

NPDC Colson Road Landfill
Monitoring Programme
Annual Report
2017-2018

Technical Report 2018-76

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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 2017 to June 2018 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the NPDC's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the NPDC's activities.

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

NPDC holds eight resource consents, which include a total of 105 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 13 inspections, eight stormwater/discharge samples, 17 surface water samples, six groundwater samples, two biomonitoring surveys of receiving waters, and three air quality surveys. NPDC also collected six leachate samples and four under-liner drainage samples for physicochemical analysis, and provided the results of air monitoring carried out on the landfill gas flare.

At inspection issues were found in regards to site management, and although most of them were attended to and none resulted in significant off site effects, the issue of cap management and maintenance on Stage 2 was 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 may be 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 with the exception of one manganese result.

The results of biological monitoring indicated that the discharge of treated stormwater and leachate discharges from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Manganaha Stream. However, the results in the Puremu Stream and tributary indicate there may be impacts in this stream. This may be a result of habitat differences between sites, or may result from landfill discharges. It is recommended that future biological monitoring is carried out in conjunction with physicochemical water quality monitoring, in order to assist with determination of the causes of the poor results.

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.

An enclosed gas flare system was installed during the monitoring period and there was only one unsubstantiated odour complaint received during the 2017-2018 period that was potentially associated with the Colson Road landfill.

Overall, NPDC demonstrated a good level of environmental performance, however an improvement is required in their administrative performance and compliance with the resource consents as defined in Section 1.1.4. During the year under review, on-going and still unresolved issues with the compliance of the

cap on Stage 2 were noted. Although there may be some changes occurring in the receiving water quality below this area with regard to the manganese concentration, with one consent non-compliance recorded, it is not considered to be a significant adverse effect at this point in time. There was also insufficient cover found on areas at the edge of recent disposal at Stage 3. This was in contravention of an abatement notice, and took some time to resolve (three non-compliant inspections), however, there were no resultant adverse effects found. In relation to air discharge matter, there was one minor non-compliance due to a broken cap on a leachate line, but it is noted there has been a significant improvement in the environmental performance at the site following the installation of the landfill gas flare.

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

In terms of overall environmental performance by the consent holder over the last several years, this report shows that the consent holder's performance continued to improve in the year under review, however there is still an improvement required with their administrative performance and compliance with some consent conditions.

This report includes recommendations for the 2018-2019 year.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2017 to June 2018 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.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by NPDC that relate to discharges of water, discharge to land, 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 NPDC's use of water, land and air, and is the 18th 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 ten 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 interpretations, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2018-2019 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

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

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

1.1.4 Evaluation of environmental and administrative performance

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

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

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

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

Environmental Performance

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

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

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;

- Strong odour beyond boundary but no residential properties or other recipient nearby.

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

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

Administrative performance

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

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

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

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

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

1.2 Process description

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 August 2019. Once full, the area will be covered with clay and topsoil to a predetermined specification before being grassed. Leachate from Stages 2 and 3 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

The landfill had been operated for most of its life without significant off site problems, but during the 2014-2015 period, 20 complaints were received regarding odours from the landfill. The Council worked with NPDC to target on site odour sources, whilst a consultant was engaged by NPDC to provide expert advice on remedial actions and longer term solutions. Mitigation measures undertaken by NPDC during the 2014-2015 year included the installation of fixed deodorant sprayers and an automated spray system, and capping of the lateral leachate lines. There was also on-going monitoring of ponding in the landfill foot print to ensure this remained minimal.

The report produced by the consultant in June 2015 identified a number of actions that could be undertaken at the site to improve odour management including:

1. Operational improvements
 - a. Upgrade odour spray system
 - b. Regular visual inspections to identify point sources of landfill gas or odour
 - c. Modifications to leachate collection pipes as a point source of landfill gas
 - d. Improve methodology for sludge disposal
2. Cap remediation particularly with intermediate cover and targeting any gas hotspots
3. Install a gas collection and disposal system

NPDC worked towards implementing the recommendations from the consultant report, with the first two stages involving operational improvements and cap remediation undertaken during the 2015-2016 and early 2016-2017 periods.

