (Figures 4-5). Previous studies in the region suggest that sand cover begins to negatively influence hard shore communities at 30%.

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).

Summary

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, surveys were conducted between 30 January and 2 March 2018 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.

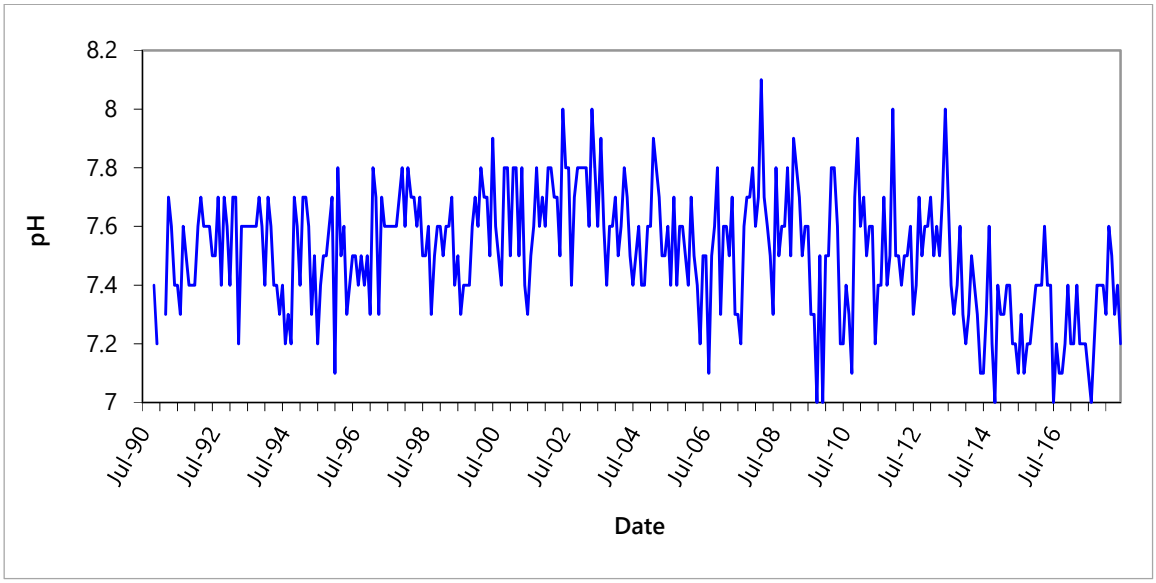
There was no distinguishable shift in species richness or diversity at the potential impact sites compared with the control sites in this year's survey. In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative 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.

