

NPDC – Colson Road Landfill
Monitoring Programme
Annual Report
2016-2017

Technical Report 2017-30

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Executive summary

The New Plymouth District Council (NPDC) operates a regional landfill located on Colson Road, New Plymouth, in the Waiwhakaiho catchment. The landfill is currently filling Stage 3 of the site which has a design capacity of approximately 800,000 cubic metres. Stages one and two have been closed and are fully reinstated. This report, for the period July 2016 to June 2017, describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the consent holder's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the consent holder's activities.

Overall, NPDC demonstrated an overall good level of environmental performance.

NPDC holds a total of eight resource consents in relation to the Colson Road landfill. These consents contain a total of 105 special conditions setting out the requirements that NPDC must satisfy. NPDC holds one consent to discharge uncontaminated stormwater into the Puremu Stream, two consents to discharge leachate and contaminated stormwater into the Puremu Stream, two consents to discharge emissions into the air, one consent to discharge solids onto and into land and one consent to discharge stormwater from earthworks. NPDC also holds one consent to divert water.

The Council's monitoring programme for the year under review included 12 inspections, eight stormwater/discharge samples, 18 surface water samples, seven groundwater samples, two biomonitoring surveys of receiving waters, and three air quality surveys. NPDC also collected seven leachate samples and three under-liner drainage samples for physicochemical analysis.

At inspection issues were found in regards to site management, and although most of them were resolved and none resulted in significant off site effects, the issue of cap management and maintenance on Stage 2 were recurrent, and remained unresolved at the end of the monitoring period.

Groundwater and under liner drainage sampling indicated that there is no significant contamination occurring in the local aquifer as a result of the landfill's presence, although there maybe emerging trends of increasing, but still low level, concentrations of chloride and nitrate/nitrite nitrogen in some bores.

Chemical and bacteriological monitoring of the Puremu and Manganaha Streams found that the receiving water quality criteria on the consents were met at the time of the three sampling surveys.

Although biomonitoring found that the macroinvertebrate results were indicative of poor to fair or poor biological health at some of the Puremu Stream sites, this was considered to be a reflection of the poor habitat conditions at these sites. It was concluded that the results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road landfill at the time of 2016-2017 surveys.

Air quality monitoring showed that off site there were no significant adverse effects in relation to suspended particulates, dust deposition rates or odour beyond the site boundary.

There were three odour complaints received in the 2016-2017 period that were associated with the Colson Road landfill. Although it was found that the site was compliant with consent conditions at the time of investigation, and on two occasions there were low level intermittent odours were found.

Overall, NPDC demonstrated a good level of environmental performance and administrative compliance with the resource consents. During the year under review there were fugitive odorous gases being emitted into the air from numerous locations onsite, without proper treatment prior to discharge, which had the potential to cause significant adverse effects. However, no substantiated odour complaints were found, and NPDC are working towards the installation of a landfill gas flare to address the issue.

For reference, in the 2016-2017 year, 74% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 21% demonstrated a good level of environmental performance and compliance with their consents.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance improved in the year under review, with further improvements expected in the 2017-2018 year with the installation of a gas collection and treatment system.

This report includes recommendations for the 2017-2018 year including a recommendation relating to an optional review of consents 4619-1, 4620-1, 4621-1, and 4779-1.1.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2016 to June 2017 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by New Plymouth District Council (NPDC). NPDC operates a regional landfill situated on Colson Road, New Plymouth, in the Waiwhakaiho catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by NPDC that relate to discharges of water, discharge to land and a stream diversion within the Waiwhakaiho catchment, and the two air discharge permits held by NPDC to cover emissions to air from the Colson Road landfill.

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 the NPDC's use of water, land, and air, and is the 17th site specific Annual Report by the Council for NPDC covering only this site. Prior to this, during the period from 1990-1999, the Council produced 10 combined NPDC landfills' Annual Reports that included the Colson Road landfill.

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 through annual programmes;
- the resource consents held by NPDC in the Waiwhakaiho catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at this NPDC landfill site.

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

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

Section 4 presents recommendations to be implemented in the 2017-2018 monitoring year.

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

1.1.3 The Resource Management Act (1991) and monitoring

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

- a. the neighbourhood or the wider community around a discharger, and may include cultural and socio-economic effects;
- b. physical effects on the locality, including landscape, amenity and visual effects;

- c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); 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 performance

Besides discussing the various details of the performance and extent of compliance by the consent holder during the period under review, this report also assigns 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 the consent holder's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

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

The categories used by the Council for this monitoring period, and their interpretations, 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 compliance

High: The administrative requirements of the resource consents were met, or any failures 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 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 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

Wastes originating from municipal refuse kerbside collection, the Colson Road transfer station, other municipal transfer stations and commercial operators are discharged to the landfill. As of December 2007 Colson Road became the sole operating landfill in the Taranaki region. Once the waste is discharged it is compacted and, according to the management plan, covered daily with clay or a suitable alternative. Currently, waste is discharged to Stage 3 of the operation, which is expected to operate until approximately 2019. Once full, the area will be covered with clay and topsoil to a predetermined specification before being grassed. Leachate from stages two and three is collected and directed to the New Plymouth wastewater treatment plant, along with contaminated stormwater from Stage 3. An aerial plan of the site is shown in Figure 1.

The current stage in use (Stage 3) has a fully engineered liner consisting of high density polyethylene (HDPE) laid over compacted clay. Leachate is collected in porous pipes that have been put down in herring bone configuration over the polyethylene liner. During the 2013-2014 year, the lining of Stage 3 was completed so that the liner covered Stage 3's entire footprint. From this point on, there was an increase in the amount of potentially contaminated stormwater generated due to the increase in the lined and filled

area, and this was therefore directed to the leachate collection system for discharge via the New Plymouth wastewater treatment plant.

Daily operations at the site are governed by the requirements contained in the Colson Road Regional Landfill Management Plan.



Photo 1 Stage 3 extension works, February 2011

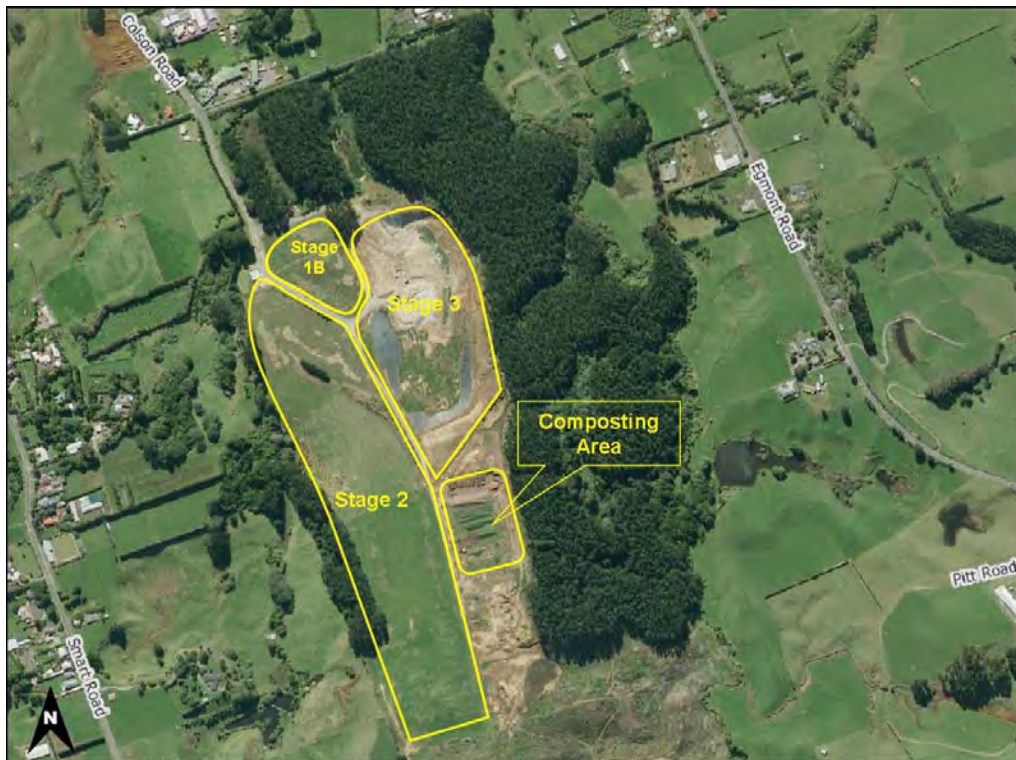


Figure 1 Aerial view of the Colson Road landfill

1.3 Resource consents

NPDC holds a total of eight resource consents in relation to the Colson Road landfill. These consents contain a total of 105 special conditions setting out the requirements that NPDC must satisfy. NPDC holds two consents to discharge uncontaminated stormwater into the Puremu Stream, two consents to discharge leachate and contaminated stormwater into the Puremu Stream, two consents to discharge emissions into the air, and one consent to discharge solids onto and into land. NPDC also holds one consent to divert water.

A change to consent was granted during the year under review for the air discharge consent (4779-1.1) to provide for the installation and operation of a landfill gas collection system and flare.

Table 1 Summary of the resource consents held by NPDC

Consent No	Purpose	Review	Expire
0226-1	Divert Puremu Stream	-	01 Oct 2026
2370-3	Discharge leachate and stormwater from area A to Puremu Stream	June 2018	01 Jun 2025
4619-1	Discharge treated stormwater and minor amounts of leachate from areas B1, B2, C1 & C2 to groundwater and the Puremu Stream	June 2018	01 Jun 2025
4620-1	Discharge uncontaminated stormwater from areas B1, B2, C1 and C2 into the Puremu Stream	June 2018	01 Jun 2025
4621-1	Discharge solids to land	June 2018	01 Jun 2025
4622-1	Discharge emissions to air from composting	June 2018	01 Jun 2025
4779-1.1	Discharge emissions to air from landfilling [change to conditions 24 January 2017]	June 2020	01 Jun 2026
6177-1	Discharge stormwater from earthworks	-	01 Jun 2020

The permits are discussed further in sections 1.3.1 to 1.3.4 below, with the discussion including a summary of the conditions on each of the consents. The summary may not reflect the full requirements of each consent condition, but these can be found in full in the resource consents, which are appended to this report (Appendix I).

1.3.1 Water discharge permits

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

NPDC holds water discharge permit **2370-3** to cover the discharge of up to 1,000 m³/day of leachate and contaminated stormwater from the closed section, Area A, of Colson Road municipal landfill to groundwater in the vicinity of and into the Puremu Stream. This permit was issued by the Council on 19 March 2003 under Section 87(e) of the RMA. This consent was reviewed in June 2006 and is due to expire on 1 June 2026.

Condition 1 requires the consent holder to adopt the best practicable option to avoid or minimise adverse effects.

Condition 2 requires that the consent be exercised in accordance with the documentation submitted in support of the consent application.

Condition 3 prohibits certain water quality effects in the Puremu Stream.

Condition 4 prohibits significant impacts on aquatic life.

Condition 5 states that monitoring of surface and groundwaters at the site shall be to the satisfaction of the Council.

Condition 6 requires that the NPDC abides by their Proposed District Plan.

Condition 7 states that the NPDC shall maintain and comply with a site management plan.

Conditions 8 and 9 require the consent holder to maintain area A of the landfill to a certain standard.

Conditions 10 and 11 require the consent holder to maintain water flow and silt control measures on site, and prevent vehicle cleaning on site.

Conditions 12, 13, 14 and 15 state the location of a mixing zone and place restrictions on the physicochemical impacts of the discharge in the Puremu Stream.

Condition 16 states that the discharge should not render water in the Puremu Stream unfit for stock consumption.

Condition 17 requires that systems relating to leachate on the site are maintained to the satisfaction of the Council.

Condition 18 provides opportunities to review the conditions of the consent, if monitoring shows that it is warranted.

The NPDC holds resource consent **4619-1** to discharge up to 675 L/s of treated stormwater and minor amounts of leachate from areas B1, B2, C1 and C2 of the Colson Road landfill to groundwater in the vicinity of and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment. This permit was issued by the Council on 21 March 1999 under Section 87(e) of the RMA. This consent was reviewed in June 2006, provides for a further review in June 2018, and is due to expire on 1 June 2025.

Condition 1 of this consent states that the water quality of the Manganaha Stream shall not be changed as a result of the discharge.

Conditions 2 and 3 outline specific water quality criteria for the Puremu Stream that must not be exceeded as a result of the discharge.

Conditions 4 and 5 deal with management plans and monitoring programmes.

Condition 7 provides opportunities to review the conditions of the consent, if monitoring shows that it is warranted.

The NPDC holds consent **4620-1** to discharge up to 675 L/s of uncontaminated stormwater from areas B1, B2, C1 and C2 of the Colson Road landfill into the Puremu Stream, a tributary of the Mangaone Stream in the Waiwhakaiho catchment.

This permit was issued by the Council on 21 March 1999 under Section 87(e) of the RMA. This consent is due to expire on 1 June 2025.

Conditions 1, 2 and 8 specify the level of water quality in the Puremu and Manganaha Streams that must be maintained.

Condition 3 prohibits the discharge of any leachate.

Conditions 4 and 5 require that all constructions, earthworks and stormwater systems be designed and maintained in a manner that minimises erosion and land instability.

Condition 6 states the consent holder shall repair and rehabilitate any land made unstable and any erosion occurring due to the construction or maintenance of the diversion channels or landfilling operations or composting site associated with the exercise of this consent.

Condition 7 requires the consent holder to notify Council of any works that may affect the areas contributing to the stormwater discharged under this consent.

Condition 9 prohibits activities that may result in contaminated stormwater entering the Manganaha Stream.

Conditions 10 and 11 require the consent holder to produce and adhere to a compliance monitoring programme and a landfill management plan.

Conditions 12 and 13 deal with rules associated with lapse and review dates for the consent.

The NPDC holds resource consent **6177-1** to discharge stormwater (due to earthworks in providing an area for Stage 3 of the municipal landfill) onto land and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment. This permit was issued by the Council on 11 June 2003 under Section 87(e) of the RMA. It is due to expire on 1 June 2020.

Condition 1 states parameter limits on the discharge to the Puremu Stream.

Condition 2 states that leachate shall not be discharged by the exercise of the consent.

Condition 3 deals with stormwater diversion and channels.

Conditions 4 and 5 state that the activity shall not alter certain characteristics of the water or significantly adversely impact on its aquatic life.

Condition 6 relates to water monitoring.

Conditions 7 and 8 require the provision of a site management plan, contingency plan and erosion control plan.

Condition 9 outlines that the best practicable option is to be taken in the management of the site to avoid or minimise adverse effects.

Condition 10 requires repair and rehabilitation of land, if made unstable by drainage works.

Condition 11 places requirement on the consent holder in relation to stormwater movement control on the site.

Condition 12 prohibits certain water quality effects in the Puremu Stream.

Condition 13 provides opportunities for review of the consent.

These permits are 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 consent(s) which is/are appended to this report.

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.

Composting operations

The NPDC holds resource consent **4622-1** to cover the discharge of emissions into the air from composting and ancillary activities at the Colson Road landfill. This permit was issued by the Council on 21 March 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2025.

Condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from the emissions from the composting operation.

Condition 2 requires that the discharge of contaminants to air from the landfilling operations not result in offensive or objectionable odours or dust or dangerous or noxious ambient concentrations of any airborne contaminants at or beyond the boundary of the site.

Condition 3 states that the discharge shall not give rise to any significant adverse ecological effects on any ecosystems.

Condition 4 states that the nature of materials acceptable for composting and the operation of the composting activities shall give effect to the 'Assessment of Discharges to Air', July 1994 and the 'NPDC Colson Road Landfill: Landfill Management Plan', July 1994 and requires that the landfill management plan be updated at least yearly.

Conditions 5 and 6 state that any composting windrow shall be located at least 300 m from any dwelling house, and shall comprise no greater than 5% by weight of materials that are not plant-derived.

Special condition 7 required that the composting operation be initially undertaken on a trial basis for six months, with the consent holder reporting to the Council on effects-based monitoring and any complaints about odour at the end of this trial period.

Conditions 8 and 9 outline lapsing and review provisions.

Landfilling operations

The NPDC holds resource consent **4779-1** to cover the discharge of emissions into the air from the existing landfill (Area A) and proposed landfill extension in Areas A, B1, B2, C1 and C2 of the Colson Road landfill site. This permit was issued by the Council on 21 March 1999 under Section 87(e) of the RMA. This consent was reviewed in June 2006 and is due to expire on 1 June 2025.

An application to change the conditions of the consent was received on 12 December 2016 consent to allow burning of landfill gas.

NPDC is proposing to install a landfill gas collection and treatment system to minimise landfill gas emissions and provide further controls to prevent odour becoming offensive or objectionable beyond the site boundary. The improvements to the landfill gas system are proposed in up to three stages. The odour management performance of the system will be evaluated in the six months following completion of each stage and a decision made as to whether the subsequent stages necessary. The three stages are described as follows:

- Stage 1 - Construction of perimeter pipework to connect to the 12 existing protruding leachate drainage pipes and a flare. This will be preceded by a two to four week landfill gas pumping trial period to facilitate the final design of the permanent flare;
- Stage 2 - Construction of 11 gas collection wells in final areas of landfill and connection to perimeter pipework; and
- Stage 3 - Construction of 16 additional gas collection wells in the final areas of the landfill and connection to perimeter pipework.

The commencement date for the change to conditions was 24 January 2017.

The conditions contained in both consents that were in effect during the year under review are outlined below:

4779-1.0 (to 23 January 2017)

Condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from the emissions from the landfilling operation.

Condition 2 states that the discharge of contaminants to air from the landfilling operations shall not result in offensive or objectionable odours or dust or dangerous or noxious ambient concentrations of any airborne contaminants at or beyond the boundary of the site.

Condition 3 states that no material is to be burnt at the landfill site.

Condition 4 states that the discharge shall not give rise to any significant adverse ecological effects on any ecosystems.

Condition 5 states that no extraction venting of untreated landfill gases be located closer than 200 m to any boundary of the landfill property.

Condition 6 requires that the landfill be operated to give effect to the 'Air Discharge Consent Application Supporting Documentation, July 1995' and in accordance with the 'NPDC Colson Road Landfill: Landfill Management Plan, July 1994'. The management plan shall be updated at least yearly and offer no lesser level of environmental protection than the original documents.

Condition 7 requires the consent holder to consult with the Council prior to undertaking any alteration to the site or site operations other than specified in the application and supporting documentation lodged with the application.

Condition 8 requires the consent holder to meet at least once per year with the submitters of the consent and any other interested party to discuss any matter relating to the exercise of the consent and to facilitate ongoing consultation.

Condition 9 requires the consent holder to provide to the Council a report on the feasibility of collecting, extracting, venting or combusting landfill gas at the landfill, within one year of the commencement of the consent.

Conditions 10 and 11 outline the provisions for lapsing and review of the consent.

4779-1.1 (from 24 January 2017)

New conditions 1 to 3 specifically relate to the proposed flare. These conditions cover requirements for the consent holder to provide as built drawings, monitor the flare temperature and feedstock composition, and to revise the Landfill Management Plan to include the necessary procedures and record keeping to ensure and demonstrate that the system is operated appropriately.

Conditions 4 and 5 (previously 1 and 2) are unchanged.

Condition 6 (previously 3) was amended allow landfill gas to be burnt at the site in a flare.

Conditions 7 and 8 (previously 4 and 5) are unchanged.

Conditions 9 and 10 (previously 6 and 7) were changed to include the "Variation to Air Discharge Consent – Colson Road Landfill, prepared by Tonkin & Taylor Ltd and dated December 2016" in the documents that must be given effect to, and include the variation.

Conditions 11 to 13 (previously 8 to 10) are unchanged.

The provisions for review contained in condition 14 (previously 11) have been expanded to include an opportunity within 6 months of the installation of the flare.

These permits are 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 consent(s) which is/are appended to this report.

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.

The NPDC holds resource consent **4621-1** to cover the discharge of up to 500 tonnes of contaminants onto or into land per day in areas B1, B2, C1 and C2 of the Colson Road landfill. This permit was issued by the Council on 21 March 1999 under Section 87(e) of the RMA. This consent is due to expire on 1 June 2025.

Condition 1 requires the consent holder to install and maintain a further groundwater monitoring piezometer between the bores at sites AH9 and L2 and to maintain groundwater bores at the sites WQA, WQB, WQC, AH1, AH2, AH3, AH5, AH6, AH7, L1, L2, L5, L7, and L8 (as per the AEE).

Condition 2 requires the consent holder to prevent surface water runoff or contaminants to the Manganaha Stream from areas used for deposition of refuse or earthworks unless the area has been covered and rehabilitated.

Condition 3 requires the consent holder to demonstrate that the stormwater systems, surface contours and landscaping works have been undertaken to ensure that compliance with special condition 2 will be achieved, prior to commencing any use of Areas B, C1 and C2 for deposition of refuse.

Condition 4 requires that a registered engineer certify the construction, installation, integrity and performance of groundwater drainage systems, landfill lining systems and leachate interception, collection, holding, recirculation and discharge systems in Areas B1, B2, C1 and C2 prior to any discharge of solids wastes in those areas.

Condition 5 requires the consent holder to remedy or mitigate and if practicable to prevent any continuation of effects upon the quality of groundwater should the groundwater quality be significantly affected by the landfilling and composting activities.

Condition 6 outlines monitoring requirements, and criteria to be used to determine if contamination is occurring.

Condition 7 requires the consent holder to operate the landfill in a manner conforming to the relevant requirements of the 'NPDC Colson Road Landfill: Landfill Management Plan 1994' and to update the plan at least yearly.

Condition 8 outlines the criteria for the acceptance and disposal of waste types at the landfill.

Condition 9 and 10 outline provisions for lapsing and review of the consent.

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 consent(s) which is/are appended to this report.

1.3.4 Water right

The NPDC holds water right **0226-1** to allow the diversion, by culverting, of the Puremu Stream to provide road access to the landfill. The Taranaki Catchment Commission issued this on 2 April 1975, and renewed it

on 14 May 1986 under section 21 (3) of the *Water and Soil Conservation Act, 1967*. It is due to expire on 1 October 2026 as per Section 386 (2) of the RMA.

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 Colson Road landfill site consisted of five primary components, as described in Sections 1.4.2 to 1.4.6. A summary is also provided in Table 2.

Table 2 Summary of monitoring activity for 2015-2016

Activity	Number
Inspections	12
Discharge samples	2
Stormwater samples	6
Receiving water samples	18
Groundwater samples	7
Air deposition samples	12
Ambient methane readings	21
Ambient PM ₁₀ readings	15
Biomonitoring surveys	2

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with the resource consent holder over consent conditions and their interpretation and application;
- Colson Road Liaison Committee meetings;
- discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans and;
- consultation on associated matters.

1.4.3 Site inspections

The Colson Road landfill site was visited on a total of 13 occasions during the monitoring period. There were 11 routine compliance monitoring inspections undertaken and one site visit to observe the application of a trial daily cover material. 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 processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

The Council undertook sampling of both the discharges from the site and the water quality upstream and downstream of the discharge points and mixing zones. Water-quality and discharge sampling sites are shown in Figure 2.

The Puremu Stream, Manganaha Stream, and stormwater were all sampled on three occasions during the period under review. The discharge from the composting area treatment system was sampled on one occasion. The samples were analysed for a range of parameters including ammoniacal nitrogen, unionised ammonia, suspended solids, conductivity, and metals.

Groundwater in the vicinity of the landfill was sampled on one occasion, and the groundwater sampling sites are shown in Figure 3. These sites were analysed for a range of physicochemical parameters including semi volatile organic compounds (SVOC) and metals.

1.4.5 Air quality

The Council undertook sampling of the ambient air quality in the neighbourhood. Six deposition gauges were also placed at selected sites in the vicinity of the landfill and at the landfill on two occasions, and the collected samples analysed for solids. Two ambient particulate matter and three methane surveys were also undertaken. Air monitoring sites are shown in Figure 4.

Point sources of fugitive landfill gas emissions located at the inspections were also sampled and analysed for a range of landfill gas components using a MultiRae gas detector.

1.4.6 Biomonitoring surveys

Biological surveys were performed on two occasions in the Puremu Stream (three sites) and Manganaha Stream (two sites) to determine whether or not the discharges from the site have had a detrimental effect upon the communities of the streams.

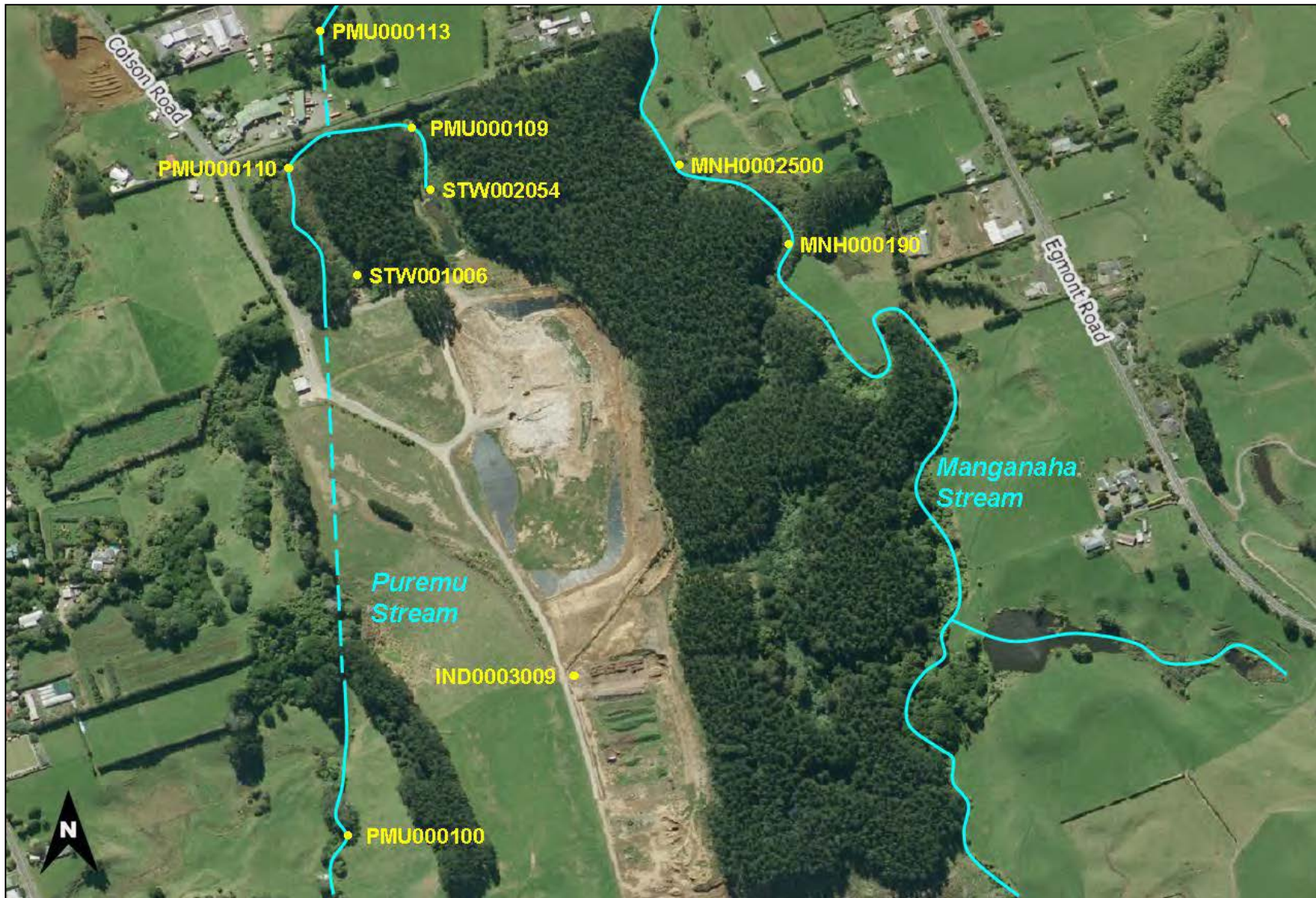


Figure 2 Aerial photo showing the stormwater and receiving water sampling sites at Colson Road landfill



Figure 3 Aerial view showing the groundwater sampling sites at Colson Road landfill

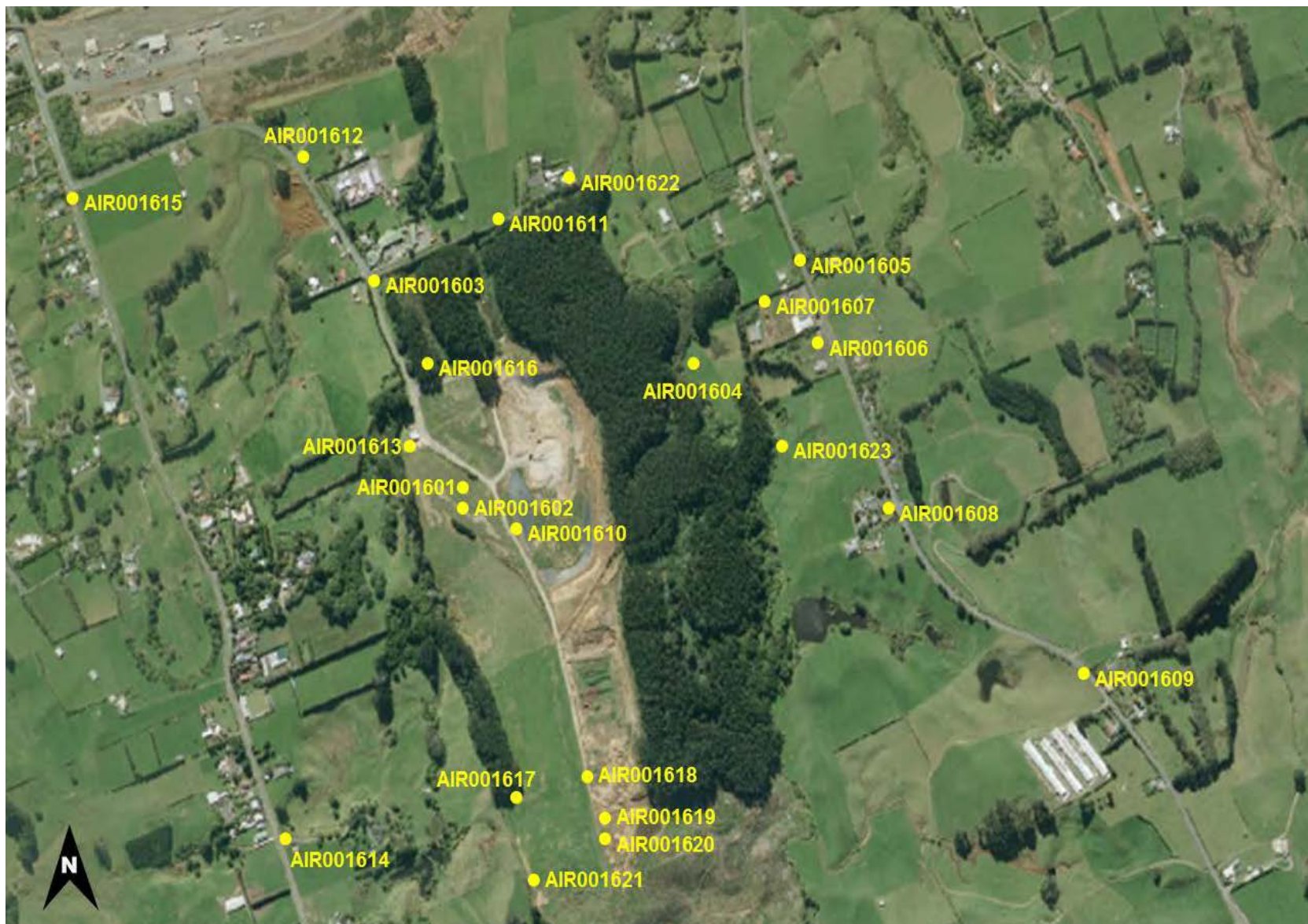


Figure 4 Aerial view showing the positions of air quality monitoring sites at and around Colson Road landfill

2 Results

2.1 Inspections

19 July 2016

The site was inspected in overcast conditions with a light south westerly breeze. There had been 23 mm of rain recorded at the New Plymouth wastewater plant in the five days prior to the inspection.