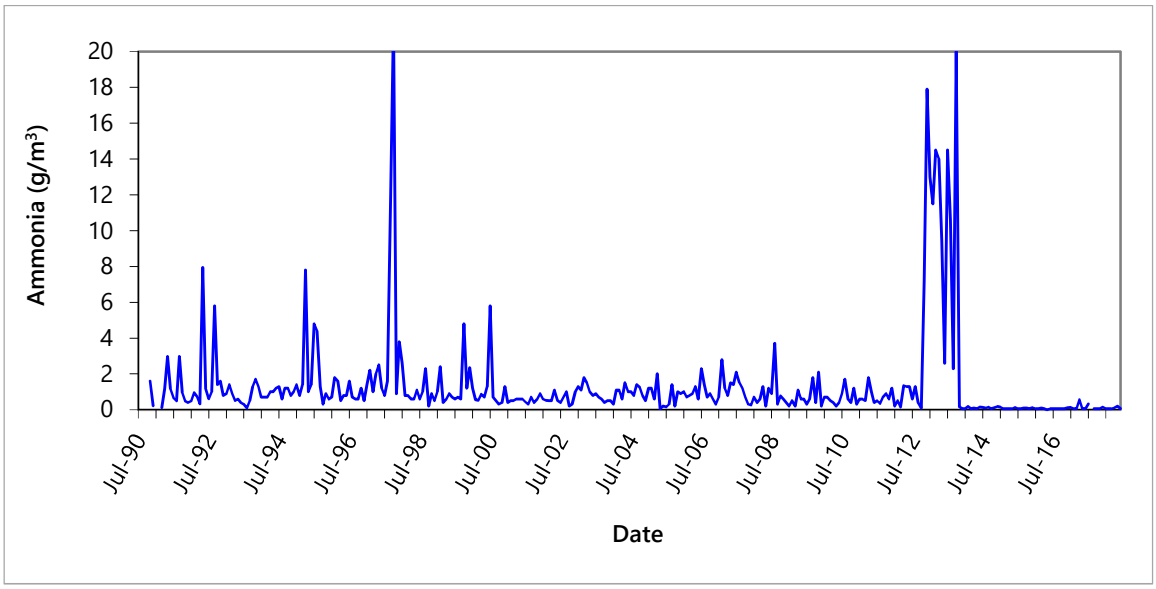
References

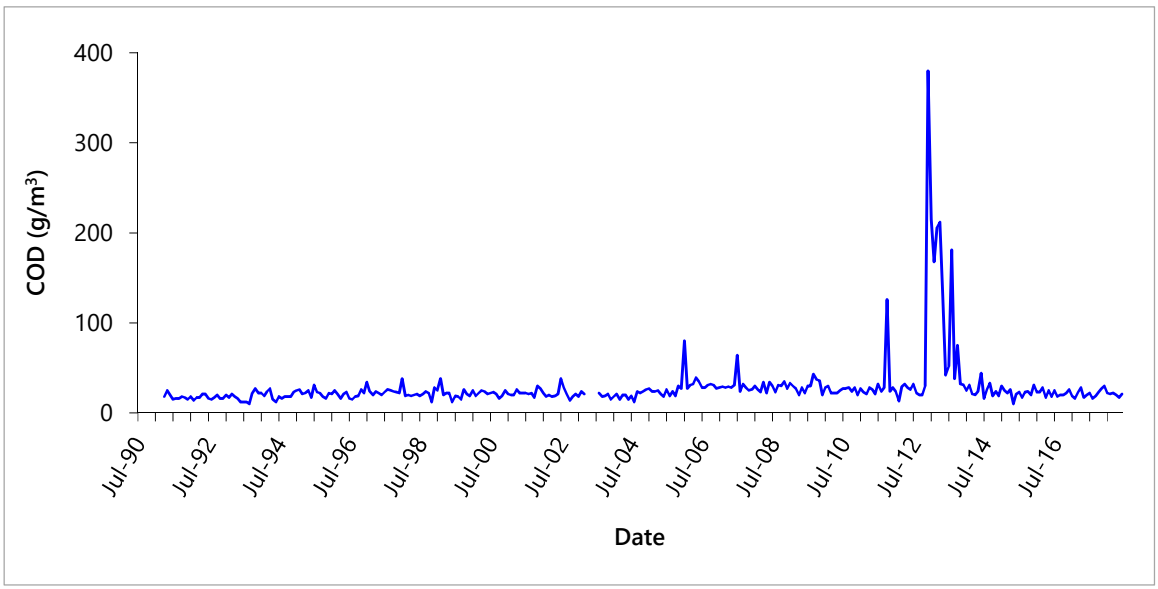
Hendrick, V.J. & Foster-Smith, R.L., 2006: *Sabellaria spinulosa* reef: a scoring system for evaluating 'reefness' in the context of the Habitats Directive. Journal of the Marine Biological Association of the United Kingdom, 86: 665–677.

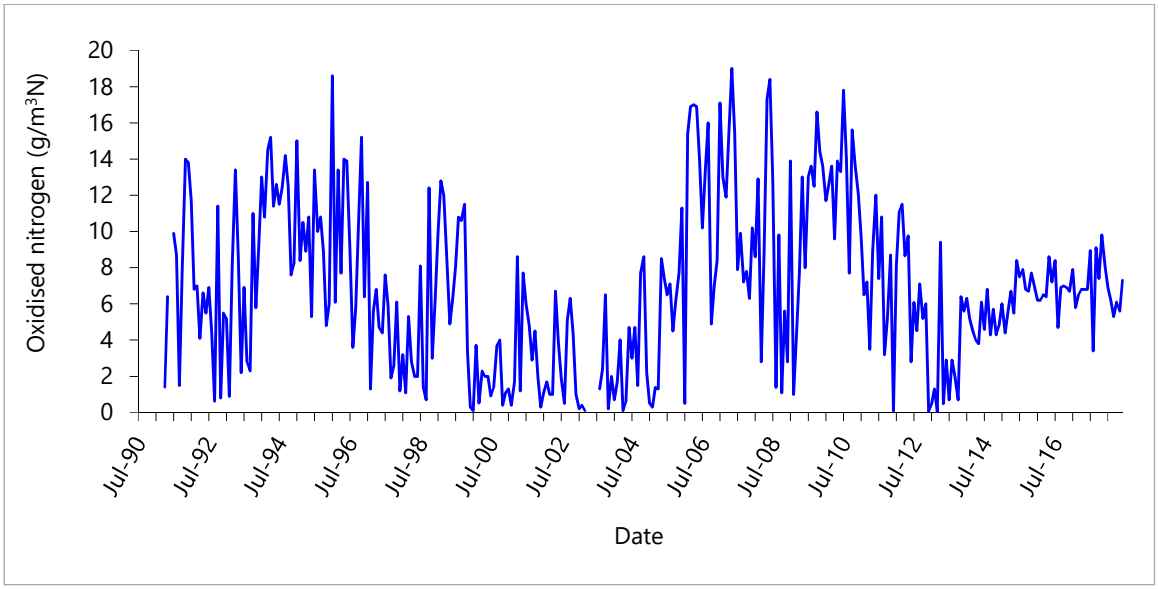
Taranaki Regional Council, 2013: Fonterra Whareroa Compliance Monitoring Programme Annual Report 2012-2013. Technical Report 2013-24.