It was found that there was no litter or odour present on Colson Road beyond the site boundary. The spray nozzles were in operation at the time of inspection. It was observed that the base of the leachate pond had been regraded since the last inspection to improve drainage. Although there were noticeable landfill gas odours localised in this area, there were no landfill gas constituents detected by the MultiRae gas meter.

The roads, silt ponds and stormwater drains were litter free, with the exception of minor amounts of litter below the eastern small silt pond and near the outlet structure below the big silt pond. There was also a dead seagull on the stream bank below the eastern small silt pond that needed to be removed. A plastic bag was removed from the big stormwater pond outlet structure at the time of inspection and the site supervisor undertook to have the other litter removed that day.

The exposed liner noted at the previous inspection had been covered.

A surface drain had been cut at the lower end of the eastern batter (inside the landfill footprint) to direct a minor leachate breakout to the leachate system. There was no flow in this drain at the time of inspection. It was found that the leachate breakouts on the western side of the landfill were also being directed to the leachate system via the drain at the northern toe. The inspecting officer was advised that during a period of dryer weather the stones covering the inlet to the leachate pipe in the drain at the northern toe would be replaced, as it appeared that these were partially silted up and were now restricting drainage through to the pipe too much.

It was observed that the small trial biofilter had been removed from the second leachate pipe up the western side and that a soil/clay mix had been placed around the fourth pipe up. It was noted that the amount of landfill gas venting from around this pipe was greatly reduced compared to the previous inspection. In one location a small amount of landfill gas was venting that was found to contain 1.0 ppm volatile organic compounds, which is greater than 99 % of the methane lower explosive limit (LEL). It also continued 9.8 ppm hydrogen sulphide and no ammonia. There were no landfill gas constituents detected at a distance of approximately 0.3 metres from the pipe.

A walkover of part of the cap on the closed landfill area was undertaken. It was observed that there was no pugging, ponding or cracking present, with the exception of the eroded area at the farm gate. It was observed a gate noted previously had still not been moved, nor the depression filled. Some ponding was noted in the gateway, but there was no exposed refuse present. The site supervisor undertook to follow up on this matter.

It was found that the machinery and portable buildings had been removed from the Return2Earth composting area. It was expected that the remaining compost was to be removed shortly. The Revital composting area was quite full of both compost and fresh green waste. It was noted that there was minimal inorganic matter present in the fresh green waste piles. The compost ponds were full and there was a very low flow discharge occurring. It was observed that this was flowing under the plastic lining in the stormwater drain. The site supervisor advised that this must have lifted in the recent strong wind and undertook to have the edge of the liner re-anchored.

There was stormwater and leachate ponded below the special waste drop off point. It was confirmed that the more liquid special waste would not be accepted after the end of this month and that the special waste

pit would be decommissioned. The levels in the area would be lifted and the stormwater from clean covered areas currently draining into the pit would be re-directed to the roadside stormwater drain. The importance of silt control was discussed with the site supervisor.

During the inspection it was noted that the refuse was being pushed into a pit, which was then lifted out and pushed across the cell with the compactor. The working area was at the top of the western side of the landfill and was estimated to be less than 900 m². It was observed that the temporary cover had been removed from a small area of old refuse in the underlying cell so that filling could occur on top of this, as is normal practice. There were no resultant offensive or objectionable odours noted in this area. It was confirmed by the site supervisor that daily cover was being applied to the working cell. It was observed that four cover panels were present around the edges of the working cell, which the site supervisor said were working well. The inspecting officer was informed that three more cover panels were expected to be delivered to the site later that day.

It was considered that, on the whole, management at the site was continuing to improve.

The following action was to be taken:

- Ensure that the management and operations at the site comply with consent conditions, the Colson Road Regional Landfill Management Plan, and abatement notice 20881 at all times, including daily cover, intermediate cover and management of the special waste pit;
- Continue with collection of windblown litter;
- Address the erosion and ponding in and around the gate way on the closed area of the landfill.

23 August 2016

The site was inspected in overcast conditions with a light south to south easterly breeze. Discharge sampling was also undertaken. There had been 1.5 mm of rain recorded at the New Plymouth wastewater treatment plant prior to inspection following nine days without rain.

There was a very brief noticeable odour found at the site boundary on Colson Road prior to the inspection. This odour dissipated within one or two minutes, and did not return.

The areas of cap of the retired areas of the landfill visible from the access road were in satisfactory condition, however the site supervisor advised that the cap repairs at the gateway were still waiting for drier weather conditions.

It was found that the majority of the compost had been removed from the Return2Earth area. The southern end of the Revital area was quite full and shredding was taking place at the time of inspection. No dust or odour issues were found. Both composting areas looked tidy. The composting ponds were all about three quarters full, but there was no discharge occurring at the time of inspection. The ponds were dark brown in colour with pine pollen floating on the surface.

The roadways, ponds and drains checked were all litter free. It was also observed that there was litter collection occurring in the forest beyond the eastern litter fence at the time of inspection.

There were significant improvements observed in the special waste area. The site supervisor advised that the surface water had been pumped into the nearby leachate line over a period of eight days. The hole had been substantially filled with refuse, which had been compacted as far as possible and covered with sawdust. The surface was now quite soft after the recent rain and work would continue when it dried out a little. Open drains and bunding had been used as a means of directing the stormwater from above the area to the western drain just inside the landfill footprint, which feeds into the leachate system. The site supervisor had noted that the leachate flow from the landfill may have slowed somewhat and so a start had been made on checking and cleaning out the bottom part of the leachate pipes where necessary. The inspecting officer was advised that this work was planned to continue in the south eastern line soon.

The active area of the landfill was very compact, and the site supervisor advised that the metal covers were working well as the method of achieving daily cover. It was noted that there was good cover on the inactive areas of the landfill and inside the landfill foot print was now looking considerably tidier. Thank you.

As noted at the previous inspection, some silt from the recently applied cover was washing down into the western drain inside the landfill footprint. It was observed that works had been undertaken since the previous inspection and some of the drain issues had been addressed. The areas that needed attention next were discussed at inspection. These areas were mainly towards the southern end of the drain, below the active area and where some ponding was occurring now that the stormwater from above the special waste pit had been redirected to this drain. Leachate breakouts were being directed to the leachate system and it was observed that the stone filter in the northern leachate/stormwater drain had been renewed.

It was found that the leachate pipe most prone to fugitive emissions was covered with a good amount of clay. Only two small (less than 2 mm) holes were present in this. The maximum landfill gas components detected at these emissions point were 3.4 ppm hydrogen sulphide, 99 % methane LEL and 2.0 ppm volatile organic compounds. However there were no noticeable odours or landfill gas components detected when a 360 degree assessment was done approximately 2 m from the leachate pipe.

Intermittent and localised landfill gas odours were noted between the landfill and compost area and at the big silt pond. The odours were initially strong at the big silt pond. A manhole cover on the leachate line to the south of the pond was realigned and the odours dissipated within about 10 minutes. It was observed that the odour mitigating sprays were in operation.

It was found that the inlet to the Puremu Stream culvert in forest that goes under the under RSPCA driveway was obstructed and was in need of clearing.

The following action is to be taken:

- Ensure that the management and operations at the site comply with consent conditions, the Colson Road Regional Landfill Management Plan, and abatement notice 20881 at all times, including daily cover, intermediate cover and management of the special waste pit;
- Continue the good work with the collection of windblown litter;
- Address the erosion and ponding in and around the gate way on the closed area of the landfill;
- Address the silt build-up and ponding in the western drain;
- Clear the Puremu Stream culvert inlet in the forest upstream of the SPCA driveway.

An email was received from the contracting company the following day to advise that the works discussed with the site supervisor were undertaken on the day of inspection.

20 September 2016

The site was inspected in overcast conditions with a very light easterly wind. There had been 34 mm of rain recorded at the New Plymouth waste waster plant in the five days prior to the inspection.

Prior to going on site it was noted that there were no off site dust or odour issues and that Colson Road was free of windblown refuse at the entrance to the site. It was found that the Puremu Stream culvert inlet (in the forest just upstream of the SPCA driveway) was obstructed. Photos were taken. At the time of inspection there were no visible effects on the Puremu Stream as a result of the discharges from the site. The location of this culvert was clarified with the site supervisor during the inspection. The site supervisor was also informed that the samples collected during the previous inspection complied with consent conditions.

The small silt ponds were litter free. It was observed that the western pond would need de-silting soon and that the outfall from the eastern pond had been cleared back to the engineered structure. There were slight

intermittent landfill gas odours noted at the leachate pond. The leachate pond was empty and litter free. There was a visible iron oxide coloured "high tide" mark present in the leachate pond that was approximately one metre below the top of the bund separating this pond from the eastern small silt pond.

There were slight intermittent landfill gas odours noted at the large silt pond. The pond, weir and outlet structure were litter free, however it was noted that there were minor amount of wind blown litter present outside the litter fence. Although the pond contents and discharge were dark brown, there had been no visible effect in the Puremu Stream. The colouration was likely to be due to the discharge from the composting area. The inspecting officer was informed that a large number of piles had been turned and chipping had been undertaken recently.

Drainage works undertaken on site were discussed. There had been a number of leachate breakouts occurring, and drainage works had been undertaken to capture these and direct them to the leachate system. Further work was required at the southern end of the landfill to capture a recent low flow breakout. The western drain had been cleared of vegetation and accumulated silt and the bund had been widened where minor amounts of stormwater/leachate had been found to be seeping through. It was found that, for the most part the drain was clear and free flowing, although there was some refuse partially obstructing flow between the fourth and fifth leachate pipe up from the northern end.

It was observed that there were a few areas where the liner had become exposed. The liner needs to be covered where possible to protect it from physical damage. Where this is not possible, the site supervisor was told to ensure that care is taken when working in these areas to prevent damage to the liner.

Landfill gas monitoring found no ambient landfill gasses present on site. One point source discharge was detected originating from the fourth leachate pipe up from the northern end. The landfill gas components detected were 40 % methane LEL, 4.0 ppm hydrogen sulphide, 0.6 ppm volatile organic compounds, and 1.0 ppm ammonia.

The parts of the Stage 2 cap that were walked had minor pugging and reasonable vegetative cover with the exception of the gateway. Repairs had been attempted in the gateway, however subsequent stock management practices had resulted in deep pugging. Some ponding was also present. NPDC was informed that the condition of the area appeared to be deteriorating and was non-compliant with special conditions 8 and 10 of consent 2370-3. It was noted that the area had become a bit of a low spot that, with the current stock management practices, was likely to require on going maintenance to avoid cap damage and ponding. If the gateway was not to be moved, as originally planned, then longer lasting remedial works needed to be considered.

Only two piles of covered Return2 Earth compost were remaining on site. The inspecting officer was informed that the third pile had been purchased by NPDC. The Revital area was quite full. There was no activity occurring in the composting areas at the time of the inspection. The compost ponds were dark brown with a trickle flow discharge occurring to the eastern stormwater drain.

It was found that the old special waste pit had been filled and the active filling area was in this vicinity. The area of exposed refuse was compact, and some of the metal covers were being put in place at the time of the inspection. The area that was being filled at the time of the previous inspection had been covered and there was little, if any, exposed refuse in the area at the time of inspection. The old tipping pit was now being used as the special waste pit, with sawdust being used to cover the special waste as it was disposed of. There was cover material present on all inactive areas inspected with little, if any, exposed refuse visible at the time of the inspection.

The following action is to be taken:

- Clear the Puremu Stream culvert inlet in the forest upstream of the SPCA driveway;
- Continue the collection of windblown litter especially below the silt ponds and in the western drain;

- Monitor silt build up in the western small silt pond and address as required;
- Continue to capture and direct leachate breakouts to the leachate system as they occur;
- As per special condition 10 of consent 2370-3 undertake remedial works on the stage 2 cap in and around the gateway and ensure that ground contours are maintained such that ponding is minimised.

2 November 2016

This inspection was undertaken in the presence of the contractor's landfill manager.

The weather was fine with a cool south westerly breeze.

The compost area was inspected and it was found that the upper section was almost completely vacated, with two piles of material left on the site. The main compost area was found to be operating in satisfactory manner. The compost treatment ponds were found to be free of litter and were discharging at a low rate. No compost odours were detected downwind of the composting area.

The eastern drain was inspected and the drain liners and cover nets were in place and appeared to be working well. Small inverted litter nets had been installed along the western approaches to the drain (and other areas around the landfill) to act as collection points for wind blown litter. Litter collection was being undertaken at the time of inspection along the eastern drain, and there were only minor amounts of litter present around the drain.

Refuse was being received into a tipping pit, then being scooped out and spread at the time of the inspection. A new 38 tonne BOMAG compacter was on site and this was being used to spread and compact refuse. The area of exposed refuse was within guideline limits and was being well managed.

The special waste pit was inspected and the discharged waste was covered in a thick layer of sawdust. The pit was close to full and a new waste pit had been dug adjacent to the current one in preparation.

The areas of the Stage 3 not in use were, for the most part, litter free and well covered in interim cover. It was outlined that significant areas of Stage 3 were being now directed to the stormwater system and that this had reduced the volume of water having to pass through the leachate system. Discussions were held around how the diversion of clear water away from the leachate system would minimise the amount of water building up in the landfill, and how this would be likely to reduce leachate generation, gas expulsion and ultimately odour production.

The leachate flow running around from the western batter was found to have reduced and at the time of inspection was flowing at approximately 0.5-1 L/s. The northern batter still had some exposed refuse present and it was outlined that this was the last remaining area to be addressed in regard to improved interim cover. It was also outlined that this area was going to receive a thick cover to prevent the occasional leachate breakout that had been occurring.

The large silt pond and its surrounds were found to be free of litter and there did not appear to be any significant sediment build-up in the pond. The discharge was inspected and found to be relatively clear. The smaller western silt pond had an accumulation of sediment in it and it was noted that it was likely to need de silting soon.

During the inspection no offensive odours were noted, with noticeable odours noted in and around the tip face and the leachate drain.

4 November 2016

The site was visited again on 4 November 2016 to complete the inspection.

The cap on Stage 2 was inspected and it was found that interim works had been undertaken to mitigate the effects of the stock damage on the cap in the upper gateway. Soil had been used to fill in the depression, however it had been partially churned up by the passage of cattle. It was noted that only sheep were being grazed at the site at the time of inspection. It was outlined that a new fence was to be constructed once the weather improved and the gate moved away from the crown of the cap.

The Puremu Stream was inspected and it was found to be running relatively clean and clear with no effects noted. Both culvert grates were found to be free of debris.

The following action was to be taken:

- Monitor silt build up in the western small silt pond and address as required;
- Continue to capture and direct leachate breakouts to the leachate system they occur;
- As per special condition 10 of consent 2370-3, undertake remedial works on the Stage 2 cap in and around the gateway and ensure that ground contours are maintained such that ponding is minimised.

30 November 2016

The site inspection was undertaken in showery weather conditions with a light north westerly wind. There were no off site odours or litter found on Colson Road prior to the inspection, and the Puremu Stream SPCA culvert inlet was clear of debris. There were no visible effects observed in the Puremu Stream.

It was noted that there was a reasonable amount of silt being tracked on to the main access road that would need monitoring due to the potential for sediment discharges or dust.

Mechanical mulching and/or screening was being undertaken in the compost area at the time of inspection. No dust or odour issues were found. The compost ponds were full, but not discharging. The contents of these ponds were dark brown and litter free.

There were light landfill gas odours downwind of southern litter fence and on the access track to the special waste pit. Strong, intermittent but localised odours were found at the big silt pond, in the immediate vicinity of the loose manhole cover over the leachate line. The landfill gas component concentrations measured at the cover were methane LEL: greater than 99%, hydrogen sulphide: 3.8 ppm, volatile organic compounds: 1.1 ppm, ammonia: 1 ppm. It was noted that the odour mitigating sprays in this area were operating at the time of inspection. There was only one point source of landfill gas found along the western boundary of the landfill footprint. This was at the fourth capped leachate pipe from the northern end of the landfill. No landfill gases were detectable until approximately 10 cm from the pipe. The maximum landfill gas components found at the points of discharge were methane LEL: greater than 99%, hydrogen sulphide: 84 ppm, volatile organic compounds: 2.2 ppm, ammonia: 4 ppm.

It was found that there had been significant changes made to the drainage on the eastern side of the landfill. A silt fence placed in a secondary drain running up gradient of the deep eastern stormwater drain was found to be quite full of silt and it was noted that this would need cleaning out soon. The silt ponds were, on the whole, in satisfactory condition. However it was observed that there was a bank of silt present in the small westernmost silt pond. The area around and below the large silt pond was free of visible litter. There was a small amount of litter still present in the tributaries below the small silt ponds, but it had previously been agreed that this would be addressed at a time of low stream flows for safety reasons. There was some exposed plastic observed in the western stormwater drain (photograph taken). Please confirm that this is not a piece of damaged liner. It was noted that there was quite a lot of punga debris around the edge of the leachate pond that may have the potential to become an obstruction over the grate of the leachate drainage sump.

The active landfill area was tidy and very compact, and waste in the special waste pit had adequate temporary cover material applied.

After the inspection a telephone call was made to the contractor's landfill manager. It was explained that it might be a little while before the inspection advice was to be issued, and as such it would be good to discuss any queries and action items arising from the inspection.

The inspecting officer was informed that the gateway on the cap of Stage 2 had been moved, with the new gate to be hung soon. The recontouring had not yet taken place due to the wet weather conditions that were still prevailing. That the new litter fence being constructed to the south of the large silt pond would still allow vehicular access to enable the pond to be desilted etc, The separated wood pile present on site would be spread across the base of a cell, probably over the Christmas/New Year period, and that the cleaning of all of the leachate lines was now complete.

The following action was to be taken:

- De-silt the silt fence above the intersection between the eastern stormwater drain and the northern litter fence;
- When weather permits de-silt the small western silt pond, recontour the area of eroded cap on Stage 2, and remove litter from the tributaries below the small silt ponds;
- Continue to monitor the accumulation of silt in the western drain and the punga debris in the leachate pond, and address as required;
- Ensure that bunding is maintained to ensure that leachate and potentially contaminated stormwater is directed to the leachate system, particularly on the south western side of the footprint and around the area(s) of active work;
- Ensure that dust and silt control is used to control potential effects from the tracking onto the main access road;
- Confirm that the plastic in the western drain is not damaged liner.

21 December 2016

The weather was fine with a very light changeable south easterly to south westerly breeze.

The compost area was inspected and it was found that the upper section was almost completely vacated with two piles of material left on the site. The main compost area was found to be operating in satisfactory manner. The compost treatment ponds were found to be free of litter and were discharging at a low rate. No compost odours were detected down wind of the composting area.

During the inspection the daily cover rigs were removed and refuse was being scooped up and out of the tipping pit and spread on to the tip face. The area appeared to be within the 900 m² guideline.

The large silt pond and its surrounds were found to free of litter and there did not appear to be any significant sediment build-up in the pond. The discharge was inspected and found to relatively clear. The smaller western silt pond had an accumulation of sediment in it and it was noted that it would likely need de silting soon.

The Puremu Stream was inspected and it was found to be running relatively clean and clear with no effects noted. Both culvert grates had a minor amount of debris in them and it was noted that regular cleaning should continue.

During the inspection only light intermittent odours were noted at the boundary, with stronger odours noted in and around the tip face and along the western batter.

No significant issues were noted overall, however it was noted that not all matters raised in the previous inspection were checked for follow up on this occasion.

The following action was to be undertaken:

- Monitor silt build up in the western small silt pond and address as required;
- Continue to capture and direct leachate breakouts to the leachate system they occur;
- Check culvert grates;
- Undertake any outstanding works required in the previous inspection.

31 January 2017

The weather was fine with a light south westerly breeze. The inspecting officers were accompanied by the contractors' site supervisor.

The compost area was inspected and it was found that the upper section was empty and tidy. The main Revital compost area was found to be operating in satisfactory manner. Mulching was underway at the time, with no odour or dust issues noted. Strong landfill gas and fresh waste odours were detected around the compost treatment ponds. These ponds were approximately one third full and discharging at a trickle flow. The ponds were substantially free of litter. No composting odours were detected downwind of the composting area. The netting rubbish traps on the perimeter stormwater drains were working well, with minimal amounts of litter present in the drains.

Reclaimed soil from Sutherland Park was being applied as daily cover to the sides of the cell during the inspection. The special wastes pit was well marked with no unauthorised material noted in the pit and no gases detected around the perimeter.

Landfill gas was observed bubbling out of a leachate drain adjacent to the cell. The leachate sump alongside the road was dry at the time of inspection. All leachate from the southern side of the landfill was being captured and directed to the leachate pond in an appropriate manner, with no sign of overflows.

The large silt pond and its surrounds were found to be free of litter. The level of the pond was low and some clearing of vegetation around the sump was required. The build-up of silt in the western small silt pond has been removed thank you. The discharge was inspected and found to be slight milky immediately downstream.

The stormwater pond had an accumulation of silt in it. NPDC were advised that photos were taken and that the levels would be checked against the photographic record (to determine if visible silt is due to accumulation or lower than normal pond levels). It was noted that the surface runoff trench was working well, diverting any sediment runoff away from the pond. It was reported that minor amounts of litter at the pond outlet to the tributary required some attention. The sump and weir at the discharge point were clear and free flowing.

The Puremu Stream was inspected and it was found to be running relatively clean and clear with no effects noted. Both culvert grates were tidy and regular cleaning is maintaining a noticeable improvement.

Strong intermittent wafts of odour from older refuse and landfill gas were apparent on the site, however no gases were detected by the gas meter. Intermediate cover was being stripped back each day in an effort to reduce the potential for odour release. Landfill gas was detected tracking up the side of the leachate pipes (methane LEL: 11%), and odours were detected around the caps on the pipes.

Vehicle dust tracking issues were noted from the site entrance, and discussed on site with staff, who advised that sweeping would be carried out as required. The gateway area on Stage 2 was dry, but a minor amount of re-contouring was still required to prevent ponding in wet months.

No significant issues were noted overall, and levels of litter around the site were very low. It was requested that the good litter collection practise be continued.

The following action was to be undertaken:

- Ensure any stormwater from open areas of the landfill is captured and directed to the leachate system;
- Monitor sediment build-up in the northern end of the stormwater drain.

10 March 2017

The site was inspected in fine weather with a light north westerly breeze.

The compost area was inspected and it was found that the upper section was empty and tidy. The main Revital compost area was found to be operating in satisfactory manner. No odour or other airborne nuisances were noted in association with compost operation. The compost ponds were not discharging at the time of inspection.

Refuse was being received and spread at the time of inspection. The open tip face was well controlled and within the 900 m² limit. The access tracks in an around the tip face were noted to be especially dusty and it was outlined by the site supervisor that the water cart was in the process of being filled to remedy this. The special waste pit was inspected and no issues were noted.

The western batter had been contoured and track rolled in preparation for a final layer of clay and top soil. It was outlined that the works had been delayed whilst a new subsurface leachate drain was being designed. It was also outlined that once the area was complete that surface stormwater runoff would be diverted to the clean water ponds. There was only a small amount leachate present in the western drain at the time of the inspection.

No issues were noted with either the large or small silt ponds. Litter control in these areas was good and silt accumulation was not significant.

The Puremu Stream was inspected and it was found to be running relatively clean and clear with no effects noted. Both culvert grates were free of significant amounts of accumulated debris

Strong intermittent wafts of fresh refuse and landfill gas were apparent on the site, however no ambient gases were detected by the gas meter. Dust was noted to be prevalent at the site but no objectionable dust levels were noted at the boundary. Landfill odours were noted within the boundary but not detected off-site.

No significant issues were noted overall, and levels of litter around the site were very low. It was requested that the good litter collection practise be continued.

6 April 2017

The weather was fine with a light north westerly breeze. There had been 100 mm of rainfall during the preceding two days. A self notification was received from NPDC stating that the heavy rain had flooded the control box for the leachate pump causing one pump to fail. This resulted in an overflow of the leachate/stormwater mix to the stream.

It was outlined that the valve from the leachate collection pond at the toe of the landfill had been almost closed to ensure the remaining pump could keep up and prevent further overflow. At the time of the inspection technicians were on site and the pumps had been fixed. It was noted that the level in the lower pond was below the overflow pipe.

The leachate collection pond at the toe of the landfill was inspected, and it was found that leachate was being released to the lower pond at a sufficient rate to prevent build up of leachate in this area. However, it

was noted that leachate was flowing freely from the perimeter drains indicating that fluid had built up in the filled areas.

The main Revital compost area was found to be operating in satisfactory manner. No odour or other airborne nuisances were noted in association with compost operation. The compost ponds were discharging at a trickle rate

At the time of the inspection there was little activity at the tip face and no issues were noted in regards to tip face management.

No issues were noted with either the large or small silt ponds. Litter control in these areas was good and silt accumulation was not significant. It was outlined that when the large silt pond was de-silted, that a silt layer 3 metres deep had been removed.

The Puremu Stream was inspected and it was found to be running relatively clean and clear with no effects noted. Both culvert grates were inspected and the upper grate was found to have significant debris accumulated in it. Staff were allocated to clean this out at the time of the inspection.

Strong intermittent wafts of fresh refuse and landfill gas were apparent on the site, however no ambient gases were detected by the gas meter. Landfill odours were noted within the boundary but not detected off-site.

2 May 2017

The site was visited in fine weather with a light north easterly breeze. There had been 49 mm of rain over the previous four days.

The Revital compost area was found to be operating in a satisfactory manner. No odour or other airborne nuisances were noted in association with the compost operation. The piles were inspected and found to contain less than 5% non-plant matter. No discharge was occurring from the compost treatment ponds at the time of inspection.

At the time of the inspection staff were shaping the current cell prior to finishing it off. It was noted that the batter around the benched area had exposed refuse and it was outlined that the whole area would be covered with interim cover and seeded within a few days.

A road had been constructed down to the northern end of Stage 3 in preparation for starting a new cell in that area. It was outlined that the new area would be bunded and designed to allow contaminated stormwater and leachate to flow back into the active area and then be diverted to the leachate system. It was also outlined that the permanent sub-surface leachate drain had been constructed on the western batter and once the gas collection system had been installed, this area (and the northern batter) would be shaped and covered with permanent cover.

The eastern batter was inspected and it was noted that the south eastern section of Stage 3 had been seeded with grass and was draining to the perimeter stormwater drain. The silt trap and at the north eastern corner of Stage 3 was full of silt and needed attention.

The site supervisor undertook to prepare a map of the landfill area to clarify the landfill layout and drainage flow paths.

No issues were noted with either the large or small silt ponds. Litter control in these areas was good and no silt accumulation was noted. The leachate overflow pond was almost empty indicating that the pumps were keeping up with inflows, however it was noted that the collection area at the toe of the northern batter was quite full, indicating elevated levels of water in the filled areas.

The Puremu Stream was inspected and it was found to be running clean and clear with no effects noted. Both culvert grates were inspected and found to be free of debris.

Strong intermittent wafts of fresh refuse and landfill gas odours were apparent on the site, and a transitory ambient reading of 0.1 ppm hydrogen sulphide was noted on the western batter. No objectionable odours were noted at the boundary.

23 May 2017

The site was inspected in a gentle to moderate breeze and overcast conditions following a light early morning shower (less than 0.5 mm of rain). There had been 39 mm of rain recorded at the New Plymouth wastewater treatment plant in the week preceding the inspection, but no rainfall since the 20 May.

There was no overland stormwater flow at the time of sampling or inspection. There were only intermittent but noticeable landfill gas odours detected off site. Extensive heterotrophic growths were found within the consented mixing zone in the eastern Puremu Stream tributary, above and below sampling site PMU000109. Photos were taken. A sample collected confirmed the presence of an unknown fungus, but ruled out the presence of sewage fungus. These growths were not found to be present immediately below the large silt pond, in the western tributary or at the compliance point for discharges from the large silt pond (site PMU000113). NPDC was informed that, had this been found beyond the mix zone (at or below PMU000113), it would have been considered to be a significant adverse effect. NPDC were also advised that this was a recent phenomenon, as there were no heterotrophic growths found to be present in the Puremu Stream or in either of the tributaries at the biomonitoring survey carried out on 10 May 2017. It was noted that the small culvert at the track crossing over the eastern tributary was partially obstructed. The entrance to the culvert under the SPCA driveway was clear of obstructions.

At inspection it was found that the odour mitigation sprays were in operation, and the inspecting officer was advised that the system was set in a 20 minutes on/off cycle. There were issues with the dosing pump resulting in a reduced odorant dosing rate. Repairs had been undertaken, and a new pump had been ordered.

Litter at the site was being well controlled. The small silt ponds were in a satisfactory condition. The large silt pond was discoloured dark brown and the discharge was slightly yellow in colour, however there was no discolouration evident beyond the mix zone. The silt levels in the pond appeared to be low, but there was a build up of silt at the western end of the weir.

There was a minor accumulation of silt in the leachate pond and a fencepost was found in the outlet grate. An operator was dispatched to remove this at the time of inspection. The water levels in the leachate pond and drainage trench at the northern toe of the landfill were low. The inspecting officer was informed that works had just been completed on the outlet structure from the drainage trench that would allow the discharge pipe to the leachate pond pipe to be cleared if/when necessary.

It was found that there was relatively intensive strip grazing being undertaken on the cap of the closed areas of the landfill. This was causing the vegetative cover to be stripped and pugged. Areas of the cap were also boggy underfoot. Photos were taken.

At the Revital compost area it was found that more than 50 percent of the compost that had been observed previously had been removed from the site. The pad appeared to be quite muddy. The compost ponds were relatively full, but were not discharging at the time of the inspection.

The active filling area was compact and the area of exposed refuse appeared to be within the prescribed limits. There were stockpiles of dark brown, rich looking soils present on site that had been used as cover material over a relatively large area. The inspecting officer was advised by the operator that this was peaty material from a site on De Havilland Drive and was only being used within areas of the landfill where the stormwater drained to the leachate collection system.

There were no dust issues found at the site and only light intermittent landfill gas odours were detected on the eastern side of the site and at the big silt pond during the inspection.

The following action was to be undertaken:

- Ensure management and grazing of the cap of the closed landfill is appropriate to comply with all the special conditions of consent 2370-3, particularly the vegetative cover and stormwater drainage requirements;
- Clear the track culvert in the eastern Puremu Stream tributary. It is recommended that this be done with care due to the heterotrophic growths present in the tributary, which would be considered a significant adverse effect if found to be present beyond the mix zone;
- Remove accumulated silt from the weir of the big silt pond.

28 June 2017

The site was inspected in fine weather with a light to gentle south easterly breeze. There had been 18.5 mm of rain in the preceding week, with 1.5 mm of rain in the two days prior to inspection.

Ambient air monitoring was also undertaken. There were light and intermittent compost odours present at one off site location, however no landfill gas odours were noted. No hydrogen sulphide or methane were detected off site. The highest on site suspended particulate reading found was 0.42 mg/m³ on the main access road, downwind of a moving vehicle. The highest off site suspended particulate concentration recorded was 0.03 mg/m³, approximately half way along Colson Road (site AIR001612).

The condition of the receiving waters was checked. Heterotrophic growths were again found in the eastern tributary in the vicinity of site PMU000109. There were no such growths found in the western tributary or in the Puremu Stream. NPDC were asked to continue to monitor this, as should these growths be found beyond the mixing zone, it would be considered to be a breach of special condition 3 of consent 4619. It was found that the culvert in the eastern tributary had been cleared of debris.

There were areas of ponding, pugging, deep vehicle tracks and sparse vegetative cover on the cap of the closed areas of the landfill. Photographs were taken. NPDC were instructed to ensure that damage to the cap from farming activities is prevented, and cap integrity is maintained as per special condition 8 of consent 2370.

The compost area was busy, with mulching of stockpiled material occurring at the time of the inspection. It was noted that there was steam being emitted from some of the stock piles. Although there were strong compost odours noted at the downwind of the operation (at the southern litter fence) there were no offensive or objectionable odours found off site. The compost ponds were dark brown with a thin film on top. They were not discharging at the time of inspection.

There were four small special waste pits at the southern end of the landfill. Although there was a reasonable amount of cover applied to most parts of the pits, with the exception of what appeared to be the active pit, there were some small areas where more cover should be added.

There were leachate breakouts evident on the eastern side of the landfill. These were found to be occurring from relatively high levels at the southern end of the landfill. Drainage channels dug at the edge of the fill to carry the leachate breakouts to the leachate system had resulted in the liner being exposed and rips were observed in places over a 10 to 15 m stretch. There were some minor leachate breakouts up gradient of the holes in the liner. The consent holder was phoned at the time of inspection and the matter was also discussed with staff on site. The on site staff were advised to contact NPDC for technical advice on appropriate repair techniques as the patch(es) would need to be properly seamed/welded rather than just taped in place. This was recorded as an unauthorised incident on the Councils incident register and is discussed further in Section 2.8.1

Fugitive landfill gas emissions were observed bubbling through in some of the leachate breakout areas. Although there were some strong localised odours they reduced in intensity within a few meters of the discharge points.

It was found that the compactor had become stuck and staff were attempting to dig it out at the time of inspection. There was still refuse placement taking place in a different area, and the area that had been getting used for waste disposal when the compactor got stuck had been covered with sawdust as temporary/daily cover. There were only minor intermittent odours noted in this area and few, if any, seagulls present. Under the circumstances, this was considered to be an acceptable temporary means of covering the refuse.

The leachate pond was found to contain a lot of silt, to the point where the outlet grate was not visible. Site staff were advised of this at the time of inspection and undertook to investigate and address any potential blockages. There was a very large covered area on the western side of the landfill that looked to have the potential to be draining to the pond. It was recommended that this be investigated, and appropriate silt retention devices be put in place to prevent the volumes of silt causing issues with the leachate collection and disposal system.

There were minor landfill gas and compost odours present at the large silt pond and both the pond and the tributary below the pond had a dark brown appearance.

Litter control at the site was very good. It was noted that netting over, and plastic linings in, the stormwater drains were starting come away. This was documented not as a compliance issue, but was noted because if this control method was helpful, the contractor may want to undertake some maintenance on these.

The following action is to be undertaken:

- Ensure that the liner is appropriately repaired;
- Ensure that the grate in the leachate pond remains clear and that the effectiveness of the leachate collection and disposal system is not compromised by silt etc. Silt control measures are recommended to prevent silt entering the pond from the surface water runoff;
- As per special condition 8 of consent 2370 prevent damage to the cap from farming activities and maintain cap integrity;
- Please continue to monitor the receiving waters to ensure that the heterotrophic growths do not extend beyond the mixing zone;
- Continue the good work with litter control.

2.2 NPDC monitoring results

2.2.1 Leachate

The NPDC collected seven samples of leachate during the 2016-2017 monitoring period. Analyses were carried out for a range of parameters. The leachate is pumped to, and treated at the New Plymouth wastewater treatment plant. Whilst the leachate is not discharged directly to the environment, the results are used by the Council to compare with groundwater and surface water quality. The results are also of interest to the Council because the leachate can reveal information about the landfill processes taking place. The results of the analyses from the samples collected by the NPDC are presented in Table 3.

Table 3 Chemical analysis of Colson Road landfill leachate

Parameter	Unit	21-Jul-16	14-Aug-16	14-Oct-16	01-Dec-16	25-Jan-17	13-Apr-17	25-May-17
pH	pH	7.3	7.4	7.0	7.3	7.4	7.4	7.4
BOD	g/m ³	65	83	47	57	58	62	60
Suspended solids	g/m ³	41	31	118	10	24	28	31
Conductivity	mS/m	681	-	363.8	643	635	706	-
Alkalinity	g/m ³	2,661	3100	-	-	-	2880	2753
Ammoniacal N	g/m ³	530	320	280	510	540	470	-
Chromium	g/m ³	0.1	-	<0.1	<0.1	<0.1	0.11	<0.1
Copper	g/m ³	<0.02	<0.02	0.03	<0.02	<0.02	0.07	<0.2
Iron	g/m ³	8.5	12.5	10.1	8.7	16.0	9.24	12.0
Lead	g/m ³	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1
Manganese	g/m ³	1.50	1.50	1.09	1.42	1.34	-	2.00
Nickel	g/m ³	0.03	0.04	<0.03	0.04	0.03	0.04	0.04
Zinc	g/m ³	0.04	<0.04	0.05	<0.04	<0.04	0.08	0.06

The results gathered by NPDC during the year under review reflect typical leachate quality. As there are no obvious trends emerging at this stage, the concentration variations within each parameter are likely to reflect seasonal variations in leachate quality.

2.2.2 Under liner drainage

NPDC collected two samples of the groundwater that drains from a network of pipes under the liner. The results of the analyses are given in Table 4. The quality of this water is a useful indicator of whether leachate is passing through the liner. This is especially important in view of the slip that occurred in 2005 that ripped the liner in several places on the western side of Stage 3. The exposed rips were repaired but it was not known if the liner had ripped underneath the slipped refuse. There were also rips in the liner at the edge of the landfill footprint found in the June 2017 inspection. The rips were small, but in an open drainage channel that was capturing leachate breakouts from the south eastern area of the landfill. These were appropriately repaired early in July 2017.

On going drainage analysis has shown that little, if any, contamination has been occurring in the groundwater immediately below the liner, and the results from this monitoring period continue to show this.

The levels of key indicator species such as zinc and ammoniacal nitrogen remain comparable to background levels, and are relatively stable over time. Chloride and iron levels also remain within normal ranges for Taranaki groundwater

Monitoring during the 2016-2017 year indicates that there does not currently appear to be any potential issues in regards to faecal coliform levels, and that the unusually high faecal coliform result obtained on 18 March 2014 (3,460 cfu/100ml) was likely to have been as a result of sample contamination, rather than the start of an on going issue. Monitoring of the under liner groundwater will be continuing.

Table 4 Results of analysis of under liner drainage

Parameter	Unit	18-Aug-16	8-Feb-17	16-Jun-17
pH	pH	6.7	6.7	6.6
Carbonaceous biochemical oxygen demand	g/m ³	<2	<2	<2
Suspended solids	g/m ³	6	18	6
Faecal coliforms	/100ml	3	5	<3
Conductivity	mS/m	-	48.9	45.7
Turbidity	N.T.U.	40.0	58.0	67.0
Alkalinity	g/m ³	108	131	126
Ammoniacal nitrogen	g/m ³ -N	2.1	2.9	2.5
Cadmium	g/m ³	<0.02	<0.002	<0.02
Chromium	g/m ³	<0.1	<0.02	<0.1
Chloride	g/m ³	58.0	65.0	61.8
Copper	g/m ³	<0.02	<0.02	<0.02
Iron	g/m ³	5.4	7.0	5.9
Lead	g/m ³	<0.1	<0.03	<0.1
Manganese	g/m ³	1.50	2.30	2.27
Nickel	g/m ³	<0.03	<0.008	<0.03
Zinc	g/m ³	<0.04	<0.04	<0.04

2.3 Results of dry weather receiving environment monitoring

The Colson Road landfill site has two streams associated with it. The Puremu Stream has been culverted to run under the north-western quadrant of the landfill site. It emerges from the culvert near the landfill entrance driveway, and then flows approximately 300 m to a second culvert that takes it under two other properties. Just upstream of the second culvert, the unnamed tributary that carries discharge from the large settling pond, flows into the main stream stem. The smaller silt pond discharges directly into the main stream stem just upstream of the confluence (see Figure 5).

The Manganaha Stream follows alongside the eastern boundary of the site and is approximately 200 m away from the landfill (at its closest point). As required by the landfill's water discharge permits, there are no direct discharges into the Manganaha Stream from the landfill.

Tables 5-7 give the results of the dry weather freshwater sampling undertaken during the period under review. An aerial view of the sampling sites is given in Figure 2.

2.3.1 Manganaha Stream

On both sampling occasions the Manganaha Stream showed no adverse effects from the landfilling operation.

The upstream and downstream results showed very little difference in water quality on both sampling occasions. All results were comparable to background levels, and were similar to those found over the last five years.

Table 5 Chemical analysis of the Manganaha Stream

Parameter	Units	03-May 2017		23-May-2017	
		MNH000190 u/s of landfill	MNH000250 d/s of landfill	MNH000190 u/s of landfill	MNH000250 d/s of landfill
Alkalinity	g/m ³ – CaCO ₃	24	23	24	24
Conductivity	mS/m	13.2	13.3	13.1	13.1
Acid soluble iron	g/m ³	0.51	0.54	0.47	0.47
Ammonia (unionised)	g/m ³ -N	0.0003	0.00029	0.00013	0.00012
Ammoniacal nitrogen	g/m ³ -N	0.049	0.047	0.024	0.022
pH	pH	7.3	7.3	7.3	7.3
Suspended solids	g/m ³	4	5	4	5
Temperature	Deg C	14.3	14.2	12.8	12.8
Dissolved zinc	g/m ³	<0.005	<0.005	<0.005	<0.005

There are no specific consent conditions in regards to the Manganaha Stream water quality other than that authorised discharges to land, and to the Puremu Stream from the landfill shall not affect water quality in the Manganaha Stream.

Based on these results, and those from previous monitoring periods, the landfill's presence is having no measurable effect on water quality in the Manganaha Stream.

2.3.2 Puremu Stream

The Puremu Stream was also sampled on two occasions in dry weather under low to moderate flow conditions.

The downstream sampling sites shown in Figure 5 and the results are given in Tables 6 and 7.

Table 6 Chemical analysis of the Puremu Stream, sampled on 3 May 2017

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109 Trib d/s large silt pond	PMU000110 d/s landfill culvert	PMU000113 d/s SPCA drive culvert	Consent limits at PMU000113* (PMU000110**)
Alkalinity	g/m ³ CaCO ₃	23	100	42	46	NA
BOD	g/m ³	0.5	3.6	2.1	1.6	NA
Conductivity	mS/m	12.4	41.2	18.4	20.3	NA
Dissolved oxygen	g/m ³	9.41	4.57	9.09	8.99	≥ 8.41 (≥ 5.0)
DRP	g/m ³	0.003	0.014	<0.003	<0.003	NA
Faecal coliforms	cfu/100ml	390	4000	230	730	≤1,000
Unionised ammonia	g/m ³ N	0.0001	0.00886	0.00792	0.0078	NA

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109 Trib d/s large silt pond	PMU000110 d/s landfill culvert	PMU000113 d/s SPCA drive culvert	Consent limits at PMU000113* (PMU000110**)
Ammoniacal N	g/m ³ N	0.042	1.83	1.34	1.32	2 (2.5)
Nitrate/nitrite N	g/m ³ N	0.44	0.56	1.09	1.06	10 (100)
Oxygen saturation	%	91.2	44.2	87.2	86.2	NA
pH	pH	6.9	7.2	7.3	7.3	≥6.5 & ≤8.5
Sulphates	g/m ³	7.2	12.1	11.0	10.8	1,000 (500)
Suspended solids	g/m ³	2	8	<2	<2	12
Temperature	Deg C	13.9	14.0	13.6	13.6	(≤15.9)

Key: *Consent limits shown in brackets are for consent 2370-3 at site PMU000110.

** Consent limits with no brackets are for consent 4619 at site PMU000113

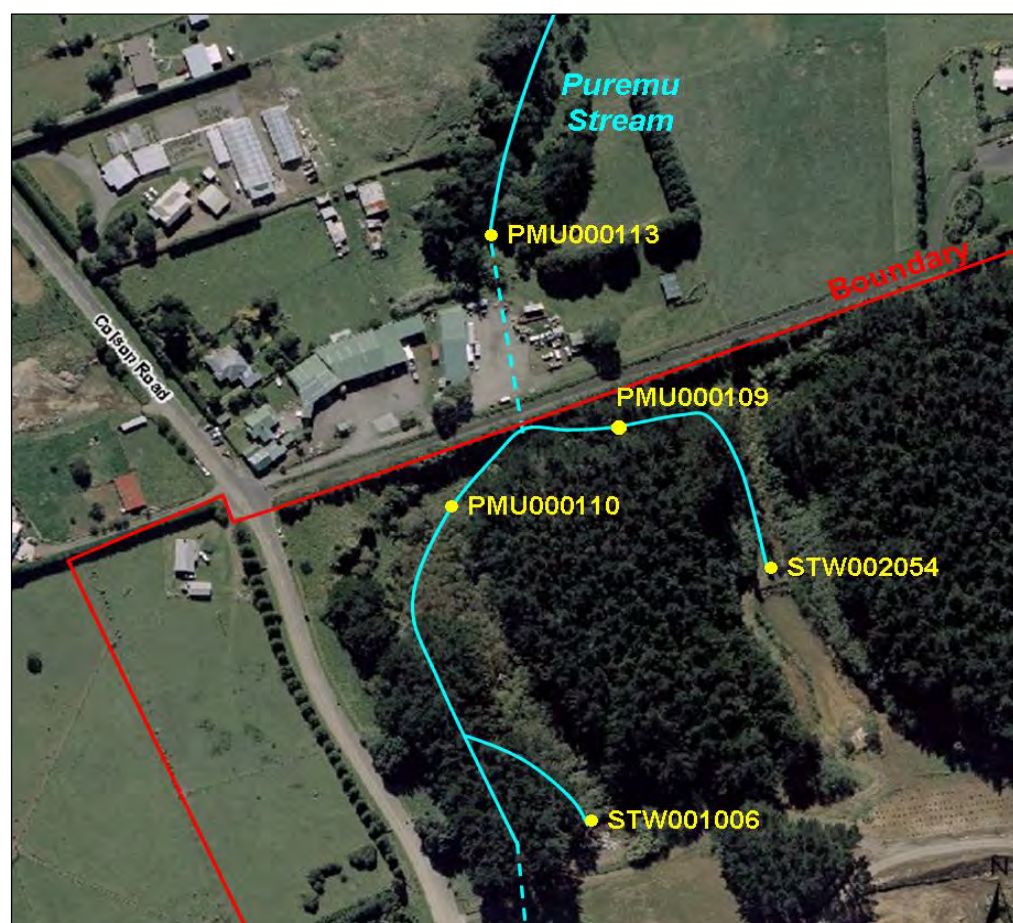


Figure 5 Sampling sites on the Puremu Stream down stream of the landfill

Table 7 Chemical analysis of the Puremu Stream, sampled on 23 May 2017

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109 Trib d/s large silt pond	PMU000110 d/s landfill culvert	PMU000113 d/s SPCA drive culvert	Consent limits at PMU000113* (PMU000110**)
Alkalinity	g/m ³ CaCO ₃	25	96	40	43	NA
BOD	g/m ³	<0.5	3.4	2.1	1.9	NA
Conductivity	mS/m	12.6	40.1	17.7	19.2	NA
Dissolved oxygen	g/m ³	9.91	5.03	9.83	9.81	≥8.91 (5.0)
DRP	g/m ³	<0.003	0.021	<0.003	<0.003	NA
Faecal coliforms	cfu/100ml	580	2400	200	250	≤1,000
Unionised ammonia	g/m ³ N	0.00008	0.00463	0.00524	0.0053	NA
Ammoniacal N	g/m ³ N	0.039	1.62	1.22	1.28	2 (2.5)
Nitrate/nitrite N	g/m ³ N	0.65	0.63	1.06	1.03	10 (100)
Oxygen saturation	%	90.1	46.7	91.3	90.2	NA
pH	pH	6.9	7.0	7.2	7.2	≥6.5 & ≤8.5
Sulphates	g/m ³	7.3	9.8	9.9	9.8	1,000 (500)
Suspended solids	g/m ³	2	8	4	<2	12
Temperature	Deg C	11.3	13.1	12.4	11.9	(≤13.3)

Key: *Consent limits shown in brackets are for consent 2370-3 at site PMU000110.

** Consent limits with no brackets are for consent 4619 at site PMU000113

The samples taken during the year under review complied with the consent conditions of both 2370 and 4619.

2.3.3 Dry weather metals analysis

Consents 2370 and 4619 have some differing limits on the concentrations of various metals at sites PMU000100 and PMU000113 respectively, with PMU000110 being the compliance point for consent 2370, and with PMU000113 being the compliance point for consent 4619.

In the consents, total recoverable metal limits are given as absolute concentrations that must not be exceeded, whereas the dissolved metal limits are given in terms of a maximum permitted increase relative to the upstream site.

In previous monitoring periods, as the limits for each are similar, and PMU000110 is only short way upstream of PMU000113, a metals screen was undertaken on site PMU000113 only, with site PMU000100 (upstream of the landfill) acting as a control.

During the 2013-2014 year, metals monitoring at sites PMU000110 and PMU000109 was introduced. The results of the dry weather metals monitoring are given in Tables 8 and 9.

Table 8 Results of metal analysis undertaken on 3 May 2017

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Dissolved aluminium	g/m ³	0.011	0.044	0.005	0.007	0.111
Total aluminium	g/m ³	0.033	0.22	0.06	0.034	5.0 (5.0)
Dissolved arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.05
Total arsenic	g/m ³	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.2 (0.1)
Dissolved beryllium	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	NA
Total beryllium	g/m ³	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.1 (0.1)
Dissolved boron	g/m ³	0.017	0.032	0.027	0.027	NA
Total boron	g/m ³	0.0179	0.035	0.028	0.027	5.0 (0.5)
Dissolved cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.001
Total cadmium	g/m ³	< 0.000053	< 0.000053	< 0.000053	< 0.000053	0.05 (0.01)
Dissolved cobalt	g/m ³	< 0.0002	0.002	0.0004	0.0005	NA
Total cobalt	g/m ³	< 0.00021	0.0023	0.00044	0.00058	1.0 (0.05)
Dissolved chromium	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.02

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Total chromium	g/m ³	0.00058	0.00057	< 0.00053	< 0.00053	1.0 (0.1)
Dissolved copper	g/m ³	0.0007	0.0031	0.0007	0.0009	0.0027
Total copper	g/m ³	0.00084	0.004	0.00088	0.00091	0.5 (0.2)
Dissolved iron	g/m ³	0.33	1.78	0.4	0.51	0.63
Total iron	g/m ³	0.69	3.4	0.87	1.06	10.0 (5.0)
Dissolved manganese	g/m ³	0.032	2.9	0.4	0.61	NA
Total manganese	g/m ³	0.039	2.8	0.4	0.6	5.0 (1.0)
Dissolved lead	g/m ³	< 0.00010	0.00036	< 0.00010	< 0.00010	0.002
Total lead	g/m ³	< 0.00011	0.00053	< 0.00011	< 0.00011	0.1 (0.1)
Dissolved selenium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.002
Total selenium	g/m ³	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.05 (0.02)
Dissolved vanadium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	NA
Total vanadium	g/m ³	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.1 (0.1)
Dissolved zinc	g/m ³	0.0024	0.0034	0.0017	0.0014	0.0324
Total zinc	g/m ³	0.0026	0.005	0.0019	0.0018	2.4 (2.0)

* The result of the dissolved fraction was greater than that of the total, but within the analytical variation of the methods

Table 9 Results of metal analysis undertaken on 23 May 2017

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Dissolved aluminium	g/m ³	0.009	0.051	0.004	0.007	0.109
Total aluminium	g/m ³	0.081	0.143	0.078	0.079	5.0 (5.0)

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Dissolved arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.05
Total arsenic	g/m ³	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.2 (0.1)
Dissolved beryllium	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	NA
Total beryllium	g/m ³	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.1 (0.1)
Dissolved boron	g/m ³	0.016	0.028	0.023	0.023	n/a
Total boron	g/m ³	0.0164	0.031	0.023	0.023	5.0 (0.5)
Dissolved cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.001
Total cadmium	g/m ³	< 0.000053	< 0.000053	< 0.000053	< 0.000053	0.05 (0.01)
Dissolved cobalt	g/m ³	< 0.0002	0.0017	0.0004	0.0004	NA
Total cobalt	g/m ³	0.00027	0.0022	0.00045	0.00059	1.0 (0.05)
Dissolved chromium	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.02
Total chromium	g/m ³	< 0.00053	0.00057	< 0.00053	< 0.00053	1.0 (0.1)
Dissolved copper	g/m ³	< 0.0005	0.0027	< 0.0005	0.0005	0.0025
Total copper	g/m ³	0.00071	0.0035	0.00072	0.00105	0.5 (0.2)
Dissolved iron	g/m ³	0.26	2.2	0.30	0.42	0.56
Total iron	g/m ³	0.71	3.60	1.00	1.05	10.0 (5.0)
Dissolved manganese	g/m ³	0.025	2.5	0.36	0.5	NA
Total manganese	g/m ³	0.049	2.6	0.37	0.53	5.0 (1.0)
Dissolved lead	g/m ³	< 0.00010	0.0005	< 0.00010	< 0.00010	0.002
Total lead	g/m ³	< 0.00011	0.00069	< 0.00011	0.00012	0.1 (0.1)
Dissolved selenium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.001

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Total selenium	g/m ³	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.05 (0.02)
Dissolved vanadium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	NA
Total vanadium	g/m ³	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.1 (0.1)
Dissolved zinc	g/m ³	0.0027	0.0038	0.0013	0.0016	0.0327
Total zinc	g/m ³	0.004	0.005	0.0015	0.0046	2.4 (2.0)

* The result of the dissolved fraction was greater than that of the total, but within the analytical variation of the methods

The results show that all parameters were in compliance with the conditions on consents 2370 and 4619 and that, although there were very slight increases in some of the metals determined, there were also a number of metals for which the concentrations decreased in a downstream direction. No increases of environmental significance were found between the site upstream and sites downstream of the landfill.

2.4 Result of stormwater and receiving environment monitoring

A survey was conducted during a rainfall event and the results are given in the tables below. Table 10 shows the results for discharges and receiving water into which the discharges from within the landfill catchment flow (Puremu Stream), whilst Table 11 shows the results for the Manganaha Stream, which lies adjacent the landfill site and has no surface water discharges from the landfill directed to it.

Table 10 Results of rain event monitoring – discharge and Puremu Stream samples, 23 August 2016

Site	Alkalinity g/m ³ CaCO ₃	Conductivity mS/m	Faecal Coliforms cfu/100ml	Unionised ammonia g/m ³ -N	Ammoniacal nitrogen g/m ³ -N	pH	Suspended solids g/m ³	Temp. Deg.C	Turbidity NTU
PMU000100	23	13.5	40	0.00003	0.018	6.9	<2	10.8	1.6
PMU000109	93	35.8	-	0.00076	0.372	6.9	7	11.6	19
PMU000110	44	20.5	-	0.00505	1.50	7.1	<2	12.2	3.7
PMU000113	47	21.6	350	0.00471	1.40	7.1	<2	12.2	4.4
STW001006	249	67.8	<2	0.02761	18.4	6.7	59	13.7	300
STW002054	126	46.8	2800	0.00763	1.52	7.3	8	11.4	32
IND003009	-	202	7300	0.2164	17.4	7.8	20	8.2	53

Key: Bold = Breach of conditions

() =consent condition limit (shown only if in exceedance)

Table 11 Results of rain event monitoring - Manganaha Stream, 23 August 2016

Parameter	Unit	MNH000190	MNH000250
Conductivity	mS/m	13.5	13.5
Unionised ammonia	g/m ³	0.00006	0.00014
Ammoniacal nitrogen	g/m ³ -N	0.015	0.029
pH	-	7.2	7.3
Suspended solids	g/m ³ -N	<2	<2
Temperature	Deg C	11.1	11.3
Turbidity	NTU	1.4	1.6

The Puremu Stream system receives discharges from two stormwater ponds on the site. STW001006 discharges stormwater and leachate from Stages one and two, and STW002054 discharges stormwater from the eastern forest of the site and the composting pad. STW002054 also receives leachate from Stage 3 in the event that the leachate pumping system is overloaded, or fails. It is noted that consent 4619 provides only for minor amounts of leachate to be present in this discharge.

The results show that during stormwater discharges, the site was complying with consent conditions in regards to all the water quality parameters in both the Puremu and Manganaha Streams.

At all the freshwater sites monitored the levels of ammonia, suspended solids and conductivity were within environmentally acceptable ranges, and indicated reasonable water quality during these surveys.

As stated earlier, the Manganaha Stream receives no direct discharges from the landfill catchment, but it is a useful indicator for any groundwater contamination, or potential effects from windblown refuse.

The results show that water quality in the stream is quite high and there is negligible difference in water quality when comparing the results from the two Manganaha Stream sites. These results are comparable to those obtained in previous monitoring periods.

2.5 Biological monitoring

2.5.1 Macroinvertebrate surveys

Two macroinvertebrate surveys were conducted during the year under review. Summaries of the surveys' findings are given below and a full copy of the reports can be found in Appendix II.

The sites sampled are described in Table 12 and their locations are shown in Figure 6.

Table 12 Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road landfill

Stream	Site No.	Site Code	Location	Sampling method	
				15-Feb-2017	10-May-2017
Puremu Stream	1	PMU000104	Upstream of the landfill	Sweep-sampling	Sweep-sampling
	2	PMU000110	400 m downstream landfill	Sweep-sampling	Kick-sweep
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 m upstream of the confluence with Puremu Stream	Sweep-sampling	Kick-sweep
Manganaha Stream	M4	MNH000190	10 m downstream of an unnamed tributary of the Manganaha Stream	Kick-sweep	Kick-sampling
	M6	MNH000260	500 m downstream of site M4	Sweep-sampling	Kick-sweep

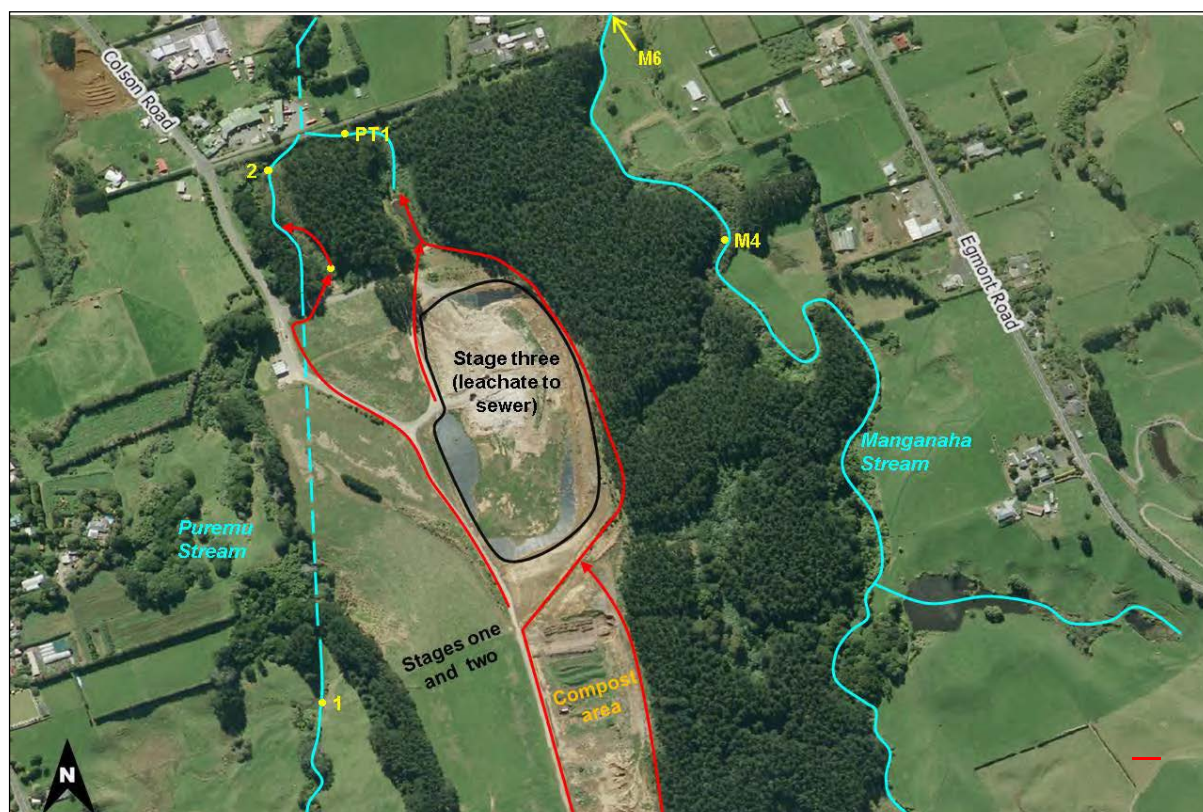


Figure 6 Biomonitoring sites related to the Colson Road landfill, New Plymouth

15 February 2017

The Council's standard 'sweep-sampling' technique was used at four sites (site 1, 2, PT1 and M6) and a combination of the 'sweep-sampling' and 'kick-sampling' techniques was used at one site (M4), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 15 February 2017. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to

environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This February 2017 macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was slightly higher than the median score for this site and slightly higher than that recorded by the previous survey. The SQMCI_s score was also above the median for the site and higher than that recorded by the previous survey. These results were indicative of 'poor' biological health and reflected a macrophyte associated community assemblage, which had been impacted by slow and low flows.

Site 2 in the Puremu Stream recorded a slightly higher MCI score but substantially lower SQMCI_s score, when compared with site 1, although both scores were not substantially different to the historical medians for the site. Site PT1 in the unnamed tributary also recorded a MCI score similar to the historical median, however the SQMCI_s score was substantially lower than the historical median for the site (by 1.1 units) and substantially lower than that recorded at site 2 (by 1.5 units) and indicated poor physicochemical water quality and/or habitat quality at this site. The iron oxide sediment recorded at the time of the survey is likely to have reduced the quality of the habitat at this site.