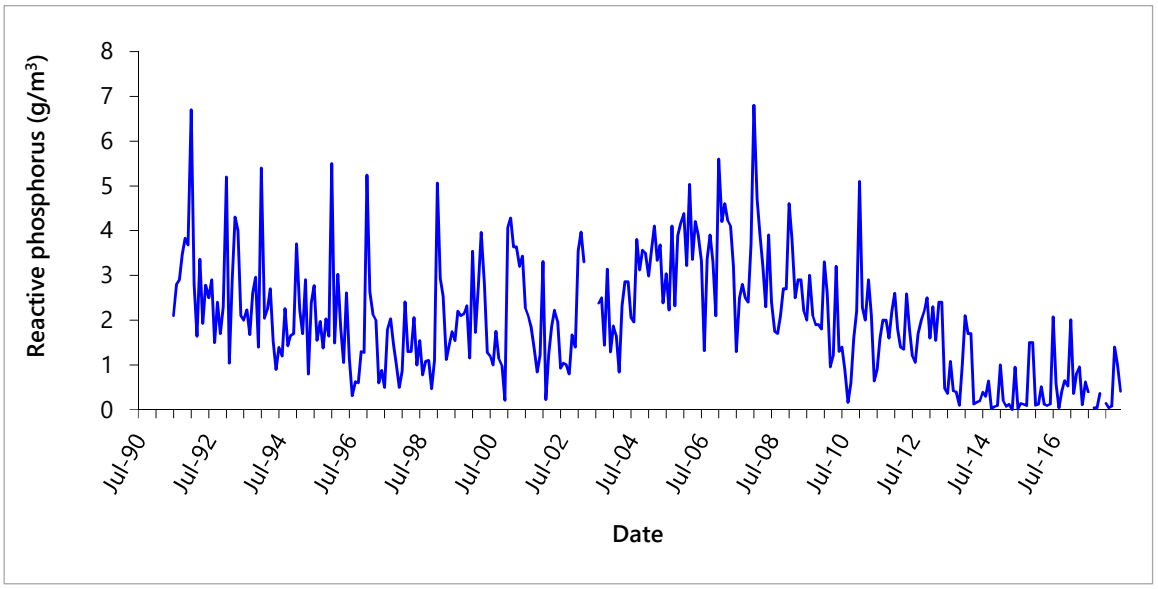
Walsby, J.R. 1982: Marine ecological baseline programme NZSFC Synthetic Petrol Plant Motunui.

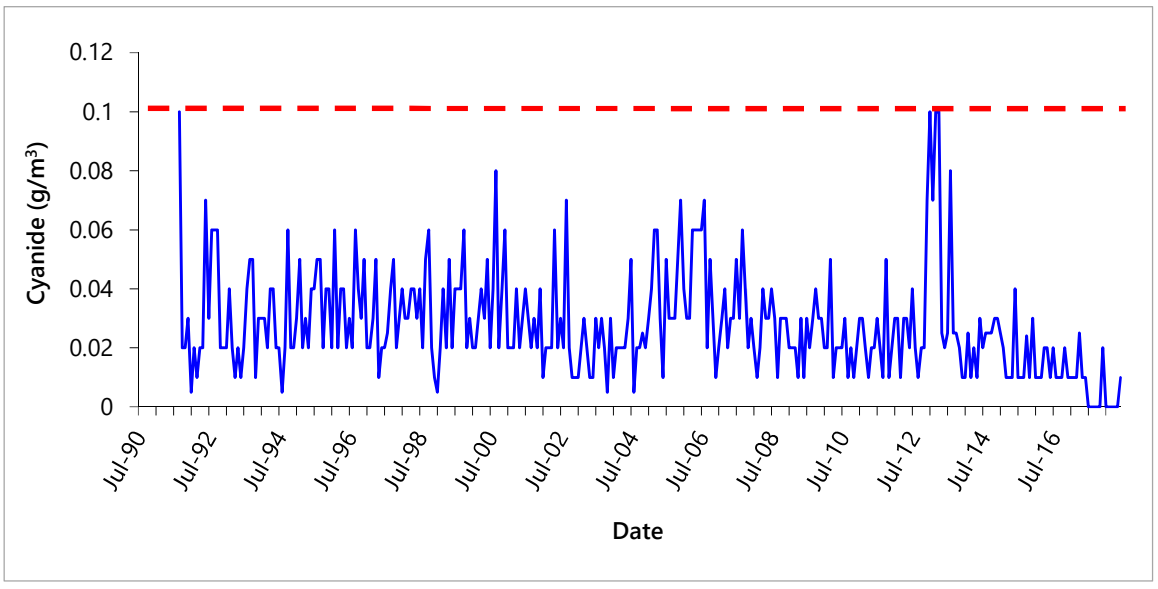

8.2
8
7.8
7.6
7.4
7.2
7
pH
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Jul-16
Date