The upstream site on the Manganaha Stream recorded an MCI score similar to the historical median for the site, however the SQMCI_s score was substantially lower. These results reflected the higher proportion of 'sensitive' taxa in the macroinvertebrate community but the numerical dominance of two 'tolerant' in particular. These results were indicative of reasonable preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained an equal proportion of 'tolerant' and 'sensitive' taxa, which resulted in the MCI score of 89 units. This MCI score was slightly lower than that recorded at the upstream site, but indicated similar biological health to the upstream site. The SQMCI_s score recorded at site M6 was also similar to that recorded at site M4.

No undesirable biological growths were detected at any of these sites during this February 2017 survey.

Overall, the results of this February 2017 survey were indicative of 'poor' biological health in the Puremu Stream and in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of 'fair' biological health at sites M4 and M6. In summary, these results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.

10 May 2017

The Council's standard 'sweep-sampling' technique was used at one site (1), the 'kick-sampling' technique was used at one site (M4), and a combination of the 'sweep-sampling' and 'kick-sampling' techniques was used at three sites (2, PT1 and M6) to collect streambed macroinvertebrates from the Puremu and Manganaha Streams and unnamed tributary of the Puremu Stream on 10 May 2017. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This May 2017 macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was higher than the median score for this site and slightly higher than that recorded by the previous survey. The SQMCI_s score was also above the median for the site and higher than that recorded by the previous survey. These results were indicative of 'fair' biological health and were reflective of reasonable preceding water quality.

Site 2 in the Puremu Stream recorded substantially lower MCI and SQMCI_s scores, when compared with site 1, although scores were not substantially different to the historical medians for the site. Site PT1 in the unnamed tributary recorded a MCI score the same as that recorded at site 2 and similar to the historical median for the site. The SQMCI_s score however, was substantially lower than the historical median for the site (by 1.2 units) and equal with the lowest SQMCI_s score recorded by this site to date. It was also substantially lower than that recorded at sites 1 and 2 (by 3.2 units and 2.2 units respectively) and indicated poor physicochemical water quality and/or habitat quality at this site. The iron oxide sediment and high proportion of silt substrate recorded at the time of the survey is likely to have reduced the quality of the habitat at this site.

The upstream site on the Manganaha Stream recorded a MCI score slightly above the historical median for the site, however the SQMCI_s score was substantially lower. These results were indicative of reasonable preceding water quality. In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained an equal proportion of 'tolerant' and 'sensitive' taxa, which resulted in the MCI score of 83 units. This MCI score was an insignificant (Stark, 1998) 10 units lower than that recorded by the upstream site. However, the SQMCI_s score recorded at site M6 was substantially higher than that recorded at site M4. These differences are likely related to subtle differences in habitat between the two sites and potentially to the variation in sampling method used between the two sites.

No undesirable biological growths were detected at any of these sites during this May 2017 survey.

Overall, the results of this May 2017 survey were indicative of 'poor' to 'fair' biological health in the Puremu Stream and 'poor' biological health in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of 'fair' biological health at sites M4 and M6. In summary, these results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.

2.6 Groundwater

Groundwater was sampled from seven bores on 9 June 2017. The results of the analyses are given in Table 13.

Like the NPDC subsurface drainage samples (Table 4, Section 2.2.1), the groundwater results show little evidence of leachate contamination. Although all parameters measured for all the bores, were well within the ranges expected in Taranaki groundwater, there are some small changes in recent years, particularly in the chloride and nitrate/nitrite nitrogen concentrations, that may be indicative of newly emerging trends (Figure 7 and Figure 8).

Table 13 Chemical analysis of Colson Road landfill groundwater sampled 9 June 2017

Parameter	Unit	GND0573	GND0255	GND0575	GND251	GND0598	GND1300	GND1301
Alkalinity	g/m ³ CaCO ₃	25	35	59	44	157	30	83
Chloride	g/m ³	58.5	42.7	64.9	19.8	21.8	20.7	33.2
Filtered COD	g/m ³	<5	5	<5	<5	6	<5	<5
Conductivity	mS/m	24.3	21.5	32.4	14.7	33.2	14.0	28.3
Water level	m	4.66	10.784	7.947	12.683	10.193	12.906	8.106
Unionised ammonia	g/m ³ N	<0.00001	<0.00001	<0.00001	<0.00001	0.02359	<0.00001	0.00011
Ammoniacal N	g/m ³ N	<0.003	<0.003	0.007	0.011	1.23	<0.003	0.027
Nitrate/nitrite N	g/m ³ N	0.6	1.76	1.14	0.17	<0.01	1.63	2.71
Nitrite N	g/m ³ N	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
pH	pH	5.8	5.6	6.1	6.2	7.8	6.0	7.1
Sulphate	g/m ³	9.2	3.7	2.4	5.2	<1	8.2	8.1
Temperature	Deg C	15.3	15.1	14.7	14.6	14.1	14.9	14.7
Dissolved aluminium	g/m ³	< 0.003	0.015	0.014	0.017	< 0.003	0.029	< 0.003
Dissolved arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved beryllium	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved boron	g/m ³	0.023	0.023	0.018	0.014	0.056	0.019	0.022
Dissolved cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved cobalt	g/m ³	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002	< 0.0002
Dissolved chromium	g/m ³	< 0.0005	< 0.0005	0.0007	0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved copper	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0008	< 0.0005
Dissolved Iron	g/m ³	< 0.02	< 0.02	< 0.02	< 0.02	0.29	< 0.02	< 0.02
Dissolved lead	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved manganese	g/m ³	0.0018	0.022	0.0091	0.0038	0.072	0.0049	0.0151
Dissolved selenium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved vanadium	g/m ³	< 0.0010	< 0.0010	0.0052	0.0013	< 0.0010	< 0.0010	0.0079
Dissolved zinc	g/m ³	0.001	0.042	0.0129	0.004	0.0063	0.015	0.0069

Bore GND0598 shows some elevation in alkalinity, ammoniacal nitrogen, pH and dissolved iron when compared to the other bores. However, this bore is up gradient of the landfill in terms of groundwater flow, and the results are consistent with those obtained from the bore since 1996. The elevated levels of these parameters were therefore unlikely to be a result of leachate contamination.

The samples were also analysed for SVOC's (semi-volatile organic compounds) and none were found to be above detection levels. A copy of the SVOC results is appended to this report.

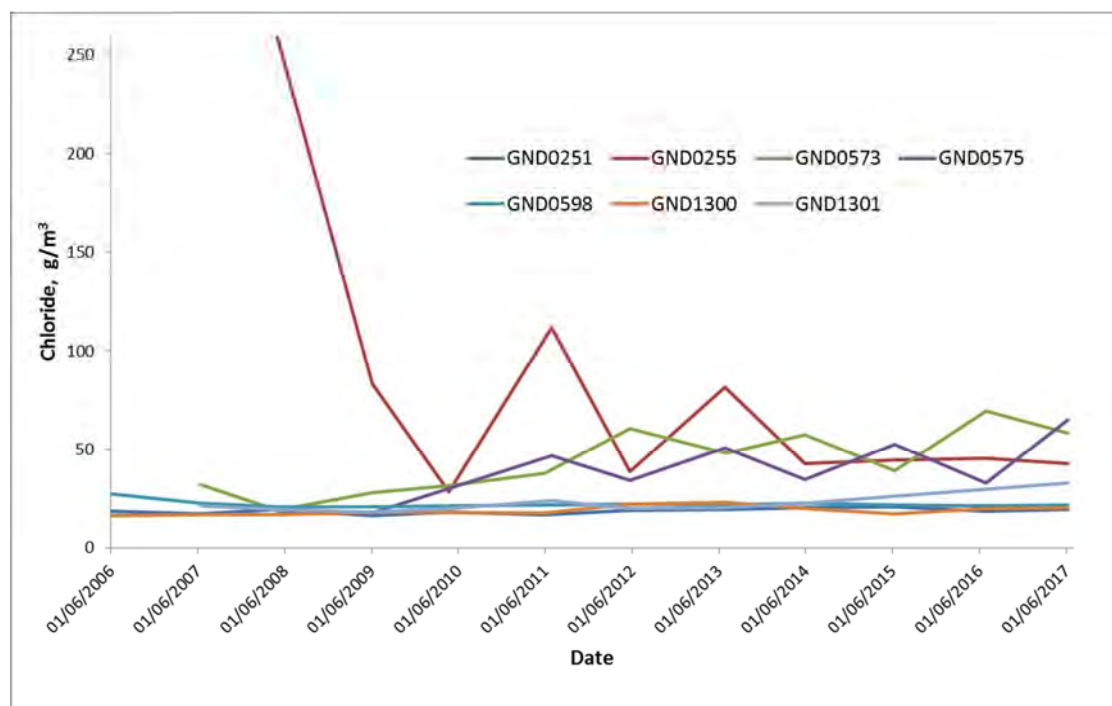


Figure 7 Chloride concentrations in the Colson Road groundwater bores, June 2006 to date

It can be seen that the chloride concentration in bore GND0255 (up gradient of the landfill) have been decreasing since the spike found in April 2008. Conversely, in bores GND0573, GND0575 (and to a lesser extent GND1301) although the changes are relatively small, it does appear that there may be an emerging trend of increasing chloride concentrations. These bores are down gradient of landfill stages two and three, and may be indicative of some minor leachate contamination.

Figure 8 shows that there may be an emerging trend of increasing nitrate/nitrite nitrogen concentrations in bores GND1300 (north east of the composing area and east of the southern end of the landfill) and GND1301 (north east of the landfill).

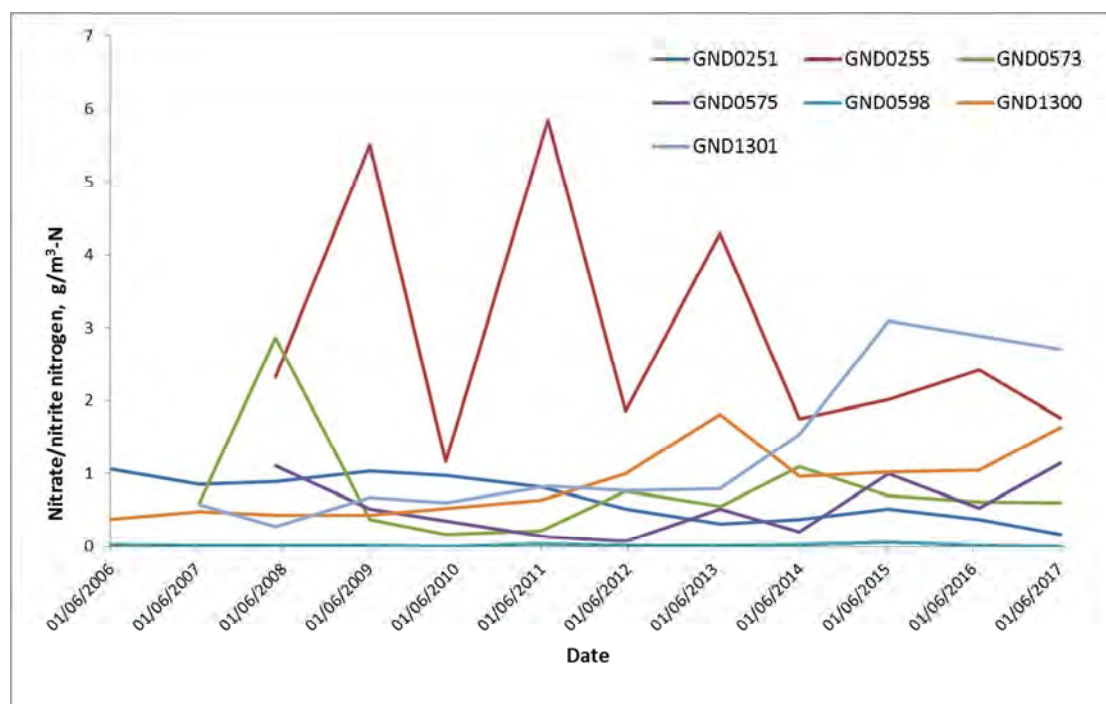


Figure 8 Nitrite/nitrite nitrogen concentrations in the Colson Road groundwater bores, June 2006 to date

In general terms, the groundwater quality in the vicinity of the landfill is good, and all parameters are comparable with typical Taranaki groundwater. The data gathered in this, and other monitoring periods, indicates that the Colson Road landfill is not having a significant adverse effect on groundwater quality.

2.7 Air

2.7.1 Results of receiving environment monitoring

2.7.1.1 Deposition gauging

Many industries emit dust from various sources during operational periods. In order to assess the effects of the emitted dust, industries have been monitored using deposition gauges.

Deposition gauges are basically buckets elevated on a stand to about 1.6 m. The buckets have a solution in them to ensure that any dust that settles out of the air is not re-suspended by wind.

Gauges are placed around the site and within the surrounding community. The gauges were left in place for a period of two weeks to a month, on two separate occasions.

The rate of dust fall is calculated by dividing the weight of insoluble material collected (g) by the cross-sectional area of the gauge (m^2) and the number of days over which the sample was collected. The units of measurement are g (grams)/ m^2 (metre²)/day.

Guideline values used by the Council for dust deposition are 4 g/ m^2 /30 days or 0.13 g/ m^2 /day deposited matter. Consideration is given to the location of the industry and the sensitivity of the surrounding community, when assessing results against these values.

Material from the gauges was analysed for solid particulates, the results of which are presented in Table 14 and Table 15.

Table 14 Air deposition monitoring results for 10 January- 30 January 2017

	Site	Days deployed	Particulate g/m ² /day
AIR001604	Adjacent to Manganaha Stream, behind rose nursery	20	0.17
AIR001608	124 Egmont Road, paddock boundary, west of house	20	0.14
AIR001622	At rear of RSPCA building	20	0.02
AIR001603	At entrance to landfill	20	0.17
AIR001613	Grass lawn, behind work shed	20	0.11
AIR001623	Behind 194 Egmont Road	20	0.04

Key: Bold = exceeded guideline value of 0.13 g/m²/day

The guideline value was exceeded at one on site location (AIR001603) and two off site locations during this survey. During this survey the prevailing wind directions were relatively strong and from the south west (48 percent of the time) and the west (19 percent of the time). The monitoring sites downwind of the main landfilling activities would have been AIR001604 and AIR001608. The samples collected from these locations were reported to be contaminated with organic matter, including pine needles, which is consistent with stronger winds carrying debris from the forestry area that lies between the landfill and the monitoring sites.

Site AIR001603 was not downwind of the landfilling activities, but as it is at the site entrance, dust generated by heavy vehicle movements may have contributed to the elevated result.

Table 15 Air deposition monitoring results for 7 February – 28 February 2017

	Site	Days deployed	Particulate g/m ² /day
AIR001604	Adjacent to Manganaha Stream, behind the rose nursery	21	0.09
AIR001608	124 Egmont Road, paddock boundary, west of the house	21	0.04
AIR001622	At rear of the RSPCA building	21	0.03
AIR001603	At entrance to the landfill	21	0.16
AIR001613	Grass lawn, behind the work shed	21	0.11
AIR001623	Behind 194 Egmont Road	21	0.07

Key: Bold = exceeded guideline value of 0.13 g/m²/day for residential areas

The gauge deployed at site AIR001603 also exceeded the guideline value during the February survey. This site was downwind of the landfill access road for 30 percent of the time. However, the winds were lighter during this survey, and this monitoring location is well within the landfill site's boundary, so the result is unlikely to represent non compliant off site effects.

2.7.1.2 Ambient suspended particulate and landfill gas component monitoring

Ambient monitoring of suspended particulates (dust) and landfill gas components was undertaken under dry weather conditions on three occasions during the year under review at seven monitoring locations on, and in the neighbourhood of, the landfill. However, due to equipment failure, suspended particulate results were obtained on only two of those occasions. The results are shown in Table 16, Table 17 and Table 18.

Particulates

Particulates can derive from many sources, including motor vehicles (especially diesels), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion and sea spray.

PM₁₀ particles (those of less than 10 µm in diameter) are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs. Health effects from inhaling PM₁₀ include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases. The national guideline for air quality (averaged over a 24 hr period) is 50 µg/m³ PM₁₀.

Suspended particulate (dust) monitoring was carried out under dry weather conditions on three occasions at seven monitoring locations on, and in the neighbourhood of, the landfill.

Landfill gas components

The landfill gas components monitored during the ambient surveys in the year under review were methane and hydrogen sulphide.

The monitoring showed that this guideline was only being exceeded at two monitoring locations, both during the June survey.

Table 16 Ambient PM10 and methane survey results 10 April 2017

Site	Methane (%LEL)	H ₂ S (ppm)	Dust µg/m ³
AIR001615	0	0	32
AIR001614	0	0	5
AIR0001609	0	0	8
AIR0001608	0	0	8
AIR0001603	0	0	28
AIR0001618	0	0	6
AIR0001610	0	0	4
Averages	0	0	13

Table 17 Ambient PM10 and methane survey results 5 May 2017

Site	Methane (%LEL)	H ₂ S (ppm)	Dust µg/m ³
AIR001609	0	0	2
AIR001608	0	0	-
AIR001603	0	0	-
AIR001618	0	0	-
AIR001610	0	0	-
AIR001616	0	0	-
AIR001614	0	0	-
Averages	0	0	-

Table 18 Ambient PM10 and methane survey results 28 June 2017

Site	Methane (%LEL)	H ₂ S (ppm)	Dust µg/m ³
AIR001614	0	0	11
AIR001612	0	0	30
AIR001611	0	0	11
AIR001610	0	0	419*
AIR001616	0	0	100*
AIR001613	0	0	10
AIR001603	0	0	15
Averages	0	0	85

* Passing vehicles noted

The instantaneous exceedances of the 24 hr average National Environmental Standard at sites AIR001610 and AIR001616 on 28 June 2017 were both inside the site boundary alongside the main access road through the landfill. It was noted that there were passing vehicles at the time the measurements were taken, therefore these results do not represent non-compliant off site effects.

2.8 Investigations, interventions, and incidents

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

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

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

In the 2016-2017 period, the Council was required to undertake significant additional investigations and interventions, or record incidents, in association with the NPDC's conditions in resource consents or provisions in Regional Plans.

In summary, during the period under review there was one incident recorded due to a breach of consent found at a routine compliance monitoring inspection and three odour complaints that were investigated by the Council. A summary of the investigations and findings in relation to each of the incident register entries is given in Table 19.

Table 19 Summary of incident register investigations during the period under review

Date and time of complaint	Incident notes	Date and time of investigation	Investigation details	Findings/ Outcomes
17 Feb 2017 10:30 PM	An odour complaint was received regarding the Colson Road Landfill, at Smart Road, Fitzroy.	17 Feb 2017 10:30 PM	In response to the complaint an odour survey was conducted in and around the area. The investigating officer found no odour at the complainant's property. Very light and very intermittent odours were found along Smart and Colson Roads. No objectionable and or offensive odour was detected. It was reported that the site was compliant at time of inspection.	Very light and intermittent odours only
18 Feb 2017 10:00 AM	An odour complaint regarding the Colson Road Landfill was received at Smart Road, Fitzroy.	18 Feb 2017 10:10 AM	Investigation found no odour at the complainant's property. Very light and very intermittent noticeable odours were found on site at the Colson Road landfill. It was found that the deodorisers were in operation. It was reported that the site was compliant at time of inspection.	No off site odours
09 May 2017 11:00 AM	A complaint was received regarding a chemical type smell at Princes Street, Fitzroy.	09 May 2017 11:00 AM	A complaint was received regarding odour in the Waiwhakaiho Valley. The investigation, undertaken during a period of fine still weather, initially detected odour near the intersection of Smart and Devon Roads. However, this quickly dissipated. Odour was again detected near the intersection of Devon and Katere Roads, however due to the shifting wind conditions this again quickly dissipated. No odour was detected for any period of time that allowed it to be fully assessed with regards to offensiveness. NPDC were asked to be aware that certain weather conditions were highly likely to result in objectionable odour being discharged beyond the boundary of the property, and to ensure that Abatement Notice EAC-20363 was being complied with at all times. In summary, the investigation found that odour was detectable intermittently, however the weather conditions were resulting in no constant odour being detected.	No offensive or objectionable odours found
28 Jun 2017 12:00 PM	During routine monitoring it was found that during the digging of a drain to control contaminated stormwater and leachate, the landfill liner had been damaged allowing leachate to discharge into soil under the liner, at Colson Road Landfill, New Plymouth.	28 Jun 2017 12:00 PM	Investigation found that although there had been damage to the liner, no contamination of the soil below the liner could be found. Monitoring of the water quality in the under liner drainage system will continue.	Consent non-compliance. The liner was repaired appropriately and letters of explanation were received and accepted.

2.8.1 Incidents found at inspection

28 June 2017

During routine monitoring it was found that during the digging of a drain to control contaminated stormwater and leachate, the landfill liner had been damaged allowing leachate to discharge into soil under the liner, at Colson Road Landfill, New Plymouth.

There were leachate breakouts evident on the eastern side of the landfill. These were found to occurring from relatively elevated levels at the southern end of the landfill. Drainage channels dug at the edge of the fill to carry the leachate breakouts to the leachate system had exposed the liner and it was found that it was ripped in places over a 10 to 15 m stretch. There were some minor leachate breakouts flowing through the drainage channel that originated up gradient of the holes in the liner. The consent holder was phoned at the time of inspection and the matter was also discussed with staff on site. The on site staff were advised to contact NPDC for technical advice on appropriate repair techniques as the patch(es) would need to be properly seamed/welded rather than just taped in place. Both NPDC and the contractor were asked to explain the circumstances around the incident and their proposed mitigation measures.

A follow up inspection was undertaken on 5 July 2017 in relation to the rips found in the liner at the routine compliance monitoring inspection undertaken on 28 June 2017. It was found that repairs were in progress at the time of the re-inspection. The area of the liner containing most of the rips had been cut out and operators were in the process of welding the new section in place. The inspecting officer was met on site by the contractor's Health Safety and Environmental (HSE) Manager. She advised that their investigations were continuing including looking at whether or not it was a historic issue or if it was possible that Warner's staff had caused the rips when the drain was dug out a month or so prior to the June inspection. Another small rip in the liner was found a little bit further south than the area currently being worked on (alongside the ninth litter fence pole from the southern end). There was also an area where it was not clear if the liner was intact and/or whether it extended past the edge of the leachate drain. Staff on site also alerted the Council officer to a small amount of refuse found under the liner in the channel that would have been excavated and back filled to anchor the liner at the time of the liner installation.

A further follow up inspection was undertaken on 7 July 2017. It was noted that, in order to carry out the repair work, the liner had been pulled back and the area excavated, exposing a trench about 0.5 m wide, approximately 4 m long and 1.1 m deep. All the rubbish that had been spotted beneath the liner on 5 July 2017 had been removed. It was noted that the trench appeared to run continuously around the perimeter of the outside of the landfill for the purpose of keying in the liner, i.e. the liner was terminated in the trench and then weighted down with soil. The trench was clearly visible as being in virgin ground. It was considered likely that the rubbish observed had been windblown at the time the liner was laid and just "kicked" into the trench as backfill. At the time of inspection there was no rubbish visible in this area of the trench and Warner's were advised that the excavation could be backfilled.

As a result of the investigations undertaken by NPDC and the contractor, the Council was advised that they would undertake the following actions in relation to this incident and to minimise the chance of a reoccurrence:

NPDC

- Sample the under liner as soon as possible to confirm there have been no adverse effects on the environment in recent weeks and continue with regular sampling and analysis on the under liner as planned;
- Install a leachate pipe as planned to drain the operational area which will cover the current exposed area; and

- Ensure inspection checklists carried out by the contractor include checking for any exposed liner.

Warner's

- Ensure the leachate liner is routinely captured and photographed during inspection
- Request a survey mark out of leachate drain and implement a 1.5 m exclusion zone for landfill work
- Inspection of leachate liner pre and post maintenance

NPDC was asked to include the procedural controls described above in the next update of the Landfill Management Plan.

2.8.2 Complaint investigations

The number of odour complaints received by Council had increased since the 2013-2014 year. Although no offensive or objectionable odours have been found off site, there were strong odours found on occasion during the 2014-2015 year, and noticeable odours found on occasion during the year 2015-2016. Localised offensive and objectionable odours were found on site during the year under review. An abatement notice, which was issued in September 2015 due to odour issues at the site and that requires NPDC to comply with the conditions of air discharge consent 4779, is still in force. During the year under review three odour complaints were received and investigated by the Council. At the time of investigation no offensive or objectionable odours were found off site and the complaints could not be substantiated. The abatement notice was complied with during the year under review.

The background to the odour issue, implementation of temporary mitigation measures and the progress towards a more permanent solution are discussed below.

A meeting was held in July 2014, at the Council offices, in order to determine why the odour was worse that winter. During these discussions it was outlined that, following the full and complete lining of Stage 3 during the 2013-2014 monitoring year, the volume of leachate and potentially contaminated stormwater had increased. It was also agreed that the leachate flow control valve was limiting the flow exiting Stage 3 causing fluids to back up in the landfill, which could potentially push out gas through and/or alongside the leachate lines. NPDC implemented interim mitigation measures during the 2014-2015 year, whilst engaging a consultant to provide advice on longer term solutions. Mitigation measures undertaken in the 2014-2015 year included:

- Installation of fixed deodorant sprayers, and automated spray system.
- Capping the lateral leachate lines.

Ensuring there was on going monitoring of any ponding in the landfill foot print to ensure this remained minimal.

An odour assessment report produced by Tonkin and Taylor after a site visit on 28 February 2015 was received by the Council on 2 June 2015. The report included the following recommendations with regard to actions to be undertaken to minimise the potential for effects:

- That a staged odour mitigation approach be adopted as per the following table, with the operational improvements to be implemented immediately and the following stages implemented as required, and
- that the odour suppressant in use be reviewed for effectiveness.

It was also noted that as the landfill was generating a significant volume of gas and does not have a capture system, reducing the permeability of the cap in one area would simply push the gas towards escaping in other areas. As odour issues typically arise from point source discharges it is beneficial to eliminate these and encourage disbursed discharge across the intermediate cap. Constructing a system to capture and

dispose of the gas is the ultimate solution, however this comes at significant cost. Tonkin and Taylor recommended undertaking stages one and two in Table 20, and if odour continued to be an issue, then the construction of a gas capture and disposal system prior to closure of the landfill may be required (their Stage 3 recommendation).

Table 20 Staged odour mitigation recommended by Tonkin and Taylor

Stage 1 (Immediately)	Operation improvements	<ul style="list-style-type: none"> Leachate pipe remediation – as required install reticulation or active recirculation to capture leachate breakouts Regular visual walkover inspections Improvements to fence-mounted odour neutralising sprays: Use odour neutralising sprays to target active filling area, particularly when daily cover is removed. Use mobile or fixed sprayers directed down or up wind of the area Review odour spray system product, pump sizing & pressure Improve the methodology for sludge disposal
Stage 2	Target hot spots	<ul style="list-style-type: none"> Cap remediation Target hot spots using odour sprays mobile or fixed sprayers

At inspection on 8 September 2015 (Section 2.1) it was found that there were objectionable odours present on site, and that there were point source discharges of landfill gases around the capped leachate lines. It was also confirmed that the daily cover requirements in the Colson Road Regional Landfill Management Plan (July 2013) were not being complied with. Compliance with the management plan is a requirement of condition 6 of consent 4779-1. One of the purposes of the daily cover given in the management plan is to control odour, and it also assists with limiting leachate generation. This non compliance with consent meant that odours were being discharged in a manner that was not expressly allowed by NPDC's air discharge consent, and an infringement notice was issued. An abatement notice was also issued requiring the NPDC to *"undertake works to ensure that all conditions of Resource Consent TRK994779 are complied with at all times"*. The reasons given for the issuing of the abatement notice were that the site was visit by a Council Enforcement Officer on 8 September 2015 and it was found that:

- The active landfill area was not being covered on a daily basis
- Fugitive odorous gases were being emitted into the air from numerous locations onsite, without proper treatment prior to discharge
- Liquid waste had been dumped into the special waste area

NPDC continued to work towards implementing the Tonkin and Taylor recommendations and achieving compliance with the management plan and consent 4779-1 during the period under review. In addition to correspondence, a number of meetings were held between the Council and NPDC (16 September 2015, 28 October 2015, 29 March 2016 and 30 May 2016) to set out the expectations of Council and to track the progress of the improvements and investigations being undertaken at the site.

During the 2015-2016 year:

- Reticulation was improved to capture leachate breakouts and mitigate associated landfill gas venting
- Regular visual walkover inspections were implemented by the operator

- NPDC engaged a Consultant to focus outstanding work such as updating the site management plan, project managing the further work to mitigate the point source discharges from the protruding leachate lines, following up on final cover being applied to areas that are at final level and reviewing operational issues to feed into future versions of the management plan
- Improvements were made to the fence mounted odour mitigating sprayers and the system was upgraded so that it could be automated
- Trials of alternative spray on daily cover materials were carried out
- A trial biofilter was installed on one of the protruding leachate lines
- The volume and pressure of the landfill gas present in the leachate system was investigated
- A preliminary design report was completed for the collection and treatment of landfill gas that could be extracted from the leachate lines and directed to either a biofilter or flare
- Data was gathered to allow the special waste disposal practices to be reviewed, with wastes with less than 20 % solids no longer being accepted after 31 July 2015 as per the site management plan
- Daily cover practices were improved, with the new contractor opting to trial large metal covers that could be lifted on to compacted refuse at the end of one working day and lifted off at the start of the next
- Intermediate cover was applied to all but a relatively small area that was to be completed as and when weather permitted

At the end of the 2015-2016 year a decision was made that the landfill gas would be collected (initially) from the leachate lines on the western side of the landfill and would be directed to a flare. The effectiveness of this would be monitored and reviewed, with the collection system to be expanded if required.

During the year under review, the detailed designs were drawn up, the air discharge consent was changed to allow for the burning of the captured landfill gas, and the contracts were awarded for the installation of the gas capture system and flare. It was expected that the flare would be installed in October 2017, however, due to the wet weather conditions experienced in the region it is possible that this may be delayed.

2.9 Management and reporting

2.9.1 Landfill management and contingency plans

Daily operations at the site are governed by the requirements contained in the Colson Road Regional Landfill Management Plan, which the consents require is updated at not less than yearly intervals.

A contingency plan is also required for the site by special condition 7 of consent 6177-1.

The management plan was updated by NPDC in February 2018, whilst the contingency plan in effect during the year under review was issued in July 2013.

2.9.2 Colson Road Landfill Liaison Committee

A liaison committee comprising representatives of NPDC, Taranaki Regional Council, landfill contractor, and neighbours of the landfill was set up in 1999 as required by condition 32 of the land use consent for Colson Road. The purpose of the committee is to facilitate the airing of concerns of the neighbours to the landfill and to ensure that the landfill's neighbours are kept abreast of the development of the landfill site.

It is also a requirement of condition 8 of consent 4779 that the consent holder, staff of the Council, submitters to the application and any other party (at the Council's discretion) meet at least once per year. The liaison committee meetings also fulfil this consent requirement.

During the period under review, the committee met on 11 October 2016 and 14 February 2017. This periodicity of meetings was agreed by all parties. The meetings covered site development progresses, operations at the landfill, and future activities. It is also an opportunity for submitters and neighbours to be kept informed of any issues arising at the site, and mitigation measures NPDC is putting in place. Attendees of the meeting agree that they are worthwhile and provide useful feedback to NPDC.

The Colson Road landfill liaison committee has been very successful to date and will continue in its present format for the 2017-2018 monitoring period.

2.9.3 Independent consultant's reports

Site inspections were undertaken by WAI Environmental (independent consultants) on 6 October 2016, 16 February 2017 and 1 June 2017.

6 October 2016

It was reported that the first impression was of a neat and tidy operation by an operator who is paying attention to detail. There was almost no free litter on the site and that which could be seen was firmly stapled by the machinery operated or collected manually. The independent consultant considered that the contractor should be commended for the attention he has already taken to ensure a litter free environment.

In particular, the report of the 6 October 2016 visit noted that:

- The promised work to relocate the farm gate between two paddocks on Stage 2 had still not been done. The soil was wet and muddy.
- The frequency of spraying from the deodorising system seemed to be regular and frequent, and it appeared that the volume of spray had been optimised. Odour was still detected on the landfill itself although the occurrence of this was infrequent and minor.
- The damaged storm pond weir had been repaired and the discharge was now more evenly spread across the weir.
- The contractor has invested heavily in cover technology to protect the working face at the end of the day.
- At the time of the visit (in the middle of the day) it was estimated that the area of exposed refuse was no more than 750 m². The working face was fully compliant with the Management Plan.
- A much smaller number of birds was evident, which may be one of the benefits of a tidy site.
- Capital Works for Stage 3 are complete although some additional work was now being contemplated to address landfill gas to control an odour issue.

On this occasion the condition of the landfill is high quality. This is the second time the Consultant had been able to report a high quality of workmanship. Whilst the regular inspection and reporting regime may be effectual in maintaining standards there is no doubt it is the contractor's efforts that achieve the greatest effect. In summary, the main matters for continued vigilance were:

- Maintenance of working face under 900 m² and continued attention to compaction.
- Ongoing litter collection.

16 February 2017

The report of the 16 February 2017 inspection noted that:

- The promised work to relocate the farm gate between two paddocks had been done. The gate had been moved closer to the road and the fence repaired. The soil had been replaced and the cover to the landfill had been replenished.
- At the silt pond it was noticed how low the pond level was and therefore how much silt there was in it. It was noted that that was probably a very good time to clean out the silt build up in order to maintain its efficacy.
- The landfill working face was within that allowed by the Management Plan.
- Special waste such as asbestos which must be double wrapped was directed to an adjacent area that appeared to be well controlled. However, it was evident that asbestos had been accepted with inadequate wrapping and the discharge had not been satisfactory. This waste should not have been accepted in this condition, and was addressed with the contractor by NPDC shortly after the visit.
- A number of leachate breakouts were observed on the sloping sides of the landfill. These had been collected in a small drain to the side and controlled.

On this occasion the condition of the landfill is of a high quality. This was the third time the consultant had been able to report a high quality of workmanship. In summary the main matters for continued vigilance were:

- Maintenance of working face under 900 m² and continued attention to compaction;
- Attention to asbestos wrapping;
- Attention to dust control; and
- Ongoing litter collection.

1 June 2017

The report of the 1 June 2017 inspection noted that:

- The area of exposed refuse was estimated to be no more than 900 m². The working face was fully compliant with the Management Plan.
- A number of leachate breakouts were observed on the sloping sides of the landfill. These have been collected in a small drain to the side and controlled. The consultant also noticed a number of places where gas could be seen bubbling out of the ground around the edges of the filled area.

The condition of the landfill was yet again of a high quality. This was the fourth time in a row that the consultant had been able to report a high quality of workmanship. In summary the main matters for continued vigilance were:

- Maintenance of working face under 900 m² and continued attention to compaction;
- Ongoing litter collection.

2.9.4 Composting

In the past concerns have been raised about whether the material in each windrow had a plant derived matter content of at least 95 % as required by consent conditions. These concerns were mostly directed at the acceptance of stock bedding which is a mixture of hay (or wood chips) and manure. To address this the Council clarified plant derived matter as being any plant derived material that has only been exposed to external degradation processes (and has not been partially or wholly ingested by any type of animal). This

definition includes green waste, shredded green waste, humate, untreated woodchip/shavings, the plant derived component of animal litter (such as hay and wood shavings), and old existing compost stored on the site. This definition does not include paunch grass, or animal manure. It is however Council's position, that poultry, goat and horse manure are acceptable constituents of the 5 % non-plant derived proportion of the windrows.

Changes occurred to the composting operations during the 2014-2015 year, due to a change in the contractor employed by Envirowaste, who is the operator of the transfer station.

The main compost operator on site changed to Revital, with the previous operator moving to a hard stand area to the south of the main composting area.

It was noted that the amount of green waste processing occurring in the main area had reduced significantly initially, but soon increased to above the volumes managed by the previous operator towards the end of that year. The volumes of green waste composted at the site remained high during the period under review. There was little, if any, non-plant derived matter contained in the green waste received at the site. One of the older compost windrows from material accepted at the site during the 2014-2015 year contained visible non-plant derived matter, but this was estimated to be less than the 5 % permitted by the consent.

It was noted that the compost produced by the new operator was coarser than the previous operator, and therefore may be less prone to leachate generation. However it was found that there was an increased volume of traffic movements over the pad during the year under review that churned up the ground. This may have resulted in increased leachate production from the nutrient rich site surface.

In summary, findings during the year under review were that, based on estimates at inspection, it appeared that the condition relating to the acceptable percentage of non-plant derived material was being complied with throughout the monitoring period. It was also considered that the stormwater from the composting areas was being managed such that compliance with the conditions of the stormwater discharge consents for the landfill were not being compromised by the composting activities.

3 Discussion

3.1 Site performance

Significant improvements were observed in the management of the site during the year under review. The main notable areas of improvement were:

- The cessation of acceptance of the more liquid special wastes;
- The draining and filling of the large ponded area below the previous contractor's special waste pit
- The working face being kept consistently within the 900 m² requirement contained in the management plan;
- Good daily cover enabled predominantly through the improved control over the working face area and the introduction of large rubber edged metal cover panels by the new contractor;
- Improved litter control;
- The cleaning of the leachate lines to try to improve drainage from within the landfill.

NPDC continued to progress towards the installation of a system that will collect landfill gas emissions from the leachate lines on the western side of the landfill. This system will be directed to an enclosed flare that is intended to achieve a minimum 95 % destruction rate, and it is expected that this will become operational in the 2017-2018 year. The proposal also allows for the staged addition of additional collection points, if required.

The contractors responsiveness to ensuring leachate breakouts were contained and silt movements into the drains, along with the prevailing wet weather conditions has resulted in the liner becoming exposed at times, generally at the edges of the landfill footprint. At the final monitoring inspection during the year under review it was found that there were exposed rips present in the liner at the eastern edge of the landfill footprint. Appropriate measures were undertaken to both repair the liner and to prevent a re-occurrence.

During the year under review it was found that leachate breakouts and fugitive landfill gas emissions had extended to the higher, southern end of the landfill indicating that there is a large volume of leachate within the landfill. This increases the load on the liner, and may increase the potential for leachate leaks. Although the under liner drainage result provided by NPDC show that there is currently little, if any, contamination occurring at the present time, improved management of the leachate and contaminated stormwater to reduce the volume of leachate within the landfill is desirable.

An on-going minor issue relating to the use of the leased area on the Stage 2 landfill cap, resulting in minor damage to the cap, is an aspect of site performance where improvement is required. It is not considered that this was likely to have resulted in any significant environmental effects, however the early signs of erosion were initially raised in the 2014-2015 year. Although, during the year under review remedial work was undertaken, cap damage found to have continued due to the stock management practices and agricultural vehicles used by the farmer leasing the area.

Council inspections found that the composting areas were well managed with no dust or odour issues reported relating to these activities. Dust control at the landfill was also adequate to ensure that there were no resultant off site effects.

Although, at times, high levels of landfill gases were found on site, along with very strong or objectionable odours, these were relatively localised. No offensive or objectionable odours were found off site at any of the routine compliance monitoring inspections or during the investigation of the three odour complaints received by the Council.

3.2 Environmental effects of exercise of consents

There were no significant adverse effects found in the Puremu Stream during the period under review. The parameter concentration limits at both of the Puremu Stream compliance points were met at the time of the three sampling surveys. Extensive heterotrophic growths were found within the mixing zone in the eastern Puremu Stream tributary at the time of the May and June inspections. NPDC were told to ensure that this does not extend beyond the mixing zone as it would constitute a significant adverse effect.

The Manganaha Stream was found not to be measurably affected by discharges from the landfill, and no direct discharges were found to this waterbody during the year under review.

Biomonitoring found that there were no indications of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road landfill at the time of either survey.

Groundwater sampling found that the groundwater in the vicinity of the site was such that no remedial actions, as contained in special condition 5 of consent 4621-1, were required. Groundwater quality remains satisfactory and there is no evidence of significant contamination either in the groundwater or in the under-liner drainage system, however there may be emerging trends of increasing chloride and/or nitrate/nitrite nitrogen in some of the bores.

With exception of four results, all ambient deposited particulate levels obtained were below the Council guideline level for dust deposition in residential areas ($0.13 \text{ g/m}^2/\text{day}$). Two of the results came from a gauge within the site boundary and the other two contained vegetation, which would have contributed to the elevated result. Therefore, based on the results of the deposition gauge surveys undertaken during the period under review, it is unlikely that landfill is causing off site dust deposition levels that exceed the guideline. Suspended particulate readings also indicate that the site is complying with National Environmental Standard for PM_{10} . There were no dust related complaints received by Council during the year under review.

Although three odour complaints were received during the year under review, there were no offensive or objectionable odours found at the time of investigation. On each occasion there were only light and intermittent odours found.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 21 to Table 29.

Table 21 Summary of performance for diversion consent 0226-1

Purpose: To divert the Puremu Stream in the Waiwhakaiho Catchment by culverting stream to provide road access to refuse tip		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Comply with Water Right 226	Site inspections	Yes
2. Pipe laid in accordance with manufacturer's specifications	Site inspection	Yes
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 22 Summary of performance for contaminated stormwater and leachate consent 2370-3

Purpose: To discharge up to 1000 m³/day [5 L/s] of leachate and contaminated stormwater from the closed section, Area A, of Colson Road municipal landfill to groundwater in the vicinity of and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practice to be adopted	Site inspection	Cap damaged from agricultural activities
2. Consent undertaken in accordance with information supplied in the application	Site inspection and review of documentation on file	Yes
3. Discharge not alter colour, clarity or pH of Puremu Stream	Site inspection and water sampling	Yes
4. No significant adverse effects on aquatic life	Site inspection, sampling and biomonitoring	Yes
5. Monitor surface water on/near the site	Undertaken by the Council via site specific monitoring programme, inspections and water sampling	Yes
6. Satisfy all requirements of the District Plan of the New Plymouth District Council	N/A	N/A
7. Management and site contingency plan	Site inspection and review of documentation on file	Grazing not being managed as per the management plan (version 9 section 7.2)

Purpose: To discharge up to 1000 m³/day [5 L/s] of leachate and contaminated stormwater from the closed section, Area A, of Colson Road municipal landfill to groundwater in the vicinity of and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment

Condition requirement	Means of monitoring during period under review	Compliance achieved?
8. Maintain a landfill capping barrier and vegetative cover	Site inspection (Stages 1 & 2)	Pugging, rutting and areas of sparse vegetation
9. Area is closed and managed in accordance with the management plan	Site inspection and review of documentation on file	As per condition 7
10. Maintain drains, ponds and contours on site to minimise unwanted water movement and ponding on site	Site inspections	Area of erosion allowing ponding
11. No cleaning or hosing out of refuse vehicles on site	Site inspections	Yes
12. The mixing zone extends downstream from the culvert outlet to 2 m above the confluence between the Puremu Stream and its tributary	N/A	N/A
13. Discharge shall not alter the Puremu Stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0°C	Site inspection and water sampling	Yes
14. Discharge shall not alter the water quality of the Puremu Stream below the given criteria	Site inspection and water sampling	Yes
15. Discharge shall not reduce the concentration of dissolved oxygen below 5 mg/litre	Site inspection and water sampling	Yes
16. Discharge shall not render the Puremu Stream unfit for stock consumption	Site inspection and water sampling	Yes
17. Satisfactorily maintain and manage the leachate collection and treatment systems	Site inspection	Yes
18. Optional review provision re environmental effects	Next opportunity for review June 2020	N/A

Purpose: To discharge up to 1000 m³/day [5 L/s] of leachate and contaminated stormwater from the closed section, Area A, of Colson Road municipal landfill to groundwater in the vicinity of and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of environmental performance and compliance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		Improvement required

N/A = not applicable

Table 23 Summary of performance for Consent 4619-1 treated stormwater and leachate discharge

Purpose: To discharge up to 675 L/s of treated stormwater and minor amounts of leachate from areas B1 B2 C1 and C2 of the Colson Road Landfill to groundwater in the vicinity of and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Water quality in the Manganaha Stream shall not be changed	Site inspection and water sampling	Yes
2. Water quality of the Puremu Stream shall not exceed the given criteria	Site inspection and water sampling	Yes
3. Discharge shall not alter the Puremu Stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0°C	Site inspection and water sampling. Heterotrophic growths found, but were within mixing zone only	Yes
4. Operate according to the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or subsequent versions with no less environmental protection. Plan to be updated at not greater than yearly intervals	Site inspection and review of documentation on file. Plan on file dated February 2017	Yes
5. Maintain and comply with a monitoring programme	Not assessed during period under review	N/A
6. Consent will lapse after six years if not exercised	N/A, consent exercised	N/A
7. Optional review provision re environmental effects	Next opportunity for review June 2018	N/A

Purpose: To discharge up to 675 L/s of treated stormwater and minor amounts of leachate from areas B1 B2 C1 and C2 of the Colson Road Landfill to groundwater in the vicinity of and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of environmental performance and compliance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 24 Summary of performance for uncontaminated stormwater consent 4620-1

Purpose: To discharge up to 675 L/s of uncontaminated stormwater from areas B1 B2 C1 and C2 of the Colson Road landfill into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Water quality in the Manganaha Stream shall not be altered	Inspections and water sampling	Yes
2. Discharge to have pH 6.5-8.5, maximum suspended solids 100 g/m ³ , and maximum ammoniacal nitrogen 0.5 g/m ³ as nitrogen	Inspections and water sampling	Not able to assess as discharge is mixed with that of consent 4619
3. No leachate discharge	Sampling and inspection	Yes
4. Channels shall minimise erosion	Site inspections	Yes
5. Channels shall minimise instability of the surrounding land	Site inspections	Yes
6. Repair land eroded/made unstable due to construction/maintenance	Site inspections	Yes
7. Notification of any proposal which may affect areas contributing runoff	Site inspections and liaison with consent holder	Yes
8. Discharge shall not alter the Puremu Stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0°C	Site inspections and water sampling	Yes

Purpose: To discharge up to 675 L/s of uncontaminated stormwater from areas B1 B2 C1 and C2 of the Colson Road landfill into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
9. No excavation or landfilling if any runoff to Manganaha Stream will contain suspended solids or any other contaminant	Site inspection and water sampling	Yes
10. Operate according to the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or subsequent versions with no less environmental protection. Plan to be updated at not greater than yearly intervals	Site inspection and review of documentation on file. Plan on file dated February 2017	Yes
11. Maintain and comply with a monitoring programme	Not assessed during period under review	N/A
12. Consent will lapse after six years if not exercised	N/A, consent has been exercised	N/A
13. Optional review provision re environmental effects	Next opportunity for review June 2018	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 25 Summary of performance for discharge to land consent 4621-1

Purpose: To discharge up to 500 tonnes/day of contaminants onto and into land in areas B1, C1 and C2 at the Colson Road landfill		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Install and maintain groundwater monitoring piezometers	Site inspection and liaison with consent holder	Yes
2. Prevent surface runoff into the Manganaha Stream from any area used or previously used for the deposition of refuse	Site inspection and water sampling	Yes
3. All drainage channels, bunds and contouring is complete prior to use	N/A	N/A

Purpose: To discharge up to 500 tonnes/day of contaminants onto and into land in areas B1, C1 and C2 at the Colson Road landfill		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
4. Civil works relating to construction of Stage 3 be certified by a registered engineer prior to use	N/A	N/A
5. Mitigate if adverse effects on groundwater	Sampling. No mitigation required	N/A
6. Maintain and comply with a monitoring programme	Not assessed during period under review	N/A
7. Operate according to the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or subsequent versions with no less environmental protection. Plan to be updated at not greater than yearly intervals	Site inspection and review of documentation on file. Plan on file dated February 2017	Yes
8. Disposal of waste shall comply with the 'criteria for calculating landfill potentials' and the 'Draft Health and Environment Guidelines for selected Timber Treatment Chemicals'	Not assessed during period under review	N/A
9. Consent will lapse after six years if not exercised	N/A, consent exercised	N/A
10. Optional review provision re environmental effects	Next opportunity for review June 2018	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 26 Summary of performance for composting air consent 4622-1

Purpose: To discharge emissions into the air from composting and ancillary activities at the Colson Road landfill		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Minimise adverse effects on the environment	Site inspection and liaison with consent holder	Yes
2. No offensive odours	Air surveys	Yes

Purpose: To discharge emissions into the air from composting and ancillary activities at the Colson Road landfill		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. No adverse ecological effects on any ecosystem	Site inspection, sampling, and neighbourhood surveys	Yes
4. Materials accepted for composting comply with the 'Assessment of Discharges to Air' July 1994 and the New Plymouth District Council Colson Road Landfill Management Plan July 1994	Site inspection	Yes
5. All composting to occur at least 300 m from any dwelling existing as of 21 March 1999	Site inspections	Yes
6. Composting piles must consist of no less than 95% plant-derived material	Site inspections and visual assessment	Yes – as best as could be estimated
7. Composting to occur on a trial basis until the consent is approved or reviewed on receipt of a full report	N/A	N/A
8. Consent will lapse after six years if not exercised	N/A, consent has been exercised	N/A
9. Optional review provision re environmental effects	Next opportunity for review in June 2018	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 27 Summary of performance for air discharge consent 4779-1 (to 23 January 2017)

Purpose: To discharge contaminants into the air from the existing landfill [Area A] and proposed landfill extension in areas A B1 B2 C1 and C2 of the Colson Road Municipal Landfill Site, New Plymouth		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option (BPO) to prevent or minimise adverse effects on the environment	Site inspection, air surveys, complaint response	BPO not implemented re: minimising odours
2. No offensive odours or dust or noxious concentrations	Site inspection, air surveys, complaint response	Yes
3. No burning on site	Site inspection, complaint response	Yes

Purpose: To discharge contaminants into the air from the existing landfill [Area A] and proposed landfill extension in areas A B1 B2 C1 and C2 of the Colson Road Municipal Landfill Site, New Plymouth		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
4. No adverse ecological effects on any ecosystem	Inspections of site and neighbouring areas	Yes
5. No venting untreated landfill gases within 200 m of any boundary	Not assessed during period under review	N/A
6. Comply with 'Air Discharge Consent Application Supporting Documentation' and according to the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994, or subsequent versions with no less environmental protection. Plan to be updated at not greater than yearly intervals	Site inspection and review of documentation on file. Plan on file dated February 2017	Yes
7. Council approval to be sought in the event of alterations at the site or to site operations	Site inspections and liaison with consent holder and site operator	Yes
8. Meet once a year to discuss any matter relating to the consent	Landfill liaison committee meetings	Yes
9. Provide a report within a year on the collection, extraction, venting and combustion of landfill gas	Review of documentation on file. Compliance previously achieved, as report had been received	Yes
10. Optional review provision re environmental effects	Next opportunity for review in June 2018	NA
11. Optional review provision re collection, extraction, venting and combustion of landfill gas	Next opportunity for review in June 2018	NA
Overall assessment of environmental performance and compliance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		Good

N/A = Not applicable

Table 28 Summary of performance for air discharge consent 4779-1 (from 24 January 2017)

Purpose: To discharge contaminants into the air associated with operation of the municipal landfill at Colson Road, New Plymouth		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Provision of temperature and feedstock composition data within three months of landfill gas flare operation commencing and annually thereafter	Site inspection, liaison with consent holder and review of documentation on file. Flare not operating during the year under review. Expected installation date approximately October 2017	N/A
2. Provision of as built plans and suppliers operating instructions within three months of operation of the flare	As above, not yet required	N/A
3. First revision of the Landfill Management plan following the installation of the flare is to include specified aspects of the flares operation, monitoring, maintenance and record keeping	As above, not yet required	N/A
4. Best practicable option (BPO) to prevent or minimise adverse effects on the environment	Site inspection, air surveys, complaint response	BPO not implemented re: minimising odours. Awaiting installation of landfill gas flare and reduction of leachate volume in the fill
5. No offensive odours or dust or noxious concentrations	Site inspection, air surveys, complaint response	Yes
6. No burning on site with the exception of the flare	Site inspection, complaint response	Yes
7. No adverse ecological effects on any ecosystem	Inspections of site and neighbouring areas	Yes
8. No venting untreated landfill gases within 200 m of any boundary	Site inspection	Yes

Purpose: To discharge contaminants into the air associated with operation of the municipal landfill at Colson Road, New Plymouth		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
9. Comply with 'Air Discharge Consent Application Supporting Documentation' and according to the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994, or subsequent versions with no less environmental protection. Plan to be updated at not greater than yearly intervals	Site inspection and review of documentation on file. Plan on file dated February 2017	Yes
10. Council approval to be sought in the event of alterations at the site or to site operations	Site inspections and liaison with consent holder and site operator	Yes
11. Meet once a year to discuss any matter relating to the consent	Landfill liaison committee meetings	Yes
12. Provide a report within a year on the collection, extraction, venting and combustion of landfill gas	Review of documentation on file. Compliance previously achieved, as report had been received	Yes
13. Optional review provision re environmental effects	Next opportunity for review in June 2018	NA
14. Additional optional review provision re collection, extraction, venting and monitoring of combustion of landfill gas within six months of the installation of any landfill gas treatment system	Additional review opportunity is within six months of installation of the landfill gas collection and treatment system	NA
Overall assessment of environmental performance and compliance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		Good

N/A = Not applicable

Table 29 Summary of performance for earthworks stormwater consent 6177-1

Purpose: <i>To discharge stormwater [due to earthworks in providing an area for Stage 3 of the municipal landfill] onto land and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharge quality within specified parameters	Site inspection and sampling	Not able to assess as discharge is mixed with that of consent 4619
2. No leachate discharged	Site inspection	Yes
3. Maintenance of drains to prevent erosion and sedimentation	Site inspections	Yes
4. No conspicuous effect on clarity or colour of receiving waters	Site inspection and sampling	Yes
5. No significant effect on aquatic life	Site inspection, sampling and biomonitoring	Yes
6. Monitoring to satisfaction of the Council	Site inspection, sampling and data review	Yes
7. Preparation and maintenance of a management plan	Review of Council records and liaison with consent holder	Plans previously provided
8. Sediment and erosion management plan	Not assessed during year under review	Plans previously provided
9. Adopt best practice	Site inspection and liaison with content holder	Yes
10. Rehabilitation of disturbed areas	Site inspection	Yes
11. Maintain stormwater system to prevent ponding and overland flow	Site inspection	Yes
12. Receiving waters not adversely affected	Site inspection, sampling and biomonitoring	Yes
13. Provision for review	No further review opportunities prior to consent expiry	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High High
Overall assessment of administrative performance in respect of this consent		

N/A = Not applicable

Overall, NPDC demonstrated a good level of environmental performance and administrative compliance with the resource consents. During the year under review there were fugitive odorous gases being emitted into the air from numerous locations onsite, without proper treatment prior to discharge, which had the

potential to cause significant adverse effects. However, no substantiated odour complaints were found, and NPDC are working towards the installation of a landfill gas flare to address the issue.

3.4 Recommendation from the 2015-2016 Annual Report

The 2015-2016 Annual Report recommended:

1. THAT monitoring of discharges from the Colson Road regional landfill in the 2016-2017 period monitoring continues at the same level as in 2015-2016.

This recommendation was implemented.

3.5 Alterations to monitoring programmes for 2017-2018

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

- the extent of information made available by previous authorities;
- its relevance under the RMA;
- its obligations to monitor emissions/discharges and effects under the RMA; and
- to report 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 emitting to the atmosphere/discharging to the environment.

It is proposed that for 2017-2018, the programme initially remains unchanged, but is reviewed following the installation of the landfill gas flare.

3.6 Exercise of optional review of consents

Resource consent **4619-1** provides for an optional review of the consent in June 2018. Condition 7 allows the Council to review the consent, if there are grounds, for the purpose of dealing with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

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

Resource consent **4620-1** provides for an optional review of the consent in June 2018. Condition 13 allows the Council to review the consent, if there are grounds, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

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

Resource consent **4621-1** provides for an optional review of the consent in June 2018. Condition 10 allows the Council to review the consent, if there are grounds, for the purpose of dealing with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

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

Resource consent **4622-1** provides for an optional review of the consent in June 2018. Condition 9 allows the Council to review the consent, if there are grounds, for the purpose of dealing with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

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

Resource consent **4779-1.1** provides for an optional review of the consent in June 2018. Condition 13 allows the Council to review the consent, if there are grounds, for the purpose of dealing with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Additionally, condition 14 allows the Council to review the consent:

- a. within six months of receipt of the report required by condition 12 and/or
- b. during June 2001, June 2003, June 2006, June 2012 and/or June 2018; and/or
- c. within the 6 months following the installation of any landfill gas collection and treatment at the site;

For the purpose of:

- I. considering the options of collecting, extracting, venting or combusting landfill gas; and/or
- II. monitoring landfill gas combustion and its effects.

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

4 Recommendations

1. THAT monitoring of discharges from the Colson Road regional landfill in the 2017-2018 period monitoring initially continues at the same level as in 2016-2017, but that it be reviewed following the installation of the landfill gas flare.
2. THAT the option for a review of resource consents 4619-1, 4620-1, 4621-1, and 4779-1.1 in June 2018, as set out in conditions 7, 13, 10, 9, and 13 and 14 of the respective consents, not be exercised, as there are no grounds that require a review to be pursued at this time.

Glossary of common terms and abbreviations

The following abbreviations and terms that may have been used within this report:

Al*	Aluminium.
As*	Arsenic.
Biomonitoring	Assessing the health of the environment using aquatic organisms
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
<i>E.coli</i>	<i>Escherichia coli</i> , an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample.
F	Fluoride.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
HDPE	High density polyethylene.
L/s	Litres per second.
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.
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.
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.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point
Moxie	A large earthmoving truck.
NH ₄	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH ₃	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO ₃	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
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.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM ₁₀	Relatively fine airborne particles (less than 10 micrometre diameter).
ppm	Parts per million on a volume/volume basis.
resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	Resource Management Act 1991 and subsequent amendments.
SS	Suspended solids.
Temp	Temperature, measured in °C (degrees Celsius).

Turb	Turbidity, expressed in NTU.
UI	Unauthorised incident.
Zn*	Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

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

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Appendix I

Resource consents held by NPDC for Colson Road landfill

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

TRK750226

WATER PERMIT

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

Name of: NEW PLYMOUTH DISTRICT COUNCIL
Consent Holder: PRIVATE BAG 2025 NEW PLYMOUTH

Change to
Conditions Date: 8 October 1986

CONDITIONS OF CONSENT

Consent Granted: TO DIVERT THE PUREMU STREAM A TRIBUTARY OF THE
MANGAONE STREAM IN THE WAIWHAKAIHO CATCHMENT
BY CULVERTING THE STREAM TO PROVIDE ROAD ACCESS
TO THE REFUSE TIP AT OR ABOUT GR: P19:070-380

Expiry Date: 1 October 2026 [as per section 386(2) of the Resource Management Act 1991]
[originally granted 2 April 1975 under the Water and Soil Conservation Act 1967 'at the pleasure of the
Commission']

Site Location: COLSON ROAD NEW PLYMOUTH

Legal Description: SEC 223 HUA DIST BK VI PARITUTU SD

Catchment: WAIWHAKAIHO 392.000

Tributary: MANGAONE 392.010
PUREMU 392.012

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

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Conditions of right

- (a) The Commission may prescribe the method of management of this right, including the limitation of periods during which the right may be fully exercised, if a water shortage or other abnormal circumstances occur in the locality.
- (b) This right may be operated only by the person holding the right or his agent and only for the purpose stated in the right.
- (c) The right may, with the consent of the Commission in writing, be transferred to a new owner or occupier of the property to which the right relates, but only on the same conditions as contained in this right.
- (d) The conditions relating to this right cannot be varied without the prior consent in writing of the Commission.
- (e) This right is not a guarantee that the quantity and quality of water specified will be available.
- (f) Unless specifically authorised by this right the discharge of water or waste containing pollutants into natural water is not permitted.
- (g) This right is not an authority to obtain access to a source of water or a point of discharge.
- (h) The grantee of the right shall keep such records as may reasonably be required by the Commission and shall if so requested supply this information to the Commission.
- (i) This right may be cancelled by the Commission, or Commission may take such other action as the Act provides, if the right is not exercised within 12 months of its granting or such longer time as the Commission may approve.
- (j) This right may be cancelled by the Commission if in the opinion of the Commission it is not diligently and beneficially exercised.
- (k) This right is granted subject to the Commission or its servants or agents being permitted access at all reasonable times for the purpose of carrying out inspections and measurements.
- (l) The design and maintenance of any works relating to the right must be to a standard adequate to meet the conditions of the right so that neither the works nor the exercise of the right is likely to cause damage to any property or injury to any person.
- (m) Should the grantee in the opinion of the Commission commit any breach of the right or its conditions the Commission may cancel the right.
- (n) This right is granted, subject to the Commission retaining the right to review the terms and conditions attached hereto including the period of the right at intervals of not less than five [5] years.
- (o) This right will expire upon the date shown overleaf or upon 14 days notice, whichever comes sooner.
- (p) The cost of supervision of this right, including water sampling deemed necessary by the Commission shall be carried by the grantee.
- (q) The final drawings of the culvert are to be submitted to the Commission for approval before work is commenced.

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VARIATION OF 14 MAY 1986:

Additional General Conditions

- (a)The grantee shall provide to the Manager, Taranaki Catchment Commission, on request plans, specifications and maintenance programmes of works associated with the exercise of this right, showing that the conditions of this right are able to be met.
- (b)The standards, techniques and frequency of monitoring of this right shall be to the specific approval of the Manager, Taranaki Catchment Commission.
- (c)The actual and reasonable cost of administration supervision and monitoring of this right, deemed necessary by the Manager, Taranaki Catchment Commission, shall be met by the grantee.
- (d)This right may be cancelled in writing to the grantee by the Commission if the right is not exercised within twelve months of the date of grant of such longer time as the Manager, Taranaki Catchment Commission, may approve.
- (e)This right may be terminated by the Commission upon not less than six months notice in writing to the grantee if, in the opinion of the Commission, the public interest so requires, but without prejudice to the grantee to apply for a further right in respect of the same matter.