20
18
16
14
12
10
8
6
4
2
0
Ammonia (g/m³)
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

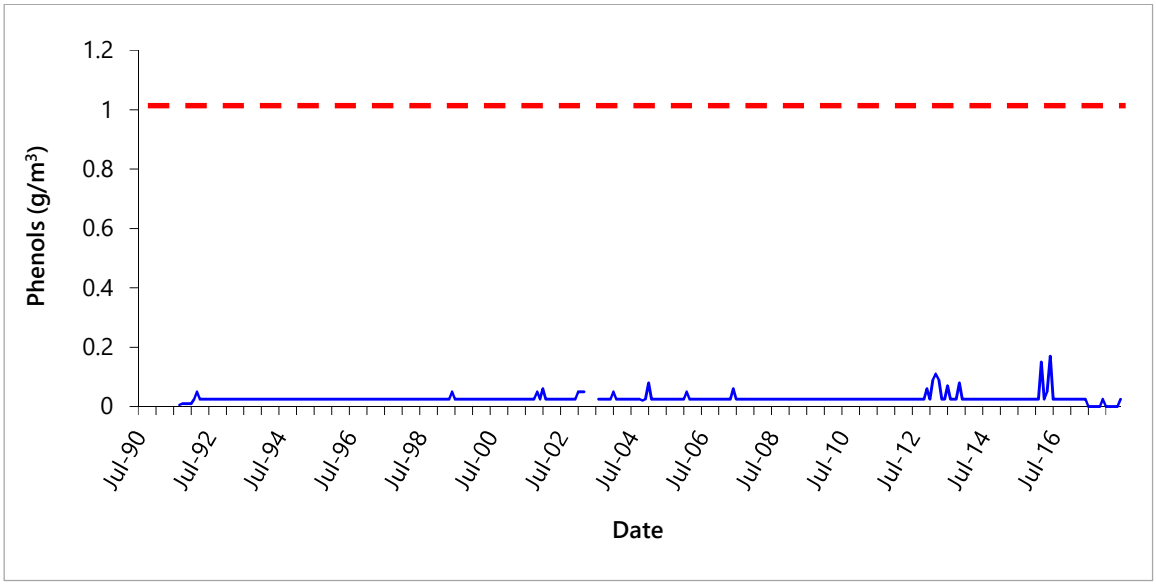

400
300
200
100
0
COD (g/m³)
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Jul-16
Date