Additional Special Conditions

- 1)The terms and conditions pertaining to Water Right 226 shall apply.
- 2)[**Note: Condition 2 was subsequently deleted as per variation of 8 October 1986.**]
- 3)The new 900 mm pipe shall be laid in accordance with the manufacturers specifications.

VARIATION OF 8 OCTOBER 1986:

Deletion of special condition 2.

Signed at Stratford on 8 October 1986

For and on behalf of
TARANAKI REGIONAL COUNCIL

OPERATIONS MANAGER

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

Review Completed 20 July 2004 [Granted: 19 March 2003]
Date:

Conditions of Consent

Consent Granted: To discharge up to 1000 cubic metres/day [5 litres/second]
of leachate and contaminated stormwater from the closed
section, Area A, of Colson Road municipal landfill to
groundwater in the vicinity of and into the Puremu Stream
a tributary of the Mangaone Stream in the Waiwhakaiho
catchment at or about GR: P19:074-372

Expiry Date: 1 June 2026

Review Date(s): June 2004, June 2006, June 2008, June 2014, June 2020

Site Location: Colson Road Landfill, Colson Road, New Plymouth

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Mangaone
Puremu

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. 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 exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 87/228, 92/205 and 1664. In the case of any contradiction between the documentation submitted in support of applications 87/228, 92/205 and 1664 and the conditions of this consent, the conditions of this consent shall prevail.
- 3. Any discharge shall not alter to a conspicuous extent the natural colour, clarity or pH of the receiving water, nor shall it contain visible oil or grease, nor shall it emit objectionable odours, nor shall it increase the temperature of the Puremu Stream by more than 2.0°C.
- 4. There shall be no significant adverse impact upon natural aquatic life downstream of the landfill as a result of the exercise of this consent.
- 5. Monitoring of surface waters and groundwater on or in the vicinity of the site shall be undertaken to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 6. The consent holder shall satisfy all relevant requirements, obligations and duties of the Proposed District Plan of the New Plymouth District Council.
- 7. The consent holder shall prepare, maintain and comply with a site management plan to the approval of the Chief Executive, Taranaki Regional Council.
- 8. The consent holder shall maintain an adequate landfill capping barrier and vegetative cover on the site to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 9. The consent holder shall ensure that the area to which this consent is attributed is closed and subsequently managed in accordance with the Colson Road Regional Landfill Management Plan provided June 2004 or as subsequently amended provided that subsequent amendments do not reduce the level of environmental protection set out in the June 2004 plan.

10. The consent holder shall maintain stormwater drains, sediment detention ponds, and/or ground contours at the site, in order to minimise stormwater movement across, or ponding on the site.
11. The consent holder shall ensure that there shall be no cleaning or hosing out of refuse-containing vehicles at the site.
12. The mixing zone in each condition of this consent shall extend for a distance downstream of the point of the culvert outlet of the Puremu Stream to 2 metres above the confluence of the unnamed tributary of the Puremu Stream and the Puremu Stream at the site's legal boundary.
13. After allowing for reasonable mixing the consent holder shall ensure that the discharge shall not give rise to any of the following effects in the receiving waters of the Puremu Stream:
 - a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
 - b) any conspicuous change in colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
 - f) an increase in the temperature of the Puremu Stream by more than 2.0° Celsius
14. The discharge shall not be shown to reduce the quality of the Puremu Stream at or beyond the mixing zone below the following criteria:

constituent	maximum concentration or level
aluminium	5.0 mg/l
arsenic	0.1 mg/l
beryllium	0.1 mg/l
boron	0.5 mg/l
cadmium	0.01 mg/l
chromium	0.1 mg/l
cobalt	0.05 mg/l
copper	0.2 mg/l
fluoride	1.0 mg/l
iron	5.0 mg/l
lead	0.1 mg/l
manganese	1.0 mg/l
nitrate + nitrite (NO ₃ -N + NO ₂ -N)	100 mg/l
nitrite -N	5.0 mg/l
selenium	0.02 mg/l
vanadium	0.1 mg/l
zinc	2.0 mg/l
ammoniacal nitrogen	2.5 mg/l
pH	6.5 - 8.5
sulphate	500 mg/l

Note: levels of trace metals expressed as total recoverable metals

15. The discharge shall not be shown to reduce the concentration of dissolved oxygen in the Puremu Stream below 5 mg/litre, beyond the mixing zone specified in special condition 12 above.
16. The discharge shall not, in the opinion of the Chief Executive, Taranaki Regional Council, contain substances or constituents other than those listed in condition 14, nor pathogenic organisms, which would render the water of the Puremu Stream, beyond the mixing zone specified in condition 12 above, unpalatable or unfit for stock consumption purposes.
17. The maintenance, management and operation of the leachate and collection and treatment systems shall be to the satisfaction of the Chief Executive, Taranaki Regional Council, to ensure that the conditions attached to this consent can be met.
18. 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 2004 and/or June 2006 and/or June 2008 and/or 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 20 July 2004

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TRK994619

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: 21 March 1999

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO A MAXIMUM OF 675 LITRES/SECOND
OF TREATED STORMWATER AND MINOR AMOUNTS OF
LEACHATE FROM AREAS B1, B2, C1 AND C2 OF THE
COLSON ROAD LANDFILL TO GROUNDWATER IN THE
VICINITY OF AND INTO THE PUREMU STREAM A
TRIBUTARY OF THE MANGAONE STREAM IN THE
WAIWHAKAIHO CATCHMENT AT OR ABOUT GR:
P19:074-372

Expiry Date: 1 June 2025

Review Date[s]: June 2006, June 2012, June 2018 and/or within six months of the
first exercise of this consent

Site Location: COLSON ROAD LANDFILL, COLSON ROAD, NEW
PLYMOUTH

Legal Description: SEC 223 HUA DIST BLK VI PARITUTU SD

Catchment: WAIWHAKAIHO 392.000

Tributary: MANGAONE 392.010
PUREMU 392.012

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 General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. THAT the water quality in the Manganaha Stream above its confluence with the Mangaone Stream shall not be changed as a result of this discharge.
2. THAT the exercise of this consent shall not cause the water quality of the Puremu Stream at the northern boundary of the site to exceed the following criteria:

Component	Criteria
pH	range within 6.5-8.5
Dissolved oxygen	maximum reduction of 1.0 gm^{-3} in the upstream dissolved oxygen concentration
Ammoniacal nitrogen	2.0 gm^{-3} for pH below 7.75 1.3 gm^{-3} for pH between 7.75-8.00 1.0 gm^{-3} for pH between 8.00-8.50
Nitrate	10 gm^{-3} as nitrogen
Nitrite	0.06 gm^{-3} as nitrogen
Faecal coliforms	1000/100 mL
Sulphate	1000 gm^{-3}
Oil and grease	10 gm^{-3}
Suspended solids maximum permitted increase in instream concentration	
[dry weather conditions]	10 gm^{-3}
[wet weather conditions]	10%
of upstream concentration	

	Maximum instream concentration Total Recoverable Metals gm⁻³	Maximum permitted increase in concentration Filtered Metals gm⁻³
Aluminium	5.0	0.1
Arsenic	0.2	0.05
Beryllium	0.1	n/a
Boron	5.0	n/a
Cadmium	0.05	0.001
Chromium	1.0	0.02
Cobalt	1.0	n/a
Copper	0.5	0.002
Iron	10.0	0.3
Lead	0.1	0.002
Manganese	5.0	n/a
Selenium	0.05	0.001
Vanadium	0.1	n/a
Zinc	2.4	0.03

3. THAT the discharge authorised by this consent, in conjunction with the exercise of any other consent associated with the landfill property, shall not give rise to any of the following effects in the Puremu Stream at the northern boundary of the site:
 - a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials [other than storm debris and suspended solids as permitted under condition 2 above];
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
4. THAT this consent shall be exercised in a manner conforming with the relevant requirements of the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan 1994', or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
5. THAT the consent holder shall provide, maintain and comply with a monitoring programme, to the satisfaction of the General Manager, Taranaki Regional Council, setting out details of monitoring to be carried out and containing guidelines for the determination of whether contamination is occurring, the initial plan to be provided at least three months prior to the exercise of this consent.
6. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional

TRK994619

Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.

7. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent, to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

GENERAL MANAGER

TRK994620

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: 21 March 1999

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO 675 LITRES/SECOND OF UNCONTAMINATED STORMWATER FROM AREAS B1 B2 C1 AND C2 OF THE COLSON ROAD LANDFILL INTO THE PUREMU STREAM A TRIBUTARY OF THE MANGAONE STREAM IN THE WAIWHAKAIHO CATCHMENT AT OR ABOUT GR: P19:074-372

Expiry Date: 1 June 2025

Review Date[s]: June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent

Site Location: COLSON ROAD LANDFILL, COLSON ROAD, NEW PLYMOUTH

Legal Description: SEC 223 HUA DIST BLK VI PARITUTU SD

Catchment: WAIWHAKAIHO 392.000

Tributary: MANGAONE 392.010
PUREMU 392.012

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

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General conditions

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

- 1. THAT the water quality in the Manganaha Stream above its confluence with the Mangaone Stream shall not be changed as a result of this discharge.
- 2. THAT the water quality of uncontaminated stormwater discharged to the Puremu Stream shall meet the following criteria:

pH	6.5-8.5
suspended solids	maximum concentration of 100 gm ⁻³
ammoniacal nitrogen	maximum concentration of 0.5 gm ⁻³ as nitrogen
- 3. THAT no leachate discharge shall be permitted by the exercise of this consent.
- 4. THAT all stormwater diversion and containment channels shall be designed, constructed and maintained so as to prevent or minimise erosion of the channel in all circumstances.
- 5. THAT the earthworks and construction associated with the landfill and the composting site and the stormwater diversion and containment channels shall be designed, constructed and maintained so as to minimise instability of the surrounding land.
- 6. THAT the consent holder shall repair and rehabilitate any land made unstable and any erosion occurring due to the construction or maintenance of the diversion channels or landfilling operations or composting site associated with the exercise of this consent.
- 7. THAT the consent holder shall notify the General Manager, Taranaki Regional Council, of any proposal which may alter or affect the areas contributing runoff insofar as may affect the exercise of this consent, other than as advised to the Taranaki Regional Council in the application for this consent, at least two months prior to commencing any such works. The consent holder shall obtain any necessary approvals under the Resource Management Act 1991 prior to commencing any such works.

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8. THAT the discharge authorised by this consent, in conjunction with the exercise of any other consent associated with the landfill property, shall not give rise to any of the following effects in the Puremu Stream at the northern boundary of the site:
 - a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials [other than storm debris and suspended solids as permitted under condition 2 above];
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life, including but not limited to, freshwater fish, eels and watercress.
9. THAT there shall be no excavation or earthworks or other landfilling-related activities or composting activities in any area if any runoff of water containing suspended solids or any other contaminant arising from such activities might by reason of land topography or engineered works enter the Manganaha Stream, and in the event of any runoff water entering the Manganaha Stream contrary to this consent the consent holder shall immediately undertake such works as may be necessary to cease the discharge and to prevent a recurrence.
10. THAT this consent shall be exercised in a manner conforming with the relevant requirements of the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
11. THAT the consent holder shall provide, maintain and comply with a monitoring programme, to the satisfaction of the General Manager, Taranaki Regional Council, setting out details of monitoring to be carried out and containing guidelines for the determination of whether contamination is occurring, the initial plan to be provided at least three months prior to the exercise of this consent.
12. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, 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(b) of the Resource Management Act 1991.
13. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

GENERAL MANAGER

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

Change To
Conditions Date: 19 January 2010 [Granted: 21 March 1999]

Conditions of Consent

Consent Granted: To discharge up to 500 tonnes/day of contaminants onto
and into land in areas B1, C1 and C2 at the Colson Road
landfill at or about (NZTM) 1697313E-5675450N

Expiry Date: 1 June 2025

Review Date(s): June 2012, June 2018

Site Location: Colson Road Landfill, Colson Road, New Plymouth

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Puremu

General conditions

- a) That 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) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

- 1. THAT the consent holder shall install and maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, a further groundwater monitoring piezometer approximately equidistant between the bores designated as AH9 and L2, and shall maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, groundwater monitoring piezometers and bores at the sites designated as WQA, WQB and WQC, as AH1, AH2, AH3, AH5, AH6, AH7, and as L1, L2, L5, L7 and L8. [Bore designations are those in Appendix A2, Figure 1, in the Assessment of Effects on the Environment prepared by Woodward-Clyde for New Plymouth District Council, July 1994].
- 2. THAT the consent holder shall prevent surface runoff of water or contaminants to the Manganaha Stream from any surface area being used or previously used for the deposition of refuse, or for extraction of soil, clay, or other cover material, or prepared for the deposition of refuse, unless such surface area has been covered and rehabilitated to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 3. THAT prior to commencing any use of any part of Area B, C1 or C2 for the deposition of refuse or for composting activities, the consent holder shall demonstrate to the satisfaction of the Chief Executive, Taranaki Regional Council, that drainage channels, bunds, surface contouring, or other engineering and landscaping works associated with an Area or part of an Area have been undertaken and completed to the extent that compliance with condition 2 above will be achieved.

4. THAT the construction, installation, placement, integrity and performance of groundwater drainage systems, landfill lining systems, and leachate interception, collection, holding, recirculation, and discharge systems in any part of Areas B1, B2, C1 and C2 of the Colson Road Landfill as described in the 'Colson Road Landfill Assessment of Effects on the Environment' July 1994 and the 'New Plymouth District Council Colson Road Landfill Management Plan' July 1994 be certified by a registered engineer prior to any discharge of solid wastes in such part of those areas.
5. THAT should groundwater quality be significantly affected by activities or processes associated with the landfill or composting, then the consent holder shall implement such measures as are necessary to remedy or mitigate and if practicable to prevent the continuation of any effect upon quality of the groundwater. 'Significantly affected' for the purposes of this condition is defined as a change greater than the maximum natural variation in any parameter for water in any piezometer, bore, or spring, and the criteria for this shall be set out in the monitoring programme under condition 6.
6. THAT the consent holder shall provide, maintain and comply with a monitoring programme, to the satisfaction of the Chief Executive, Taranaki Regional Council, setting out details of monitoring to be carried out and containing guidelines for the determination of whether contamination is occurring, the initial plan to be provided at least three months prior to the exercise of this consent.
7. THAT the disposal of wastes shall be carried out in a manner conforming with the relevant requirements of the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the Chief Executive, Taranaki Regional Council.
8. THAT the acceptance and disposal of waste types at the landfill for disposal shall conform to Section 2.5, Section 5.6 and Appendix E [or their equivalent] of the Landfill Management Plan referred to in condition 7 above, and in particular shall conform to the following:

Table 11.2 'Criteria for calculating landfill potentials' Hazardous Waste Management Handbook, Ministry for the Environment, 1994;

and

Chapter 5 of the 'Draft Health and Environmental Guidelines for Selected Timber Treatment Chemicals', Ministry for the Environment / Ministry of Health, September 1993, in compliance with the requirement for a Class 2 landfill.
9. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, 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(b) of the Resource Management Act 1991.

Consent 4621-1

10. THAT pursuant to section 128(1) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2102, June 2018 and/or within six months of the first exercise of this consent, to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 19 January 2010

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TRK994622



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

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: **21 March 1999**

CONDITIONS OF CONSENT

Consent Granted: **TO DISCHARGE EMISSIONS INTO THE AIR FROM
COMPOSTING AND ANCILLARY ACTIVITIES AT THE
COLSON ROAD LANDFILL AT OR ABOUT GR: P19:074-372**

Expiry Date: **1 June 2025**

Review Date[s]: **June 2006, June 2012 and June 2018**

Site Location: **COLSON ROAD LANDFILL, COLSON ROAD, NEW PLYMOUTH**

Legal Description: **SEC 223 HUA DIST BLK VI PARITUTU SD**

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

TRK994622

General conditions

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

- 1. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from emissions from the composting operation. 'Best practicable option' [as defined in section 2 of the Act] shall be determined by the Taranaki Regional Council, following review of the conditions of this consent as set out under condition 9 of this consent.
- 2. THAT the discharge of contaminants into the air from the composting operation shall not result in offensive or objectionable odours or dust or dangerous or noxious ambient concentrations of any airborne contaminant in the opinion of an enforcement officer of the Taranaki Regional Council, at or beyond the boundary of the site.
- 3. THAT the discharges authorised by this consent shall not give rise to any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna.
- 4. THAT the nature of materials accepted for composting and the operation of the composting activities shall give effect to the 'Assessment of Discharges to Air' July 1994, prepared for the New Plymouth District Council by Woodward-Clyde [in particular, but not exclusively, section 2.2.2] and the New Plymouth District Council Colson Road Landfill Management Plan July 1994 [in particular, but not exclusively, section 5.9.6 and Figure 1 of Appendix A] or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
- 5. THAT any composting pile or windrow shall be located at least 300 metres from any dwellinghouse existing as of 21 March 1999.
- 6. THAT the maximum proportion of a composting windrow or pile comprising other than plant-derived material shall not exceed 5% by weight.
- 7. THAT the composting operation shall initially be undertaken on a trial basis. After at least six, but not more than nine, months of operation, the consent holder shall report to the Taranaki Regional Council on trial, noting particularly the results of operation and effects-based monitoring, and recording any complaints received about odour from composting. Upon receipt of that report, the Taranaki Regional Council may either approve the continuation of composting, or require a review of this consent pursuant to section 128(1)(a) of the Resource Management Act 1991.

TRK994622

8. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, 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(b) of the Resource Management Act 1991.
9. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL



GENERAL MANAGER

TRK994779

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: 21 March 1999

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE CONTAMINANTS INTO THE AIR FROM THE
EXISTING LANDFILL [AREA A] AND PROPOSED LANDFILL
EXTENSION IN AREAS A, B1, B2, C1 AND C2 OF THE
COLSON ROAD MUNICIPAL LANDFILL SITE, NEW
PLYMOUTH AT OR ABOUT GR: P19:074-372

Expiry Date: 1 June 2025

Review Date[s]: June 2001, June 2003, June 2006, June 2012, June 2018 and/or
within six months of the first exercise of this consent

Site Location: COLSON ROAD LANDFILL EXTENSION, COLSON ROAD,
NEW PLYMOUTH

Legal Description: SEC 223 HUA DIST BLK VI PARITUTU SD

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

TRK994779

General conditions

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

- 1. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from emissions from the landfill operation. 'Best practicable option' [as defined in section 2 of the Act] shall be determined by the Taranaki Regional Council, following review of the conditions of this consent as set out under conditions 10 and 11 of this consent and having regard to the requirements of condition 6 of this consent.
- 2. THAT the discharge of contaminants into the air from the landfill operation shall not result in any of the following – offensive or objectionable odours; offensive or objectionable dust; or dangerous or noxious ambient concentrations of any airborne contaminant – as determined by at least one enforcement officer of the Taranaki Regional Council, at or beyond the boundary of the site.
- 3. THAT no material is to be burnt at the landfill site.
- 4. THAT the discharges authorised by this consent shall not give rise to any significant adverse ecological effects on any ecosystem, including but not limited to, habitats, plants, animals, microflora and microfauna.
- 5. THAT no extraction venting of untreated landfill gases be located closer than 200 metres to any boundary of the landfill property site.
- 6. THAT the operation of the landfill shall give effect to the 'Air Discharge Consent Application Supporting Documentation' July 1995, prepared for the New Plymouth District Council by Woodward Clyde, and the New Plymouth District Council Colson Road Landfill Management Plan July 1994 or any subsequent version of that document which does not lessen the standard of environmental protection afforded by that document. The management plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
- 7. THAT prior to undertaking any alteration to the site or site operations other than as specified and discussed in the application and supporting documentation lodged with the Taranaki Regional Council for this consent, which may significantly alter the nature or quantities of contaminants discharged from the site into the air, the consent holder shall consult with the General Manager, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.

TRK994779

8. THAT the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with the submitters to the consent, and any other interested party at the discretion of the General Manager, Taranaki Regional Council, to discuss any matter relating to the exercise of this consent, and in order to facilitate ongoing consultation.
9. THAT the consent holder shall, within one year of the commencement of this consent, provide a report on the feasibility of collecting, extracting, venting, or combusting of landfill gas at the Colson Road landfill, to the satisfaction of the General Manager, Taranaki Regional Council.
10. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.
11. THAT in addition to the review provisions of condition 10 above, pursuant to section 128(1)(a) of the Resource Management Act 1991 the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review within six months of receipt of the report required by condition 9, and/or during June 2001, June 2003, June 2006, June 2012 and/or June 2018, for the purpose of considering the options of collecting, extracting, venting or combusting landfill gas.

Signed at Stratford on 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

GENERAL MANAGER

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 11 June 2003
Date:

Conditions of Consent

Consent Granted: To discharge stormwater [due to earthworks in providing
an area for Stage 3 of the municipal landfill] onto land and
into the Puremu Stream a tributary of the Mangaone
Stream in the Waiwhakaiho catchment at or about GR:
P19:074-372

Expiry Date: 1 June 2020

Review Date(s): June 2004, June 2006, June 2008, June 2014

Site Location: Colson Road Landfill, Colson Road, New Plymouth

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Mangaone
Puremu

Consent 6177-1

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 water quality of uncontaminated stormwater discharge to the Puremu Stream shall meet the following criteria:

pH	6.5-8.5
suspended solids	maximum concentration of 100gm ⁻³
ammoniacal nitrogen	maximum concentration of 0.5 gm ⁻³ as nitrogen
2. No leachate discharge shall be permitted by the exercise of this consent.
3. All stormwater diversion and channels shall be designed, constructed and maintained so as to prevent or minimise erosion of the channel in all circumstances.
4. Any discharge shall not alter to a conspicuous extent the natural colour or clarity of the receiving water in the Puremu Stream.
5. There shall be no significant adverse impact upon natural aquatic life downstream of the landfill as a result of the exercise of this permit.
6. Monitoring of surface waters on or in the vicinity of the site shall be undertaken to the satisfaction of the Chief Executive, Taranaki Regional Council.
7. The consent holder shall prepare and maintain a management plan and site contingency plan for the site and associated activities on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
8. The consent holder shall prepare and maintain a site erosion and sediment control management plan for the site and associated activities on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
9. The consent holder shall at all times adopt the best practicable option, as defined in the Resource Management Act 1991, to prevent or minimise any or likely adverse effects on the environment associated with the discharges of stormwater from the site, including but not limited to the collection, containment and removal from the site of any discharge of contaminated stormwater.
10. The consent holder shall repair and rehabilitate any land made unstable and any erosion occurring due to the construction or maintenance of the diversion channels.

Consent 6177-1

11. The consent holder shall maintain stormwater drains, sediment detention ponds, and ground contours at the site, in order to minimise stormwater movement across, or ponding on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
12. After allowing for reasonable mixing the consent holder shall ensure that the discharge shall not give rise to any of the following effects in the receiving waters of the Puremu Stream:
 - a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
 - b) any conspicuous change in colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
 - f) an increase in the temperature of the Puremu Stream by more than 2.0 degrees Celsius.
13. 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 2004 and/or June 2006 and/or 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 11 June 2003

For and on behalf of
Taranaki Regional Council

Chief Executive

Appendix II

Biomonitoring reports for Colson Road landfill

To Job Manager, Lorraine Smith
From Scientific Officer, Brooke Thomas
Document 1904741
Date 01 August 2017

Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, February 2017

Introduction

New Plymouth District Council hold resource consents to authorise discharges to land and to water in relation to the operations of the Colson Road Landfill, in New Plymouth. The resource consents most relevant to this biological survey are summarised in Table 1 below.

Table 1 Summary of discharge consents held by NPDC which are of most relevance to this biological survey.

Consent	Purpose
2370	To discharge leachate to groundwater and into the Puremu Stream
4619	To discharge stormwater and leachate to land and into the Puremu Stream
4620	To discharge stormwater into Puremu Stream
4621	To discharge contaminants into land

The Colson Road landfill site has been opened up, filled and capped off progressively in stages since it was established (Figure 1). Stages 1 and 2 of the landfill site have been completed and, at present the landfill is operating in the stage 3 area of the site. A section of the site is also dedicated to the management of composting waste.

Leachate from stages two and three is collected and directed to the New Plymouth Municipal Wastewater Treatment Plant. Leachate from stage one and stormwater from these areas including the access road are directed towards the Puremu Stream which flows through the landfill site. Stormwater from the compost area and from clean areas surrounding the stage 3 area of the site is directed to a large 'stormwater pond' which then discharges into an unnamed tributary of the Puremu Stream. There may also be some stormwater runoff and groundwater seepage from the landfill towards the Manganaha Stream which runs along the north-eastern boundary of the landfill.

Biological surveys have been undertaken on the Puremu Stream since 1986, to assess potential adverse effects of leachate from the landfill on the macroinvertebrate communities of the stream. Further to this, biological monitoring has been undertaken on the Manganaha Stream since 1994 to assess the effects of seepage from the landfill site on the macroinvertebrate communities in the stream.

Results of freshwater biological surveys performed in relation to the Colson Road landfill since the 2000-2001 monitoring year are discussed in numerous biomonitoring reports listed in the references.

Methods

This survey was undertaken on 15 February 2017 at two previously established sampling sites in the Puremu Stream catchment and at two established sites in the Manganaha Stream (Figure 1 and Table 2). A third site located in an unnamed tributary of the Puremu Stream (PT1), which was routinely monitored in previous surveys, had been significantly modified by instream activities prior to the spring 2012 survey, and as a result, a new site was established 50m upstream. This is the ninth survey undertaken at this site.

Site 1 is a 'control' site on the Puremu Stream located upstream of the landfill site and site 2 is also located on this stream, but downstream of stage one and two areas. PT1 is located downstream of the large 'stormwater pond' discussed above. Site M4 is located on the Manganaha Stream downstream of an unnamed tributary which drains from the eastern side of the landfill site and site M6 is situated approximately 500 metres downstream of M4.

The standard '400 ml sweep-sampling' technique was used to collect streambed macroinvertebrates from site 1 and 2 in the Puremu Stream, site PT1 in an unnamed tributary of the Puremu Stream and site M6 in the Manganaha stream. This 'sweep-sampling' technique is very similar to Protocol C2 (semi-quantitative methods for soft-bottomed streams) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

A combination of the '400 ml sweep-sampling' technique and the standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from site M4 in the Manganaha stream. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

Table 2 Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road Landfill

Stream	Site No.	Site Code	Location	Sampling method
Puremu stream	1	PMU000104	Upstream of the landfill	Sweep-sampling
	2	PMU000110	400 metres downstream landfill	Sweep-sampling
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Sweep-sampling
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Kick-sweep
	M6	MNH000260	500 downstream of site M4	Sweep-sampling



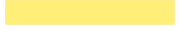



Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark *et al*. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare) = less than 5 individuals;
C (common) = 5-19 individuals;

A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

A gradation of biological water quality conditions based upon MCI ranges has been adapted for Taranaki streams and rivers from Stark's classification (Stark, 1985 and Boothroyd & Stark, 2000). This is as follows:

Grading	MCI	Code
Excellent	> 140	
Very Good	120-140	
Good	100-119	
Fair	80-99	
Poor	60-79	
Very Poor	<60	

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

Sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream.

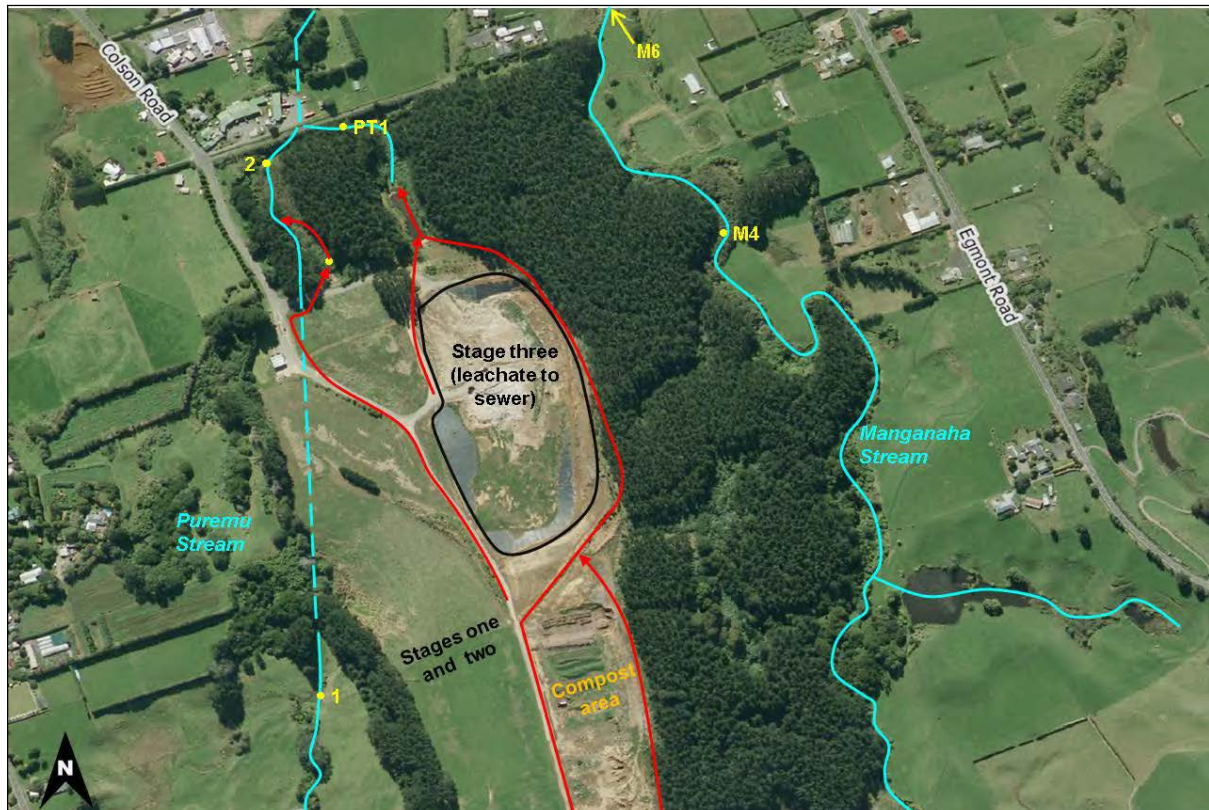


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the landfill site.

Results

At the time of this February 2017 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 16.4 °C to 17.6°C. Site 1 in the Puremu Stream had an uncoloured, clear, low and slow flow. At site 2 the stream had a grey, cloudy, moderate and steady flow. The unnamed tributary of the Puremu Stream at PT1 had an uncoloured, cloudy, low and slow flow. Iron oxide accumulations were present at site PT1 but not site 1 or 2.

At site 1 the substrate was predominantly silt with some sand and fine gravel. At site 2 the substrate was a combination of silt, hard clay and wood/root. At site PT1 the substrate was predominantly silt with some sand, fine gravel and wood/root. Complete shading of the streambed was recorded at site 2, while site 1 was unshaded. Site PT1 was partially shaded.

No periphyton was recorded at any sites in the Puremu Stream or in the unnamed tributary of the Puremu Stream. Macrophytes dominated the bed of the stream at site 1, while no macrophytes were recorded growing at site 2 or site PT1. No unusual bacterial, fungal or protozoan growths were found by microscopic examination of the samples for 'heterotrophic growths' at any of the Puremu Stream sites in this February 2017 survey.

The Manganaha Stream had an uncoloured, cloudy, moderate and steady flow at both sites M4 and M6. The water temperature at both site M4 and site M6 was 15.9°C. Site M4 was completely shaded while site M6 was partially shaded. The substrate at site M4 consisted of hard clay, gravels and sand with some silt while the substrate at site M6 was predominantly bedrock with some fine gravel, sand and silt. Extensive woody debris was recorded at site M4 while site M6 recorded patchy wood and leaves only. Both site M4 and M6 supported patchy filamentous algae growth. No unusual bacterial, fungal or protozoan growths were found in the Manganaha Stream by the microscopic examination of the samples for 'heterotrophic growths'.

Macroinvertebrate communities

A summary of the results of previous macroinvertebrate surveys performed at the sites used in the current survey is presented in Table 3 together with current results.

Table 3 Numbers of taxa and MCI values recorded in previous surveys performed at sites in the Puremu and Manganaha Streams and a tributary of the Puremu Stream in relation to the Colson Road landfill since July 1986, together with current results.

Site No.	Number of taxa				MCI values			SQMCI _s values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
1	47	8-27	18	20	60-90	74	76	33	1.4-5.0	3.7	4.1
2	59	7-24	17	17	51-87	73	78	33	1.2-3.9	3.0	2.8
PT1*	32	11-22	16	15	55-80	72	73	31	1.2-3.7	2.4	1.3
M4	42	11-25	19	21	76-104	89	91	33	2.3-6.9	4.7	3.8
M6	36	12-27	19	18	58-100	85	89	33	2.8-6.8	4.1	3.7

* Summary statistics given for PT1 combine data for sites PMU000108 and PMU000109.

Puremu Stream

The current results for the Puremu Stream and the unnamed tributary of the Puremu Stream are presented in Table 4 below.

Table 4 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 15 February 2017

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB17062	FWB17063	FWB17064
COELENTERATA	Coelenterata	3	R	-	-
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	R	R
NEMERTEA	Nemertea	3	R	R	R
NEMATODA	Nematoda	3	R	-	-
ANNELIDA (WORMS)	Oligochaeta	1	C	A	A
	Lumbricidae	5	-	R	-
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	A
MOLLUSCA	<i>Potamopyrgus</i>	4	XA	VA	-
	Sphaeriidae	3	R	C	-
CRUSTACEA	Ostracoda	1	VA	VA	XA
	<i>Paracalliope</i>	5	XA	C	R
	Talitridae	5	-	-	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	A	-	-
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>	4	R	-	-
HEMIPTERA (BUGS)	<i>Microvelia</i>	3	R	R	-
COLEOPTERA (BEETLES)	Hydrophilidae	5	-	-	R
	Scirtidae	8	-	R	-
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	R	-	-
	<i>Polypsectropus</i>	6	C	C	-
	<i>Triplectides</i>	5	C	A	C
DIPTERA (TRUE FLIES)	Hexatomini	5	-	-	R
	<i>Zelandotipula</i>	6	-	R	R
	<i>Chironomus</i>	1	-	-	R
	Orthocladiinae	2	-	C	R
	<i>Polypedilum</i>	3	-	C	-
	Tanypodinae	5	C	-	C
	Tanytarsini	3	R	-	-
	<i>Paradixa</i>	4	R	-	-
	<i>Austrosimulium</i>	3	VA	R	-
ACARINA (MITES)	Acarina	5	C	C	A
No of taxa			20	17	15
MCI			76	78	73
SQMCIs			4.1	2.8	1.3
EPT (taxa)			4	2	1
%EPT (taxa)			20	12	7
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		

R = Rare

C = Common

A = Abundant

VA = Very Abundant

XA = Extremely Abundant

Site 1 (PMU000104)

A total taxa richness of 20 taxa was recorded at site 1 (Table 3 and Figure 2). This result was two taxa more than the historical median but four taxa less than the previous survey result.

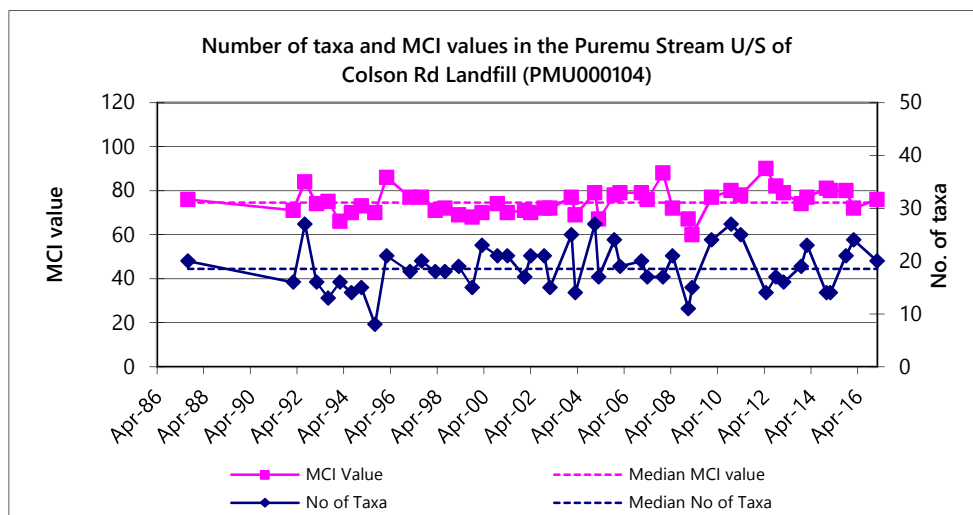


Figure 2 Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

The community at this site was characterised by two 'moderately sensitive' taxa [extremely abundant amphipod (*Paracalliope*) and abundant mayfly (*Austroclima*)] and three 'tolerant' taxa [(*Potamopyrgus*) snails, black sandfly larvae (*Austrosimulium*) and ostracod seed shrimp]. This community assemblage reflected the prevalence of macrophyte habitat recorded at this site and the low and slow flow that was recorded at the time of this survey (Table 4).

In this survey (65%) of the community consisted of 'tolerant' taxa, which resulted in the MCI score of 76 units, 2 units more than the median score recorded at this site previously and 4 units more than that recorded by the previous survey (Table 3 and Figure 2). This MCI score indicated 'poor' biological health. The numerical dominance by one 'sensitive' taxon was tempered by the dominance of one high scoring 'tolerant' taxon and resulted in a SQMCI_s score of 4.1 units (Table 4). This score was slightly higher than that recorded by the previous survey (by 0.3 unit) and was above the median score recorded by previous surveys for the site (Table 3).

Site 2 (PMU000110)

A moderate number of taxa (17) was recorded at this site which was the same as the median recorded by previous surveys at this site, and three taxa more than the richness recorded by the previous survey (Table 3 and Figure 3).

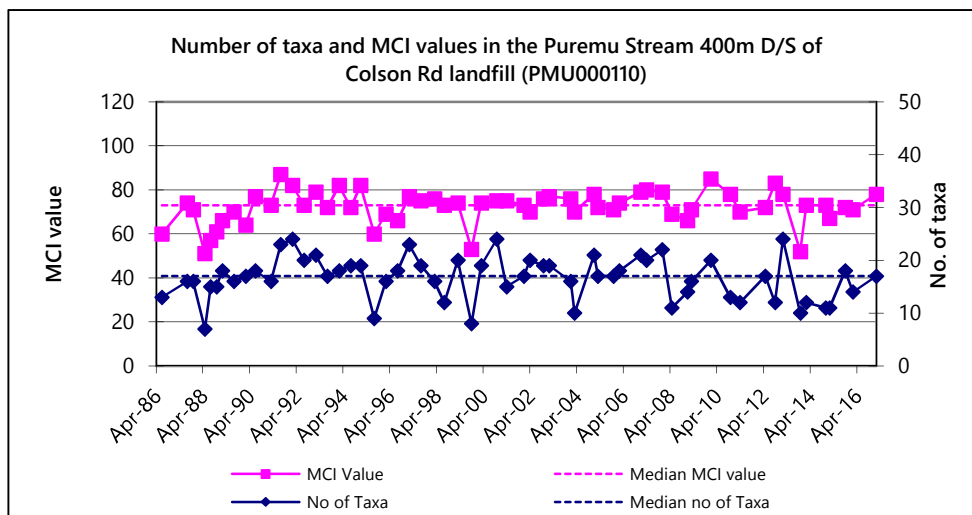


Figure 3 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

The macroinvertebrate community was characterised by three 'tolerant' taxa [oligochaete worms, (*Potamopyrgus*) snails and ostracod seed shrimp] and one 'moderately sensitive' taxon [stick-caddis (*Triplectides*)] (Table 4).

A slightly higher proportion of 'tolerant' taxa recorded at this site (59%) resulted in the MCI score of 78 units, which indicated 'poor' biological health. This MCI score was an insignificant (Stark, 1998) 5 units more than the historical median for the site and 2 units more than that recorded at site 1 (Table 3 and Figure 3). The SQMCI_s score of 2.8 units was just below the historical median for the site but substantially lower than that recorded upstream at site 1 (Table 3).

Site PT1 (PMU000108)

A total of 15 taxa was recorded at site PT1 in the unnamed tributary of the Puremu Stream, which was one taxon less than the historical median for the site and five taxa less than that recorded at the 'control' site 1 (Table 3 and Table 4).

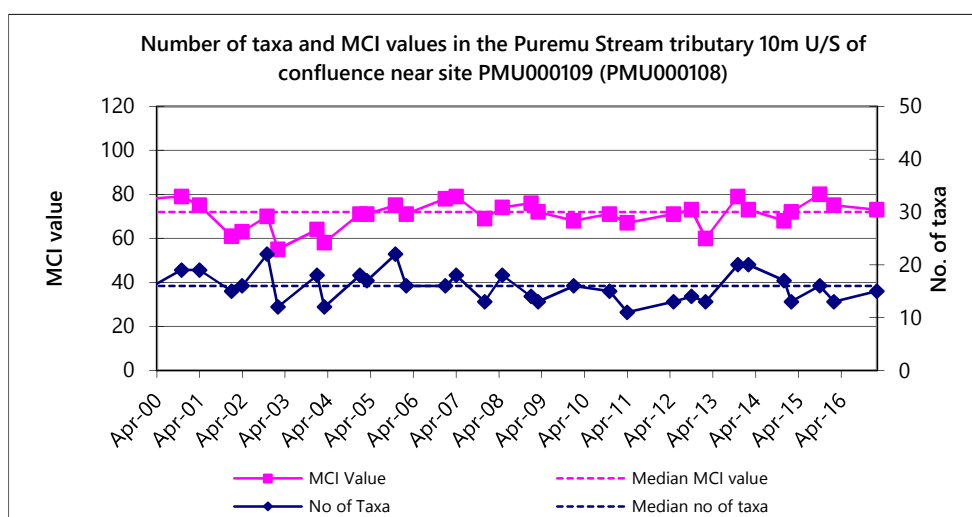


Figure 4 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Road Landfill

The community at site PT1 was characterised by three 'tolerant' taxa [oligochaete worms, leeches (Hirudinea) and ostracod seed shrimp]] and one 'moderately sensitive' taxon [mites (Acarina)] (Table 4). The similar proportion of 'tolerant' (47%) and 'sensitive' (53%) taxa in the macroinvertebrate community was reflected by the MCI score of 73 units, which indicated 'poor' biological health. This MCI score was 1 unit higher than the median MCI score for the site and an insignificant 3 units and 5 units lower than that recorded at sites 1 and 2 respectively (Table 3 and Figure 4).

One low scoring 'tolerant' taxon (ostracod seed shrimp) numerically dominated the community at this site which resulted in the low SQMCI_s score of 1.3 units, a substantial 1.1 units lower than the historical median for the site, but similar to that recorded by the previous survey (1.4 units). This score was only 0.1 unit higher than the minimum score previously recorded. This SQMCI_s score was substantially lower than that recorded at site 1 and site 2 (by 2.8 and 1.5 units respectively) and indicated poor physicochemical water quality and/or habitat quality at this site.

Manganaha Stream

The results for the current survey of the Manganaha Stream are presented in Table 5 below.

Table 5 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 15 February 2017

On 15 February 2017

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB17065	FWB17066
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	C	R
NEMERTEA	Nemertea	3	R	R
ANNELIDA (WORMS)	Oligochaeta	1	VA	A
	Lumbricidae	5	R	R
MOLLUSCA	<i>Potamopyrgus</i>	4	XA	VA
	Sphaeriidae	3	C	R
CRUSTACEA	Ostracoda	1	C	-
	<i>Paracalliope</i>	5	VA	A
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	R	C
	<i>Coloburiscus</i>	7	R	R
	<i>Zephlebia group</i>	7	A	C
ODONATA (DRAGONFLIES)	<i>Antipodochlora</i>	5	R	-
COLEOPTERA (BEETLES)	Elmidae	6	R	-
	Ptilodactylidae	8	R	-
TRICHOPTERA (CADDISFLIES)	<i>Costachorema</i>	7	-	R
	Ecnomidae/Psychomyiidae	6	-	R
	<i>Oxyethira</i>	2	-	R
	<i>Triplectides</i>	5	A	A
DIPTERA (TRUE FLIES)	Hexatomini	5	R	-
	<i>Harrisius</i>	6	R	-
	<i>Polypedilum</i>	3	R	C
	<i>Paradixa</i>	4	R	R
	<i>Austrosimulium</i>	3	C	VA
ACARINA (MITES)	Acarina	5	C	R
No of taxa			21	18
MCI			91	89
SQMCIs			3.8	3.7
EPT (taxa)			4	6
%EPT (taxa)			19	33
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa	
R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant				

Site M4 (MNH000190)

A total of 21 taxa was recorded at site M4 in this survey which was two taxa more than the historical median for the site (Table 3 and Figure 5). The community at this site was characterised by three 'moderately sensitive' taxa [amphipods (*Paracalliope*), stick caddis (*Triplectides*) and mayfly (*Zephlebia group*)] and two 'tolerant' taxa [snail (*Potamopyrgus*) and oligochaete worms] (Table 5), which was indicative of reasonable preceding water quality.

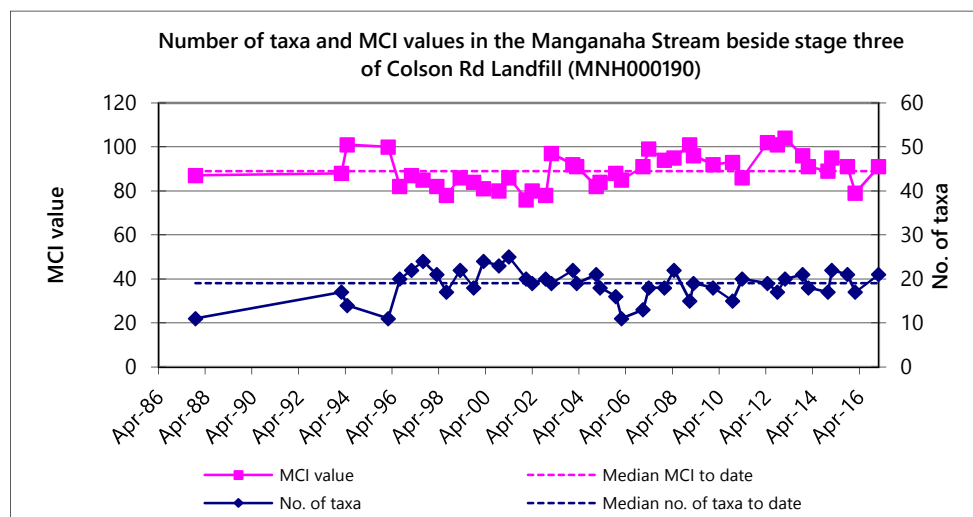


Figure 5 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

A moderate proportion of 'sensitive' taxa (57% of total taxa) in the community resulted in the 'fair' MCI score of 91 units, which was an insignificant (Stark, 1998) 2 units higher than the historical median but a significant (Stark, 1998) 12 units higher than the previous survey results for this site (Table 3 and Figure 5).

The numerical dominance of one 'tolerant' taxon was tempered by the dominance of three 'sensitive' taxa which resulted in the SQMCI_s value of 2.8 units, a substantial 0.9 unit below the median score recorded for this site.

Site M6 (MNH000260)

A total of 18 taxa was recorded at site M6, one taxon less than the median for the site and three taxa less than that recorded upstream at site M4 (Table 3 and Figure 6).

The community at this site was characterised by two 'moderately sensitive' taxa [amphipods (*Paracalliope*) and stick caddis (*Triplectides*)] and three 'tolerant' taxa [snail (*Potamopyrgus*), black sandfly larvae (*Austrosimulium*) and oligochaete worms] (Table 5).

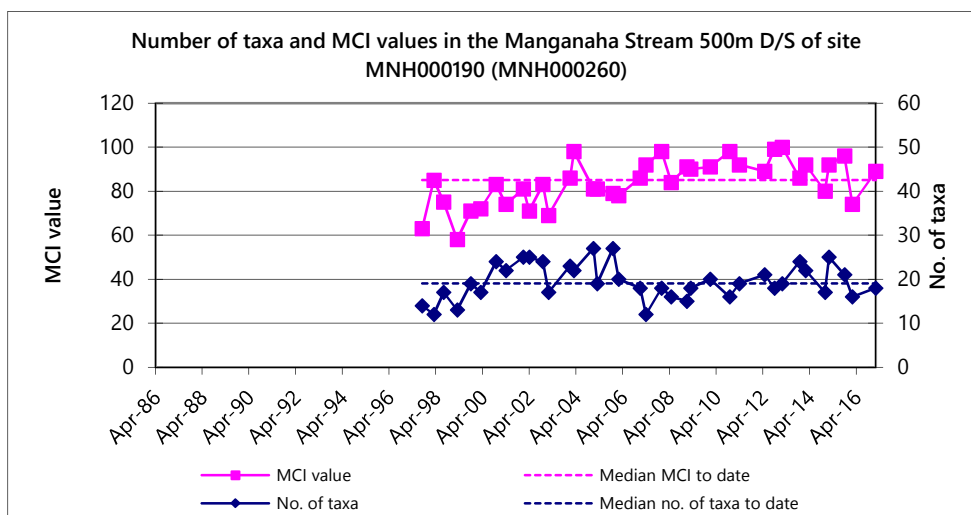


Figure 6 Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

The equal proportion of 'tolerant' and 'sensitive' taxa in the macroinvertebrate community resulted in the 'fair' MCI score of 89 units, which was 2 units lower than the MCI score recorded at site M4. This score was an insignificant (Stark,1998) 4 units higher than the historical median recorded for the site but a significant (Stark, 1998) 15 units higher than that recorded by the previous survey at this site (Table 3 and Figure 6).

The SQMCI_s score of 3.7 units was 0.4 unit lower than the median for this site but similar to that recorded upstream in the current survey (Table 3). It was slightly higher (by 0.4 unit) than that recorded by the previous survey.

It is apparent from the current survey that there was no significant difference in biological health between sites M4 and M6. Of 24 taxa recorded, 15 were recorded at both site M4 and M6. The results from the two sites on Manganaha Stream were indicative of reasonable preceding water quality. There was no indication of effects from any discharge from the landfill on the macroinvertebrate community of the stream.

Discussion and conclusions

The Council's standard 'sweep-sampling' technique was used at four sites (site 1, 2, PT1 and M6) and a combination of the 'sweep-sampling' and 'kick-sampling' techniques was used at one site (M4), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 15 February 2017. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This February 2017 macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was slightly higher than the median score for this site and slightly higher than that recorded by the previous survey. The SQMCI_s score was also above the median for the site and higher than that recorded by the previous survey. These results were indicative of 'poor' biological health and reflected a macrophyte associated community assemblage, which had been impacted by slow and low flows.

Site 2 in the Puremu Stream recorded a slightly higher MCI score but substantially lower SQMCI_s score, when compared with site 1, although both scores were not substantially different to the historical medians for the site. Site PT1 in the unnamed tributary also recorded a MCI score similar to the historical median, however the SQMCI_s score was substantially lower than the historical median for the site (by 1.1 units) and substantially lower than that recorded at site 2 (by 1.5 units) and indicated poor physicochemical water quality and/or habitat quality at this site. The iron oxide sediment recorded at the time of the survey is likely to have reduced the quality of the habitat at this site.

The upstream site on the Manganaha Stream recorded an MCI score similar to the historical median for the site, however the SQMCI_s score was substantially lower. These results reflected the higher proportion of 'sensitive' taxa in the macroinvertebrate community but the numerical dominance of two 'tolerant' in particular. These results were indicative of reasonable preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained an equal proportion of 'tolerant' and 'sensitive' taxa, which resulted in the MCI score of 89 units. This MCI score was slightly lower than that recorded at the upstream site, but indicated similar biological health to the upstream site. The SQMCI_s score recorded at site M6 was also similar to that recorded at site M4.

No undesirable biological growths were detected at any of these sites during this February 2017 survey.

Summary

Overall, the results of this February 2017 survey were indicative of 'poor' biological health in the Puremu Stream and in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of 'fair' biological health at sites M4 and M6. In summary, these results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.

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Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, May 2017

Introduction

New Plymouth District Council hold resource consents to authorise discharges to land and to water in relation to the operations of the Colson Road Landfill, in New Plymouth. The resource consents most relevant to this biological survey are summarised in Table 1 below.

Table 1 Summary of discharge consents held by NPDC which are of most relevance to this biological survey.

Consent	Purpose
2370	To discharge leachate to groundwater and into the Puremu Stream
4619	To discharge stormwater and leachate to land and into the Puremu Stream
4620	To discharge stormwater into Puremu Stream
4621	To discharge contaminants into land

The Colson Road landfill site has been opened up, filled and capped off progressively in stages since it was established (Figure 1). Stages 1 and 2 of the landfill site have been completed and, at present the landfill is operating in the stage 3 area of the site. A section of the site is also dedicated to the management of composting waste.

Leachate from stages two and three is collected and directed to the New Plymouth Municipal Wastewater Treatment Plant. Leachate from stage one and stormwater from these areas including the access road are directed towards the Puremu Stream which flows through the landfill site. Stormwater from the compost area and from clean areas surrounding the stage 3 area of the site is directed to a large 'stormwater pond' which then discharges into an unnamed tributary of the Puremu Stream. There may also be some stormwater runoff and groundwater seepage from the landfill towards the Manganaha Stream which runs along the north-eastern boundary of the landfill.

Biological surveys have been undertaken on the Puremu Stream since 1986, to assess potential adverse effects of leachate from the landfill on the macroinvertebrate communities of the stream. Further to this, biological monitoring has been undertaken on the Manganaha Stream since 1994 to assess the effects of seepage from the landfill site on the macroinvertebrate communities in the stream.

Results of freshwater biological surveys performed in relation to the Colson Road landfill since the 2000-2001 monitoring year are discussed in numerous biomonitoring reports listed in the references.

Methods

This survey was undertaken on 10 May 2017 at two previously established sampling sites in the Puremu Stream catchment and at two established sites in the Manganaha Stream (Figure 1 and Table 2). A third site located in an unnamed tributary of the Puremu Stream (PT1), which was routinely monitored in previous surveys, had been significantly modified by instream activities prior to the spring 2012 survey, and as a result, a new site was established 50m upstream. This is the tenth survey undertaken at this site.

Site 1 is a 'control' site on the Puremu Stream located upstream of the landfill site and site 2 is also located on this stream, but downstream of stage one and two areas. PT1 is located downstream of the large 'stormwater pond' discussed above. Site M4 is located on the Manganaha Stream downstream of an unnamed tributary which drains from the eastern side of the landfill site and site M6 is situated approximately 500 metres downstream of M4.

The standard '400 ml sweep-sampling' technique was used to collect streambed macroinvertebrates from site 1 in the Puremu Stream. This 'sweep-sampling' technique is very similar to Protocol C2 (semi-quantitative methods for soft-bottomed streams) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al.*, 2001).

A combination of the '400 ml sweep-sampling' technique and the standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from site 2 in the Puremu Stream, site PT1 in an unnamed tributary of the Puremu Stream and site M6 in the Manganaha stream. The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from site M4 in the Manganaha stream. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al.*, 2001).

Table 2 Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road Landfill

Stream	Site No.	Site Code	Location	Sampling method
Puremu stream	1	PMU000104	Upstream of the landfill	Sweep-sampling
	2	PMU000110	400 metres downstream landfill	Kick-sweep
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Kick-sweep
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Kick-sampling
	M6	MNH000260	500 downstream of site M4	Kick-sweep

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark *et al.* 2001). Macroinvertebrate taxa found in each sample were recorded as:







R (rare)

= less than 5 individuals;

C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

A gradation of biological water quality conditions based upon MCI ranges has been adapted for Taranaki streams and rivers from Stark's classification (Stark, 1985 and Boothroyd & Stark, 2000). This is as follows:

Grading	MCI	Code
Excellent	> 140	
Very Good	120-140	
Good	100-119	
Fair	80-99	
Poor	60-79	
Very Poor	<60	

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

Sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream.

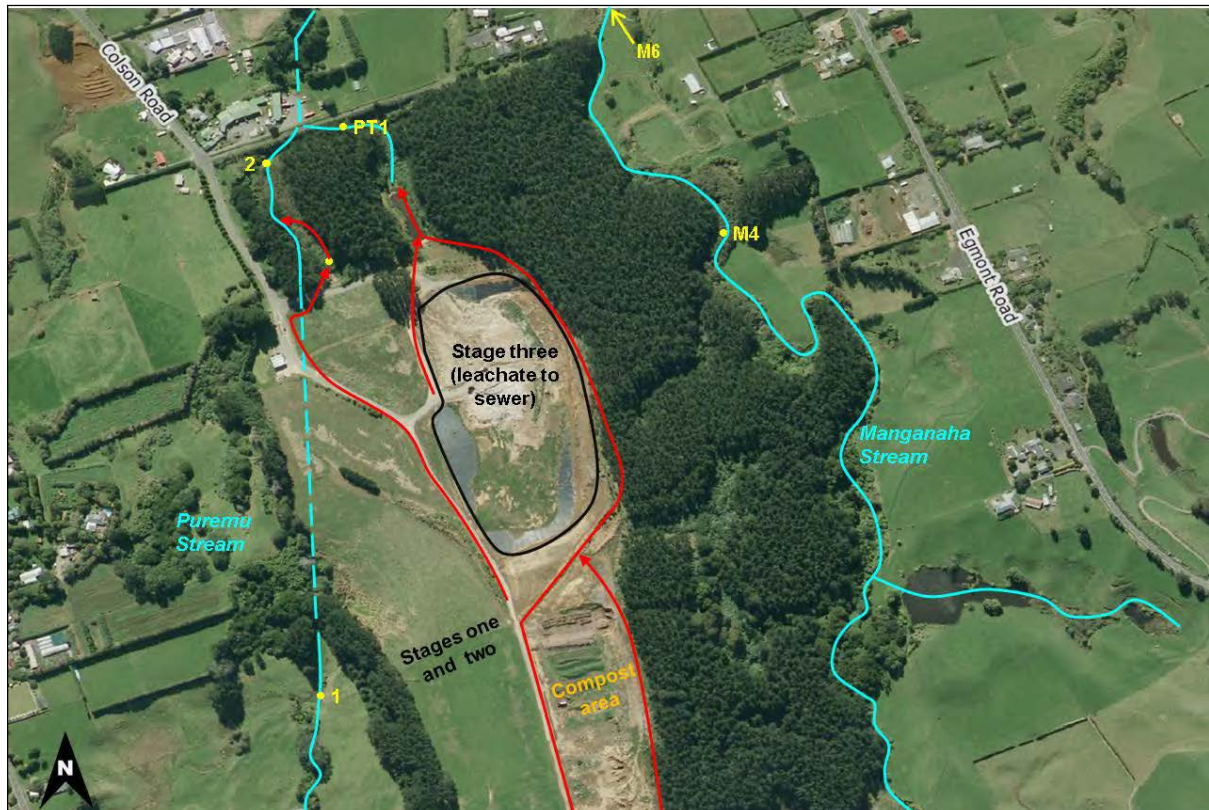


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the landfill site.

Results

At the time of this May 2017 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 13.7 °C to 14.0°C. Site 1 in the Puremu Stream and site PT1 in the unnamed tributary of the Puremu Stream had an uncoloured, clear, moderate and steady flow. At site 2, the stream had an uncoloured, cloudy, moderate and steady flow. Iron oxide accumulations were present at sites 2 and PT1 but not site 1.

At sites 1, 2 and PT1 the substrate was predominantly silt with some sand, fine gravel and wood/root. Complete shading of the streambed was recorded at site 2, while site 1 was unshaded. Site PT1 was partially shaded. No periphyton was recorded at any sites in the Puremu Stream or in the unnamed tributary of the Puremu Stream. Macrophytes dominated the bed of the stream at site 1, while no macrophytes were recorded growing at site 2 or site PT1. No unusual bacterial, fungal or protozoan growths were found by microscopic examination of the samples for 'heterotrophic growths' at any of the Puremu Stream sites in this May 2017 survey.

The Manganaha Stream had an uncoloured, cloudy, moderate and steady flow at both sites M4 and M6. The water temperature at site M4 was 13.9°C and 14.0°C at site M6. Both sites M4 and M6 were partially shaded. The substrate at site M4 consisted mainly of gravels, sand and cobble with some silt, hard clay and wood/root. The substrate at site M6 was predominantly hard clay and silt with some sand, gravels and wood/root. Both site M4 and M6 supported slippery mats of algae. No unusual bacterial, fungal or protozoan growths were found in the Manganaha Stream by the microscopic examination of the samples for 'heterotrophic growths'.

Macroinvertebrate communities

A summary of the results of previous macroinvertebrate surveys performed at the sites used in the current survey is presented in Table 3, together with current results.

Table 3 Numbers of taxa and MCI values recorded in previous surveys performed at sites in the Puremu and Manganaha Streams and a tributary of the Puremu Stream in relation to the Colson Road landfill since July 1986, together with current results.

Site No.	Number of taxa				MCI values			SQMCI _s values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
1	48	8-27	19	20	60-90	75	81	34	1.4-5.0	3.8	4.4
2	60	7-24	17	16	51-87	73	71	34	1.2-3.9	3.0	3.4
PT1*	33	11-22	16	15	55-80	72	71	32	1.2-3.7	2.4	1.2
M4	43	11-25	19	14	76-104	89	93	34	2.3-6.9	4.7	4.0
M6	37	12-27	19	20	58-100	85	83	34	2.8-6.8	4.1	5.3

* Summary statistics given for PT1 combine data for sites PMU000108 and PMU000109.

Puremu Stream

The current results for the Puremu Stream and the unnamed tributary of the Puremu Stream are presented in Table 4 below.