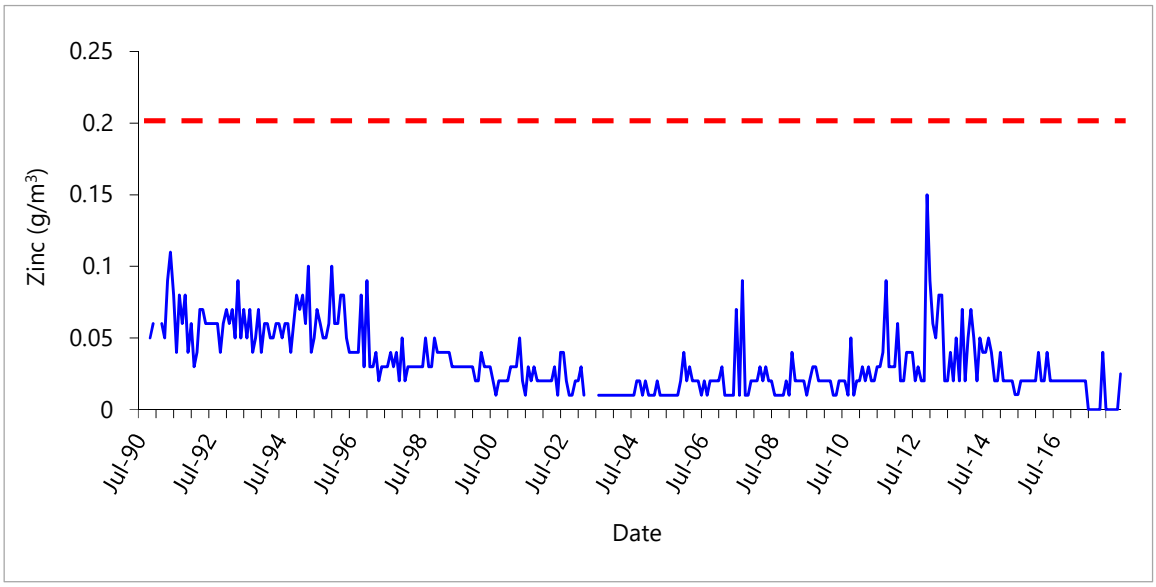




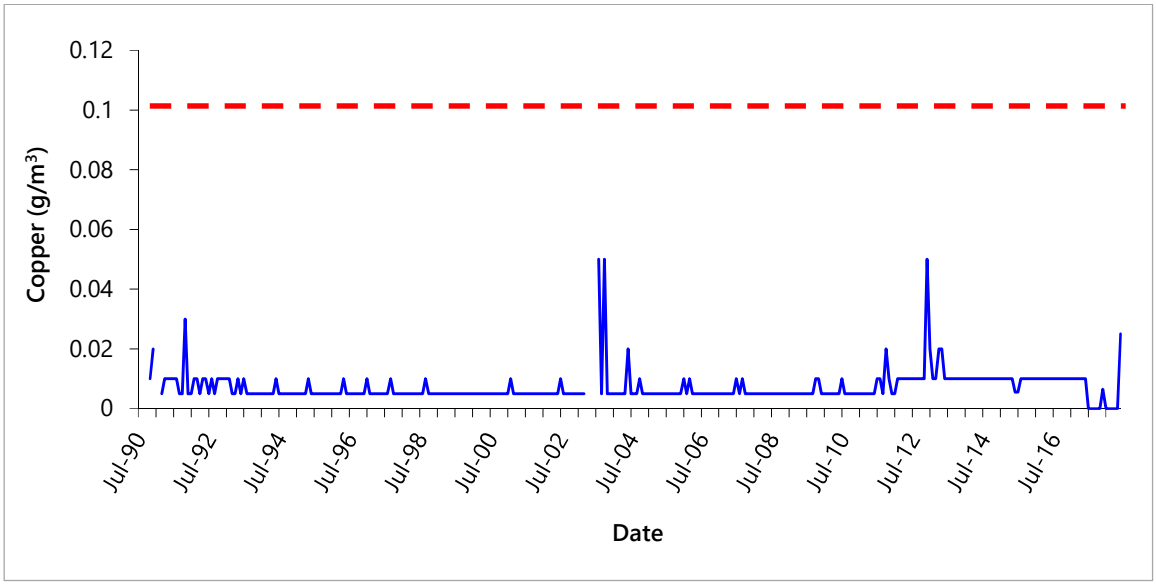
Note: Consent limit indicated by dashed red line - Detection limit = 0.02 g/m^3



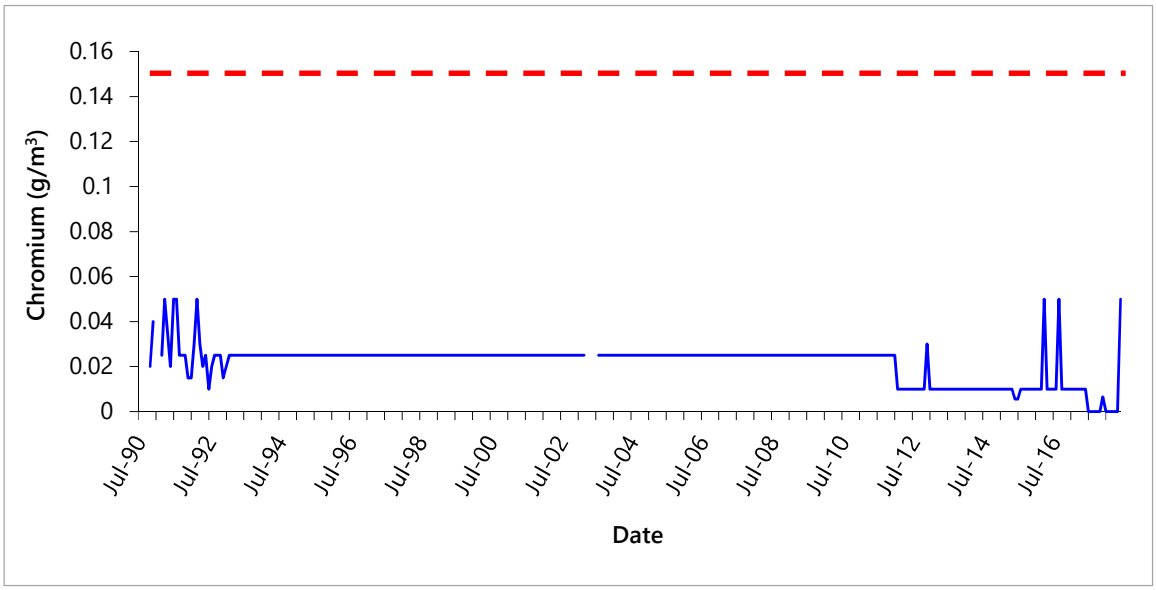
Note: Consent limit indicated by dashed red line - Detection limit = 0.05 g/m^3



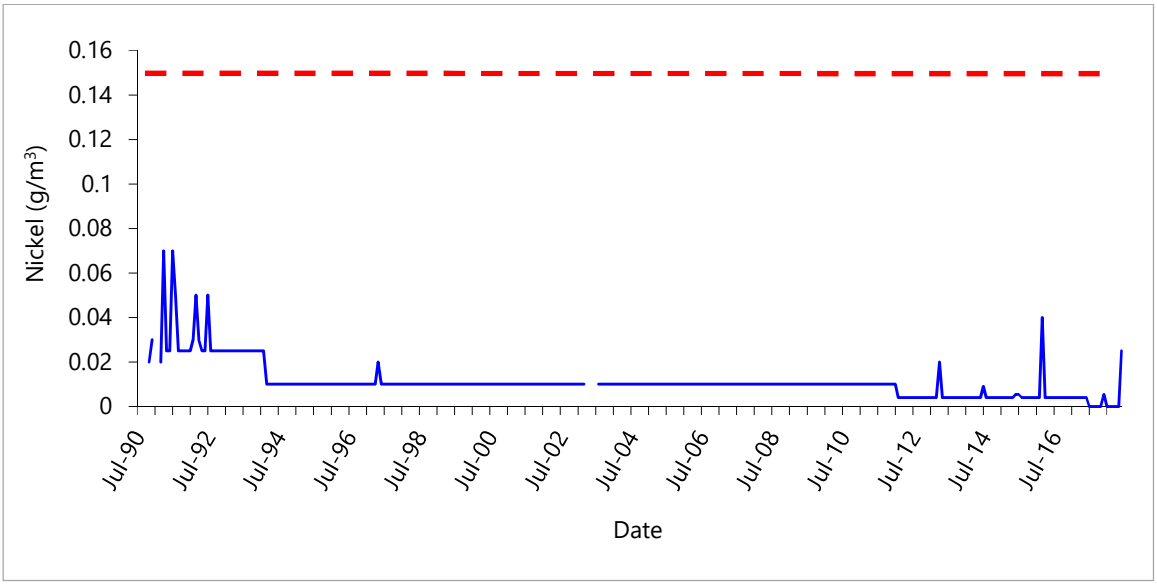
Note: Consent limit indicated by dashed red line - Detection limit between 0.04 - 0.021g/m^3



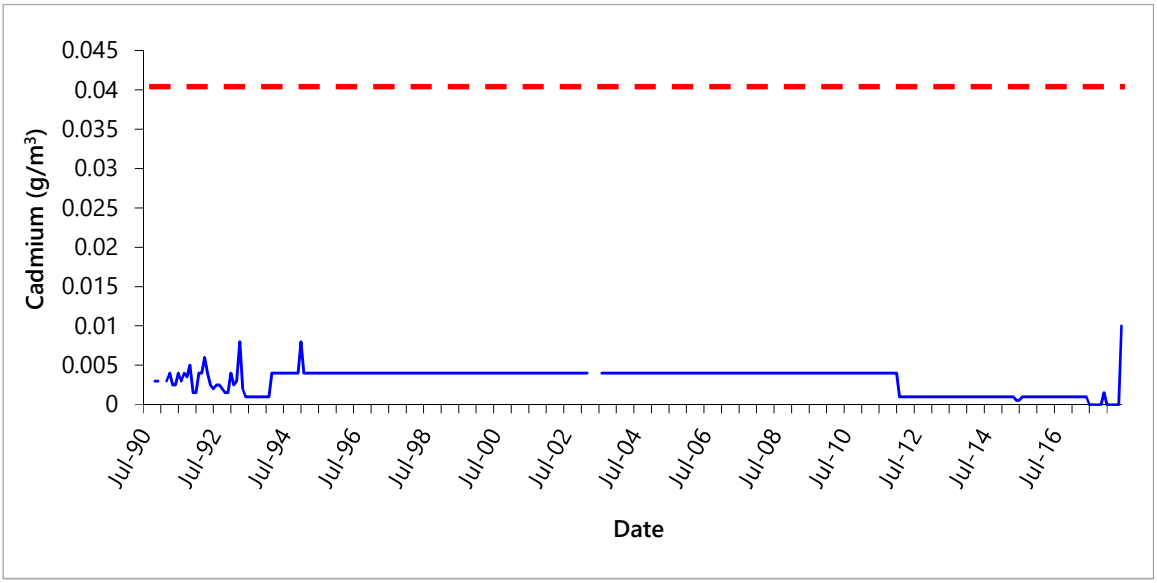
Note: Consent limit indicated by dashed red line - Detection limit between 0.01 - 0.02 g/m^3