Table 4 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 10 May 2017

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB17247	FWB17248	FWB17249
COELENTERATA	Coelenterata	3	R	-	-
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	C	-	-
NEMERTEA	Nemertea	3	R	C	A
NEMATODA	Nematoda	3	-	-	C
ANNELIDA (WORMS)	Oligochaeta	1	C	A	XA
	Lumbricidae	5	R	R	-
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	C
MOLLUSCA	<i>Gyraulus</i>	3	-	R	-
	<i>Potamopyrgus</i>	4	XA	VA	-
	Sphaeriidae	3	R	A	-
CRUSTACEA	Copepoda	5	-	-	R
	Ostracoda	1	A	A	A
	Isopoda	5	-	R	-
	<i>Paracalliope</i>	5	XA	R	-
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	A	-	-
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>	4	-	-	R
HEMIPTERA (BUGS)	<i>Microvelia</i>	3	-	R	-
COLEOPTERA (BEETLES)	Dytiscidae	5	R	-	-
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	R	-	-
	<i>Polypsectropus</i>	6	C	R	-
	<i>Psilochorema</i>	6	R	-	-
	<i>Triplectides</i>	5	C	A	R
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	-	-	R
	<i>Zelandotipula</i>	6	-	-	R
	<i>Chironomus</i>	1	-	-	C
	Orthoclaadiinae	2	R	R	R
	<i>Polypedilum</i>	3	R	R	R
	Tanypodinae	5	R	-	R
	<i>Austrosimulium</i>	3	A	R	-
ACARINA (MITES)	Acarina	5	R	C	C
No of taxa			20	16	15
MCI			81	71	71
SQMCIs			4.4	3.4	1.2
EPT (taxa)			5	2	1
%EPT (taxa)			25	13	7
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		

R = Rare

C = Common

A = Abundant

VA = Very Abundant

XA = Extremely Abundant

Site 1 (PMU000104)

A total taxa richness of 20 taxa was recorded at site 1 (Table 3 and Figure 2). This result was one taxon more than the historical median and the same as the previous survey result.

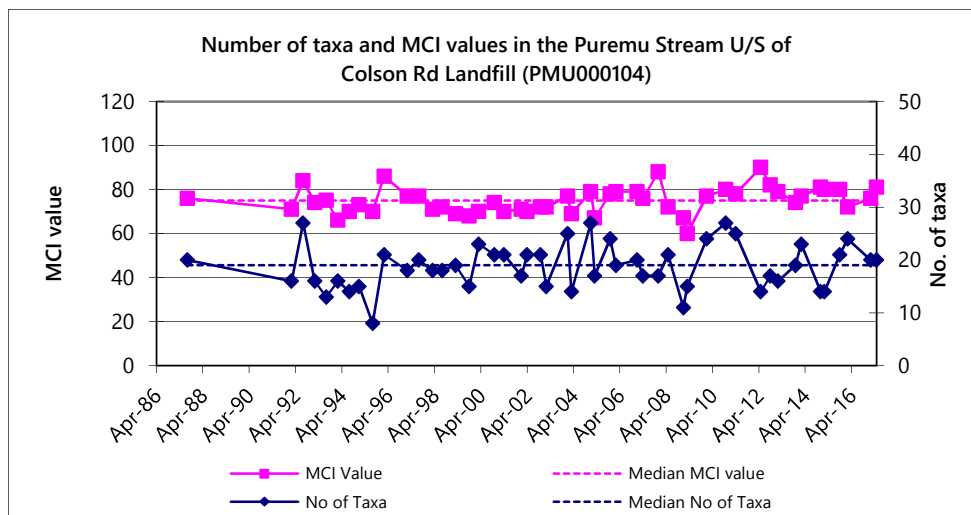


Figure 2 Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

The community at this site was characterised by two 'moderately sensitive' taxa [amphipods (*Paracalliope*) and mayfly (*Austroclima*)] and three 'tolerant' taxa [(*Potamopyrgus*) snails, black sandfly larvae (*Austrosimulium*) and ostracod seed shrimp]. This community assemblage reflected the prevalence of macrophyte habitat recorded at this site (Table 4).

In this survey an equal proportion of 'tolerant' and 'sensitive' taxa were recorded in the macroinvertebrate community which resulted in the MCI score of 81 units, 6 units more than the median score recorded at this site previously and 5 units more than that recorded by the previous survey (Table 3 and Figure 2). This MCI score indicated 'fair' biological health. The numerical dominance by one 'sensitive' taxon and one 'tolerant' taxon resulted in the SQMCI_s score of 4.4 units (Table 4). This score was slightly higher than that recorded by the previous survey (by 0.3 unit) and was well above the median score recorded by previous surveys for the site (Table 3).

Site 2 (PMU000110)

A total taxa richness of 16 taxa was recorded at this site, which was one taxon less than the median recorded by previous surveys at this site, and one taxon less than the richness recorded by the previous survey (Table 3 and

Figure 3).

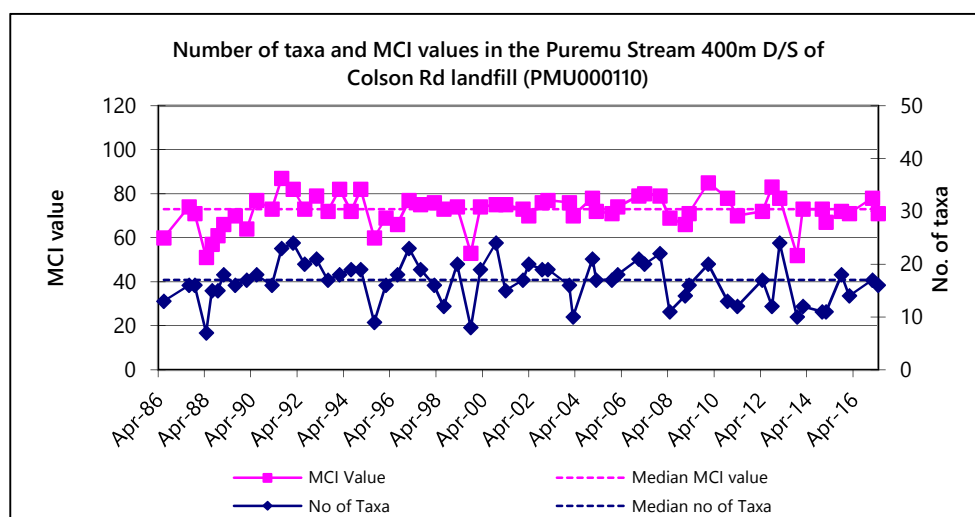


Figure 3 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

The macroinvertebrate community was characterised by four 'tolerant' taxa [oligochaete worms, snails (*Potamopyrgus*), fingernail clam (*Sphaeriidae*) and ostracod seed shrimp] and one 'moderately sensitive' taxon [stick-caddis (*Triplectides*)] (Table 4).

A slightly higher proportion of 'tolerant' taxa recorded at this site (63%) resulted in the MCI score of 71 units, which indicated 'poor' biological health. This MCI score was an insignificant (Stark, 1998) 2 units less than the historical median for the site and 10 units less than that recorded at site 1 (Table 3 and

Figure 3). The SQMCI_s score of 3.4 units was above the historical median for the site but substantially lower than that recorded upstream at site 1 (Table 3).

Site PT1 (PMU000108)

A total of 15 taxa was recorded at site PT1 in the unnamed tributary of the Puremu Stream, which was one taxon less than the historical median for the site and five taxa less than that recorded at the 'control' site 1 (Table 3 and Table 4).

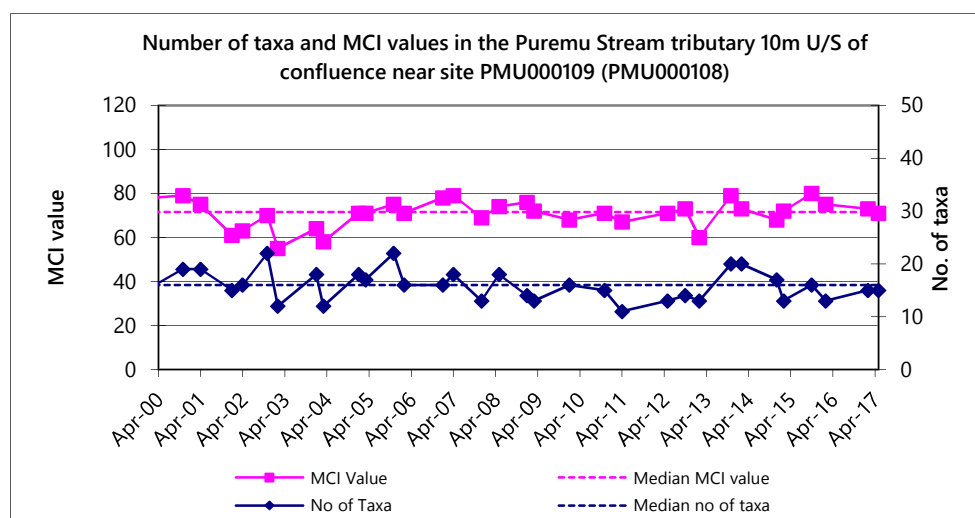


Figure 4 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Road Landfill

The community at site PT1 was characterised by three 'tolerant' taxa [oligochaete worms, ostracod seed shrimp and proboscis worms (Nemertea)] (Table 4). A higher proportion of 'tolerant' (60%) taxa in the macroinvertebrate community was reflected by the MCI score of 71 units, which indicated 'poor' biological health. This MCI score was 1 unit lower than the median MCI score for the site, an insignificant (Stark, 1998) 10 units lower than that recorded at site 1, and the same as that recorded at site 2 (Table 3 and Figure 4).

One low scoring 'tolerant' taxon (extremely abundant oligochaete worms) numerically dominated the community at this site which resulted in the low SQMCI_s score of 1.2 units, a substantial 1.2 units lower than the historical median for the site, but similar to that recorded by the previous survey (1.3 units). This score was equal to the minimum score previously recorded. This SQMCI_s score was substantially lower than that recorded at site 1 and site 2 (by 3.2 and 2.2 units respectively) and indicated poor physicochemical water quality and/or habitat quality at this site.

Manganaha Stream

The results for the current survey of the Manganaha Stream are presented in Table 5 below.

Table 5 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 10 May 2017

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB17250	FWB17251
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	-	R
NEMERTEA	Nemertea	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	A	C
	Lumbricidae	5	-	R
MOLLUSCA	<i>Physa</i>	3	-	R
	<i>Potamopyrgus</i>	4	VA	VA
	Sphaeriidae	3	R	R
CRUSTACEA	Ostracoda	1	-	C
	<i>Paracalliope</i>	5	A	VA
	<i>Paratya</i>	3	-	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	C	VA
	<i>Coloburiscus</i>	7	C	A
	<i>Zephlebia group</i>	7	R	A
ODONATA (DRAGONFLIES)	<i>Antipodochlora</i>	5	R	R
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	-	R
	Oeconesidae	5	R	-
	<i>Triplectides</i>	5	C	VA
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	R	-
	Orthoclaadiinae	2	R	-
	<i>Polypedilum</i>	3	-	R
	Tanypodinae	5	-	R
	<i>Austrosimulium</i>	3	R	C
ACARINA (MITES)	Acarina	5	R	R
No of taxa			14	20
MCI			93	83
SQMCIs			4.0	5.3
EPT (taxa)			5	5
%EPT (taxa)			36	25
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa	
R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant				

Site M4 (MNH000190)

A total of 14 taxa was recorded at site M4 in this survey which was five taxa less than the historical median for the site (Table 3 and Figure 5). The community at this site was characterised by one 'moderately sensitive' taxon [amphipods (*Paracalliope*)] and two 'tolerant' taxa [snail (*Potamopyrgus*) and oligochaete worms] (Table 5), which was indicative of reasonable preceding water quality.

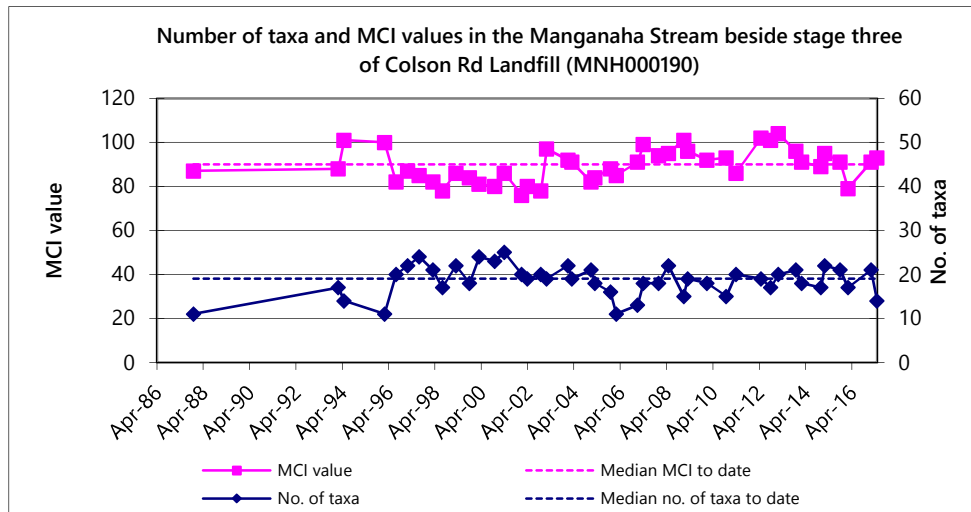


Figure 5 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

A higher proportion of 'sensitive' taxa in the macroinvertebrate community resulted in the 'fair' MCI score of 93 units, which was an insignificant (Stark, 1998) 4 units higher than the historical median and an insignificant 2 units higher than the previous survey results for this site (Table 3 and Figure 5).

The numerical dominance by two 'tolerant' taxa was tempered by the dominance of one 'sensitive' taxon which resulted in the SQMCI_s value of 4.0 units, a substantial 0.7 unit below the median score recorded for this site, but 0.2 unit higher than that recorded by the previous survey (Table 3).

Site M6 (MNH000260)

A total of 20 taxa was recorded at site M6, one taxon more than the median for the site and six taxa more than that recorded upstream at site M4 (Table 3 and Figure 6).

The community at this site was characterised by five 'moderately sensitive' taxa [amphipods (*Paracalliope*), mayflies (*Austroclima*), (*Zephlebia group*) and (*Coloburiscus*) and stick caddis (*Triplectides*)] and one 'tolerant' taxon [snail (*Potamopyrgus*)] (Table 5).

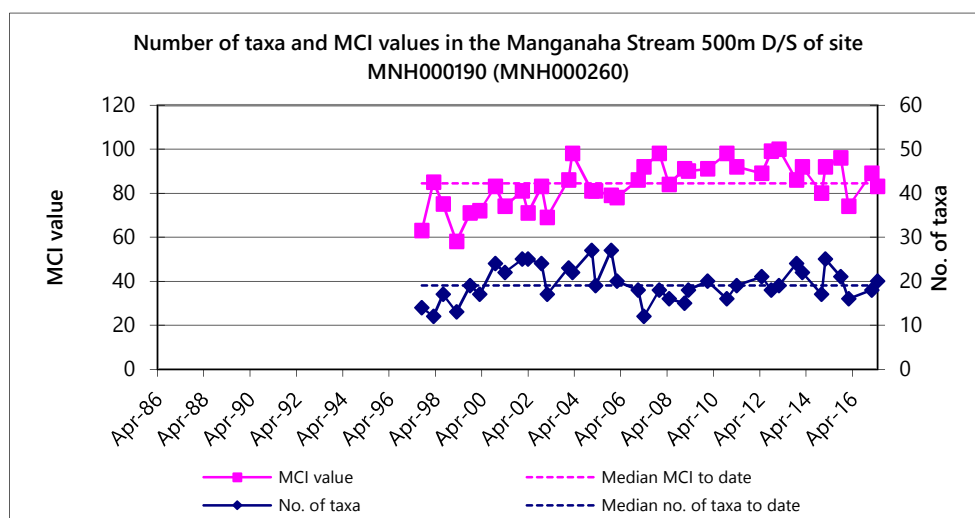


Figure 6 Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

The equal proportion of 'tolerant' and 'sensitive' taxa in the macroinvertebrate community resulted in the 'fair' MCI score of 83 units, which was an insignificant (Stark, 1998) 10 units lower than the MCI score recorded at site M4. This score was also an insignificant (Stark, 1998) 2 units lower than the historical median recorded for the site and an insignificant 6 units lower than that recorded by the previous survey at this site (Table 3 and Figure 6).

The SQMCI_s score of 5.3 units was a substantial 1.2 units higher than the median for this site and a substantial 1.3 units higher than that recorded upstream in the current survey (Table 3). It was also substantially higher (by 1.6 units) than that recorded by the previous survey.

It is apparent from the current survey that there were some differences in macroinvertebrate indices between sites M4 and M6. Of the 23 taxa recorded, only 11 were recorded at both sites M4 and M6. In addition, there were four significant changes in taxa abundances between the two sites; likely a result of subtle habitat changes between the two sites or potentially due to a change in sampling technique used between the two sites. The results from the two sites on Manganaha Stream were indicative of reasonable preceding water quality. There was no indication of effects from any discharge from the landfill on the macroinvertebrate community of the stream.

Discussion and conclusions

The Council's standard 'sweep-sampling' technique was used at one site (1), the 'kick-sampling' technique was used at one site (M4), and a combination of the 'sweep-sampling' and 'kick-sampling' techniques was used at three sites (2, PT1 and M6) to collect streambed macroinvertebrates from the Puremu and Manganaha Streams and unnamed tributary of the Puremu Stream on 10 May 2017. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution,

and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This May 2017 macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was higher than the median score for this site and slightly higher than that recorded by the previous survey. The SQMCI_s score was also above the median for the site and higher than that recorded by the previous survey. These results were indicative of 'fair' biological health and were reflective of reasonable preceding water quality.

Site 2 in the Puremu Stream recorded substantially lower MCI and SQMCI_s scores, when compared with site 1, although scores were not substantially different to the historical medians for the site. Site PT1 in the unnamed tributary recorded a MCI score the same as that recorded at site 2 and similar to the historical median for the site. The SQMCI_s score however, was substantially lower than the historical median for the site (by 1.2 units) and equal with the lowest SQMCI_s score recorded by this site to date. It was also substantially lower than that recorded at sites 1 and 2 (by 3.2 units and 2.2 units respectively) and indicated poor physicochemical water quality and/or habitat quality at this site. The iron oxide sediment and high proportion of silt substrate recorded at the time of the survey is likely to have reduced the quality of the habitat at this site.

The upstream site on the Manganaha Stream recorded a MCI score slightly above the historical median for the site, however the SQMCI_s score was substantially lower. These results were indicative of reasonable preceding water quality. In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained an equal proportion of 'tolerant' and 'sensitive' taxa, which resulted in the MCI score of 83 units. This MCI score was an insignificant (Stark, 1998) 10 units lower than that recorded by the upstream site. However, the SQMCI_s score recorded at site M6 was substantially higher than that recorded at site M4. These differences are likely related to subtle differences in habitat between the two sites and potentially to the variation in sampling method used between the two sites.

No undesirable biological growths were detected at any of these sites during this May 2017 survey.

Summary

Overall, the results of this May 2017 survey were indicative of 'poor' to 'fair' biological health in the Puremu Stream and 'poor' biological health in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of 'fair' biological health at sites M4 and M6. In summary, these results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.

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Appendix III

Groundwater results



ANALYSIS REPORT

Page 1 of 5

Client:	Taranaki Regional Council	Lab No:	1790251	SPV1
Contact:	L Smith	Date Received:	10-Jun-2017	
	C/- Taranaki Regional Council	Date Reported:	21-Jun-2017	
	Private Bag 713	Quote No:	36283	
	Stratford 4352	Order No:		
		Client Reference:	Colson Rd Landfill GW May 2017	
		Submitted By:	L Smith	

Sample Type: Aqueous

Sample Name:	GND 0573 08-Jun-2017 9:30 am	GND 0255 08-Jun-2017 11:35 am	GND 1300 08-Jun-2017 2:25 pm	GND 0598 09-Jun-2017 12:15 pm	GND 0251 09-Jun-2017 1:35 pm
Lab Number:	1790251.1	1790251.2	1790251.3	1790251.4	1790251.5

Individual Tests

Dissolved Aluminium	g/m ³	< 0.003	0.015	0.029	< 0.003	0.017
Dissolved Arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Beryllium	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Boron	g/m ³	0.023	0.023	0.019	0.056	0.014
Dissolved Cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Chromium	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005
Dissolved Cobalt	g/m ³	< 0.0002	< 0.0002	0.0002	< 0.0002	< 0.0002
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	0.0008	< 0.0005	< 0.0005
Dissolved Iron	g/m ³	< 0.02	< 0.02	< 0.02	0.29	< 0.02
Dissolved Lead	g/m ³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Manganese	g/m ³	0.0018	0.022	0.0049	0.072	0.0038
Dissolved Selenium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Vanadium	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0013
Dissolved Zinc	g/m ³	0.0010	0.042	0.0150	0.0063	0.0040

Haloethers Trace in SVOC Water Samples by GC-MS

Bis(2-chloroethoxy) methane	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bis(2-chloroethyl)ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bis(2-chloroisopropyl)ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4-Bromophenyl phenyl ether	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
4-Chlorophenyl phenyl ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005

Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS

2,4-Dinitrotoluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,6-Dinitrotoluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
N-Nitrosodi-n-propylamine	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
N-Nitrosodiphenylamine + Diphenylamine	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS

Aldrin	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
alpha-BHC	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
beta-BHC	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
delta-BHC	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
gamma-BHC (Lindane)	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4,4'-DDD	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4,4'-DDE	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4,4'-DDT	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dieldrin	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Endosulfan I	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010



Sample Type: Aqueous						
Sample Name:		GND 0573 08-Jun-2017 9:30 am	GND 0255 08-Jun-2017 11:35 am	GND 1300 08-Jun-2017 2:25 pm	GND 0598 09-Jun-2017 12:15 pm	GND 0251 09-Jun-2017 1:35 pm
Lab Number:		1790251.1	1790251.2	1790251.3	1790251.4	1790251.5
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Endosulfan II	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulfate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Endrin ketone	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Heptachlor epoxide	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Hexachlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Acenaphthylene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Anthracene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[a]anthracene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[a]pyrene (BAP)	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[g,h,i]perylene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[k]fluoranthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
1&2-Chloronaphthalene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Chrysene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Dibenzo[a,h]anthracene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Fluoranthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Fluorene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Indeno(1,2,3-c,d)pyrene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
2-Methylnaphthalene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Naphthalene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Phenanthrene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Pyrene	g/m ³	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,4-Dichlorophenol	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,4,6-Trichlorophenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4-Dimethylphenol	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
3 & 4-Methylphenol (m- + p-cresol)	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2-Methylphenol (o-Cresol)	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Nitrophenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Pentachlorophenol (PCP)	g/m ³	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4,5-Trichlorophenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Diethylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dimethylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Di-n-butylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Di-n-octylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m ³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Di(2-ethylhexyl)adipate	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,3-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,4-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005

Sample Type: Aqueous						
Sample Name:		GND 0573 08-Jun-2017 9:30 am	GND 0255 08-Jun-2017 11:35 am	GND 1300 08-Jun-2017 2:25 pm	GND 0598 09-Jun-2017 12:15 pm	GND 0251 09-Jun-2017 1:35 pm
Lab Number:		1790251.1	1790251.2	1790251.3	1790251.4	1790251.5
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Hexachloroethane	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2,4-Trichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m ³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Carbazole	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dibenzofuran	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Isophorone	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Sample Name:		GND 0575 09-Jun-2017 9:05 am	GND 1301 09-Jun-2017 10:30 am			
Lab Number:		1790251.6	1790251.7			
Individual Tests						
Dissolved Aluminium	g/m ³	0.014	< 0.003	-	-	-
Dissolved Arsenic	g/m ³	< 0.0010	< 0.0010	-	-	-
Dissolved Beryllium	g/m ³	< 0.00010	< 0.00010	-	-	-
Dissolved Boron	g/m ³	0.018	0.022	-	-	-
Dissolved Cadmium	g/m ³	< 0.00005	< 0.00005	-	-	-
Dissolved Chromium	g/m ³	0.0007	< 0.0005	-	-	-
Dissolved Cobalt	g/m ³	< 0.0002	< 0.0002	-	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-	-	-
Dissolved Iron	g/m ³	< 0.02	< 0.02	-	-	-
Dissolved Lead	g/m ³	< 0.00010	< 0.00010	-	-	-
Dissolved Manganese	g/m ³	0.0091	0.0151	-	-	-
Dissolved Selenium	g/m ³	< 0.0010	< 0.0010	-	-	-
Dissolved Vanadium	g/m ³	0.0052	0.0079	-	-	-
Dissolved Zinc	g/m ³	0.0129	0.0069	-	-	-
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m ³	< 0.0005	< 0.0005	-	-	-
Bis(2-chloroethyl)ether	g/m ³	< 0.0005	< 0.0005	-	-	-
Bis(2-chloroisopropyl)ether	g/m ³	< 0.0005	< 0.0005	-	-	-
4-Bromophenyl phenyl ether	g/m ³	< 0.0003	< 0.0003	-	-	-
4-Chlorophenyl phenyl ether	g/m ³	< 0.0005	< 0.0005	-	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
2,4-Dinitrotoluene	g/m ³	< 0.0010	< 0.0010	-	-	-
2,6-Dinitrotoluene	g/m ³	< 0.0010	< 0.0010	-	-	-
Nitrobenzene	g/m ³	< 0.0005	< 0.0005	-	-	-
N-Nitrosodi-n-propylamine	g/m ³	< 0.0010	< 0.0010	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	g/m ³	< 0.0010	< 0.0010	-	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m ³	< 0.0005	< 0.0005	-	-	-
alpha-BHC	g/m ³	< 0.0005	< 0.0005	-	-	-
beta-BHC	g/m ³	< 0.0005	< 0.0005	-	-	-
delta-BHC	g/m ³	< 0.0005	< 0.0005	-	-	-
gamma-BHC (Lindane)	g/m ³	< 0.0005	< 0.0005	-	-	-
4,4'-DDD	g/m ³	< 0.0005	< 0.0005	-	-	-
4,4'-DDE	g/m ³	< 0.0005	< 0.0005	-	-	-
4,4'-DDT	g/m ³	< 0.0010	< 0.0010	-	-	-
Dieldrin	g/m ³	< 0.0005	< 0.0005	-	-	-
Endosulfan I	g/m ³	< 0.0010	< 0.0010	-	-	-
Endosulfan II	g/m ³	< 0.0010	< 0.0010	-	-	-
Endosulfan sulfate	g/m ³	< 0.0010	< 0.0010	-	-	-
Endrin	g/m ³	< 0.0005	< 0.0005	-	-	-
Endrin ketone	g/m ³	< 0.0010	< 0.0010	-	-	-

Sample Type: Aqueous						
Sample Name:		GND 0575 09-Jun-2017 9:05 am	GND 1301 09-Jun-2017 10:30 am			
Lab Number:		1790251.6	1790251.7			
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Heptachlor	g/m ³	< 0.0005	< 0.0005	-	-	-
Heptachlor epoxide	g/m ³	< 0.0005	< 0.0005	-	-	-
Hexachlorobenzene	g/m ³	< 0.0005	< 0.0005	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m ³	< 0.0003	< 0.0003	-	-	-
Acenaphthylene	g/m ³	< 0.0003	< 0.0003	-	-	-
Anthracene	g/m ³	< 0.0003	< 0.0003	-	-	-
Benzo[a]anthracene	g/m ³	< 0.0003	< 0.0003	-	-	-
Benzo[a]pyrene (BAP)	g/m ³	< 0.0003	< 0.0003	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m ³	< 0.0003	< 0.0003	-	-	-
Benzo[g,h,i]perylene	g/m ³	< 0.0003	< 0.0003	-	-	-
Benzo[k]fluoranthene	g/m ³	< 0.0003	< 0.0003	-	-	-
1&2-Chloronaphthalene	g/m ³	< 0.0003	< 0.0003	-	-	-
Chrysene	g/m ³	< 0.0003	< 0.0003	-	-	-
Dibenzo[a,h]anthracene	g/m ³	< 0.0003	< 0.0003	-	-	-
Fluoranthene	g/m ³	< 0.0003	< 0.0003	-	-	-
Fluorene	g/m ³	< 0.0003	< 0.0003	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m ³	< 0.0003	< 0.0003	-	-	-
2-Methylnaphthalene	g/m ³	< 0.0003	< 0.0003	-	-	-
Naphthalene	g/m ³	< 0.0003	< 0.0003	-	-	-
Phenanthrene	g/m ³	< 0.0003	< 0.0003	-	-	-
Pyrene	g/m ³	< 0.0003	< 0.0003	-	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m ³	< 0.0005	< 0.0005	-	-	-
2,4-Dichlorophenol	g/m ³	< 0.0005	< 0.0005	-	-	-
2,4,6-Trichlorophenol	g/m ³	< 0.0010	< 0.0010	-	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m ³	< 0.0010	< 0.0010	-	-	-
2,4-Dimethylphenol	g/m ³	< 0.0005	< 0.0005	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m ³	< 0.0010	< 0.0010	-	-	-
2-Methylphenol (o-Cresol)	g/m ³	< 0.0005	< 0.0005	-	-	-
2-Nitrophenol	g/m ³	< 0.0010	< 0.0010	-	-	-
Pentachlorophenol (PCP)	g/m ³	< 0.010	< 0.010	-	-	-
Phenol	g/m ³	< 0.0010	< 0.0010	-	-	-
2,4,5-Trichlorophenol	g/m ³	< 0.0010	< 0.0010	-	-	-
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m ³	< 0.0010	< 0.0010	-	-	-
Diethylphthalate	g/m ³	< 0.0010	< 0.0010	-	-	-
Dimethylphthalate	g/m ³	< 0.0010	< 0.0010	-	-	-
Di-n-butylphthalate	g/m ³	< 0.0010	< 0.0010	-	-	-
Di-n-octylphthalate	g/m ³	< 0.0010	< 0.0010	-	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m ³	< 0.003	< 0.003	-	-	-
Di(2-ethylhexyl)adipate	g/m ³	< 0.0010	< 0.0010	-	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	-	-	-
1,3-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	-	-	-
1,4-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	-	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m ³	< 0.0005	< 0.0005	-	-	-
Hexachloroethane	g/m ³	< 0.0005	< 0.0005	-	-	-
1,2,4-Trichlorobenzene	g/m ³	< 0.0005	< 0.0005	-	-	-

Sample Type: Aqueous					
Sample Name:		GND 0575 09-Jun-2017 9:05 am	GND 1301 09-Jun-2017 10:30 am		
Lab Number:		1790251.6	1790251.7		
Other SVOC Trace in SVOC Water Samples by GC-MS					
Benzyl alcohol	g/m ³	< 0.005	< 0.005	-	-
Carbazole	g/m ³	< 0.0005	< 0.0005	-	-
Dibenzofuran	g/m ³	< 0.0005	< 0.0005	-	-
Isophorone	g/m ³	< 0.0005	< 0.0005	-	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	1-7
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-7
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.003 g/m ³	1-7
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-7
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-7
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.005 g/m ³	1-7
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00005 g/m ³	1-7
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-7
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0002 g/m ³	1-7
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-7
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-7
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-7
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-7
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-7
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-7
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