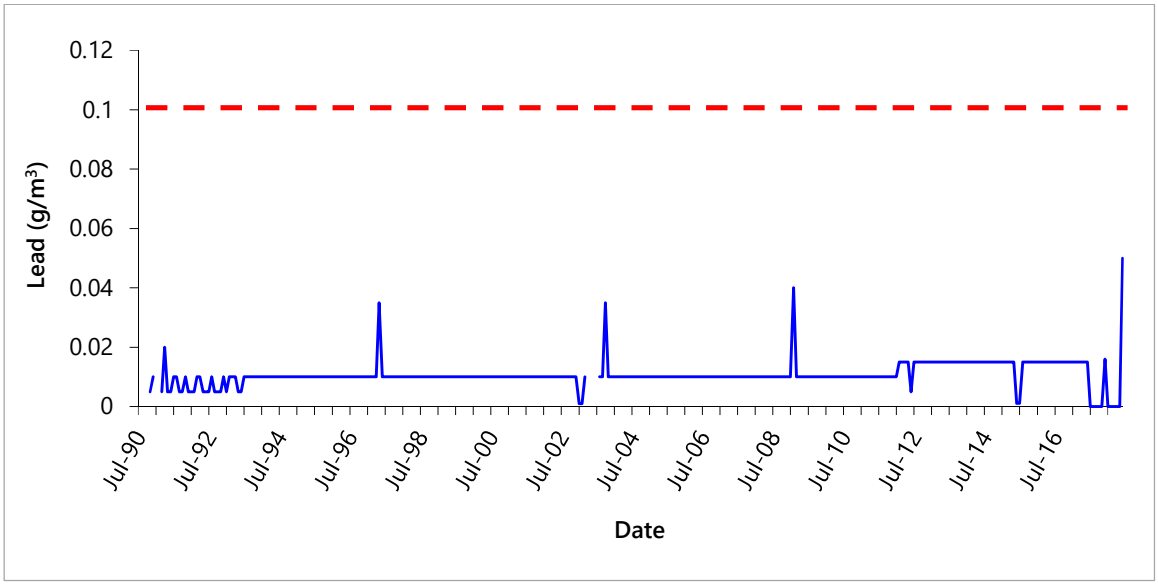
Note: Consent limit indicated by dashed red line - Detection limit between 0.011 - 0.05 g/m^3



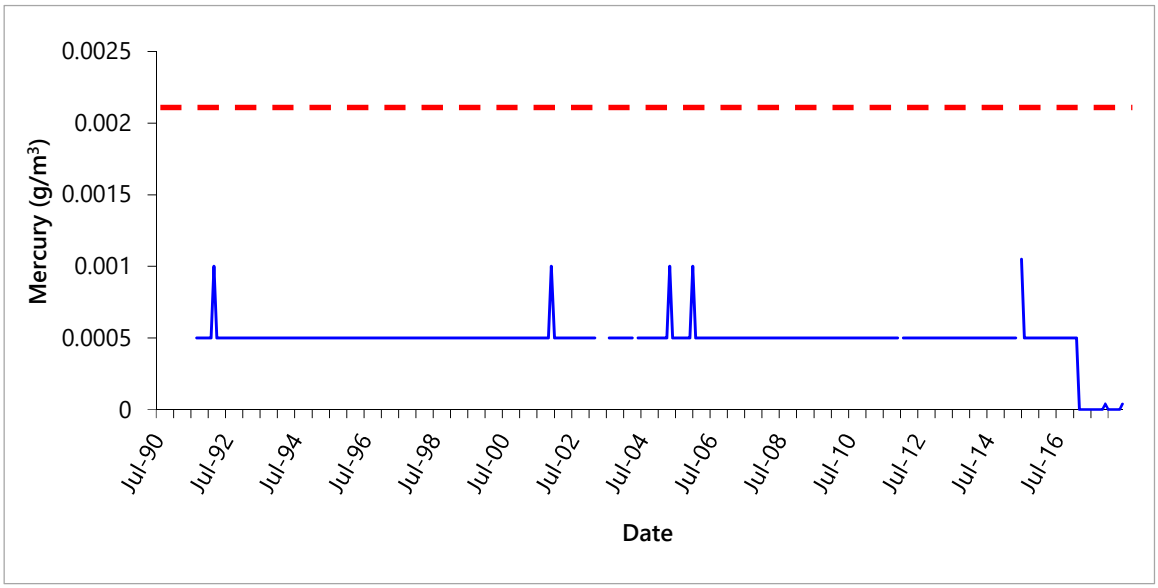
Note: Consent limit indicated by dashed red line - Detection limit between 0.008 - 0.02 g/m^3



Note: Consent limit indicated by dashed red line - Detection limit between 0.0011 - 0.008 g/m^3



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 III

Results of routine sludge lagoon monitoring 2017-2018

Bore 1	Parameter					
	pH	Ammoniacal nitrogen g/m^3	Faecal coliforms No./100ml	RDP g/m^3	NOx g/m^3	COD g/m^3
Jul-17	5.3	0.05	2.5	0.04	16.1	10
Aug-17	5.4	N/D	2.5	0.04	8.9	11
Sep-17	5.5	0.05	2.5	0.04	5.1	10
Oct-17	5.6	0.22	2.5	0.04	4	12
Nov-17	6.1	2	5	0.04	0.2	18
Dec-17	6.4	2.2	1	0.23	0.2	20
Jan-18	6.6	4.9	2.5	0.82	0.04	21
Feb-18	6.6	5	2.5	1.57	0.04	25
Mar-18	6.6	5.3	23	1.13	1.1	18
Apr-18	6.4	5.2	260	0.9	0.2	20
May-18	6.5	6.1	2.5	1.34	0.025	16
Jun-18	5.6	0.18	2.5	0.04	6.8	15
Summary of 2017-2018 results						
Minimum	5.3	0.05	1	0.04	0.025	10
Maximum	6.6	6.1	260	1.57	16.1	25
Median	6.25	2.2	2.5	0.135	0.65	17
Historical statistics (1990-2017)						
Number	297	297	294	107	297	296
Minimum	4.9	0.05	1	0.015	0.01	1
Maximum	7.1	100	2300	2.78	28	48
Median	6.2	2.38	5	0.04	0.4	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/m^3	Faecal coliforms No./100ml	RDP g/m^3	NOx g/m^3	COD g/m^3
Jul-17	5.8	0.05	50	0.13	0.1	43
Aug-17	5.8	N/D	32	0.04	0.2	34
Sep-17	5.9	0.42	2.5	0.04	0.04	34
Oct-17	5.8	0.05	20	0.04	0.31	26
Nov-17	5.9	0.67	2.5	0.04	0.1	77
Dec-17	5.9	0.05	2.5	0.04	1.5	17
Jan-18	6.3	2.14	15	0.08	0.04	35
Feb-18	6.2	2.1	1	0.04	0.04	27
Mar-18	5.4	0.05	240	0.04	13.5	21
Apr-18	5.8	0.28	23	0.04	0.03	25
May-18	6	0.58	5	0.04	0.025	20
Jun-18	5.8	0.05	70	0.04	0.4	48
Summary of 2017-2018 results						
Minimum	5.4	0.05	1	0.04	0.025	17
Maximum	6.3	2.14	240	0.13	13.5	77
Median	5.85	0.28	17.5	0.04	0.1	30.5
Historical statistics (1990-2017)						
Number	297	296	295	107	297	296
Minimum	4.9	0.05	0.5	0.015	0.02	6
Maximum	7.4	25	10,000	0.26	40	181
Median	6.1	1.95	5	0.025	0.14	16.9

Bore 3	Parameter					
	pH	Ammoniacal nitrogen g/m^3	Faecal coliforms No./100ml	RDP g/m^3	NOx g/m^3	COD g/m^3
Jul-17	6.5	0.05	800	0.09	0.3	45
Aug-17	6.6	N/D	510	0.04	0.31	32
Sep-17	6.3	0.05	460	0.04	0.5	23
Oct-17	6.4	0.05	800	0.04	0.24	47
Nov-17	6.2	0.16	25	0.04	0.3	33
Dec-17	6.1	0.05	5	0.04	3.8	34
Jan-18	6.2	0.18	5,900	0.04	0.7	28
Feb-18	6.2	0.58	10	0.04	0.4	19
Mar-18	6.5	0.05	2,680	0.1	0.3	26
Apr-18	6.2	0.1	60	0.04	0.3	36
May-18	6.1	0.14	22	0.04	0.22	13
Jun-18	6.3	0.05	750	0.04	0.1	16
Summary of 2017-2018 results						
Minimum	6.1	0.05	5	0.04	0.1	13
Maximum	6.6	0.58	5,900	0.1	3.8	47
Median	6.25	0.05	485	0.04	0.3	30
Historical statistics (1990-2017)						
Number	288	288	288	97	286	287
Minimum	5	0.05	2.5	0.025	0.02	1
Maximum	7.3	198	72,000	0.8	64	740
Median	6.3	0.575	5	0.05	0.2	25

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-17	6.6	0.72	140	6.7	4	200
Aug-17	6.6	0.51	40	6.7	5.4	5
Sep-17	6.7	0.49	137	6.6	3.9	663
Oct-17	6.6	0.51	770	6.6	3.2	1,160
Nov-17	6.6	0.32	2,300	6.6	2.6	6,000
Dec-17	6.6	0.56	190	6.7	5.1	440
Jan-18	6.6	0.45	233	6.6	2	480
Feb-18	6.6	0.57	530	6.6	3	1,120
Mar-18	6.6	0.54	730	6.6	2.8	810
Apr-18	6.6	0.5	3,060	6.7	2.4	7,300
May-18	6.8	0.52	135	6.6	3.1	407
Jun-18	6.6	0.47	103	6.7	4.8	120
Summary of 2017-2018 results						
Minimum	6.6	0.51	30	6.7	3.44	140
Maximum	6.7	0.94	1,900	6.8	5.6	2,430
Median	6.7	0.58	280	6.7	4.2	325
Historical statistics (1990-2017)						
Number	292	292	291	291	292	291
Minimum	6	0.005	5	6.4	0.13	5
Maximum	7	7.5	6,960	7.1	27	13,280
Median	6.6	0.5	90	6.7	4.75	120