Specifically:

- 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 carry out outstanding work such as updating the site management plan, project managing further work to mitigate the point source discharges from the protruding leachate lines, following up on final cover being applied to areas that were 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.
- NPDC recognised that optimal operational performance could not be achieved under the current tender cost and in April 2016 the landfill operator contract was tendered with the intention of lifting operational performance.
- Daily cover practices were improved, with the new contractor opting to trial large metal covers that could be lifted onto 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.

- Clay was used to try to prevent fugitive emissions around leachate line protrusions.
- The large special waste 'lagoon' was remediated.

During 2017-2018 a fully enclosed gas flare was installed at the site as a mitigation measure for reducing odours at the landfill site. The landfill is approaching capacity and is due to close in 2019 but could continue to produce potentially odorous gas for up to 30 years.

Commissioning of the landfill gas management system occurred during January to March 2018, with operational and monitoring procedures developed to ensure the gas system was managed effectively. NPDC operations staff have been provided with training in order to carry out operation of the system in a safe and effective manner, while ongoing support and maintenance is provided by consultants.

There has been a noticeable reduction in odour around the landfill perimeter since all of the above measures have been initiated and the operation of the flare began. This has resulted in no odour complaints being received in relation to the site since October 2017, and only one unsubstantiated complaint that was received in September 2017, before the flare was installed.



Photo 2 Leachate pipes feeding into the gas collection system



Photo 3 The fully enclosed flare

1.3 Resource consents

NPDC holds eight resource consents in relation to the Colson Road landfill (Table 1). 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.

Table 1 Consents held by NPDC that relate to the Colson Road landfill

Consent number	Purpose	Review	Expires
0226-1	Divert Puremu Stream	-	01 Oct 2026
2370-3	Discharge leachate and stormwater from area A to Puremu Stream	June 2020	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	-	01 Jun 2025
4620-1	Discharge uncontaminated stormwater from areas B1, B2, C1 and C2 into the Puremu Stream	-	01 Jun 2025
4621-1	Discharge solids to land	-	01 Jun 2025
4622-1	Discharge emissions to air from composting	-	01 Jun 2025
4779-1	Discharge emissions to air from landfilling	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 permit

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

NPDC holds 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.

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. The conditions of the consent were changed on 24 January 2017 to allow burning of landfill gas so that a landfill gas collection and treatment system could be installed to help prevent odour at the site.

Conditions 1 to 3 relate to the flare, covering the 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.

Condition 4 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 5 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 6 states that no material is to be burnt at the landfill site with the exception of landfill gas in a flare.

Condition 7 states that the discharge shall not give rise to any significant adverse ecological effects on any ecosystems.

Condition 8 states that no extraction venting of untreated landfill gases be located closer than 200 m to any boundary of the landfill property.

Condition 9 requires that the landfill be operated in accordance with consent application and variation supporting documentation and the landfill management plan. The management plan shall be updated at least yearly and offer no lesser level of environmental protection than the original documents.

Condition 10 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 11 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 12 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 13 and 14 outline the provisions for lapsing and review of the consent.

These permits are attached to this report in Appendix I.

1.3.3 Discharges of wastes to land

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

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.

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 2017-2018

Activity	Number
Inspections	13
Discharge samples	2
Stormwater samples	6
Receiving water samples	17
Groundwater samples	6
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 resource consent holders over consent conditions and their interpretation and application;
- Colson Road Liaison Committee meetings;
- discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

The Colson Road landfill site was visited 13 times during the monitoring period. There were 12 routine compliance monitoring inspections undertaken and one additional site visit in relation to rips found in the liner during the final routine compliance monitoring inspection of 2016-2017. With regard to consents for the discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the

consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 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 twice. 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

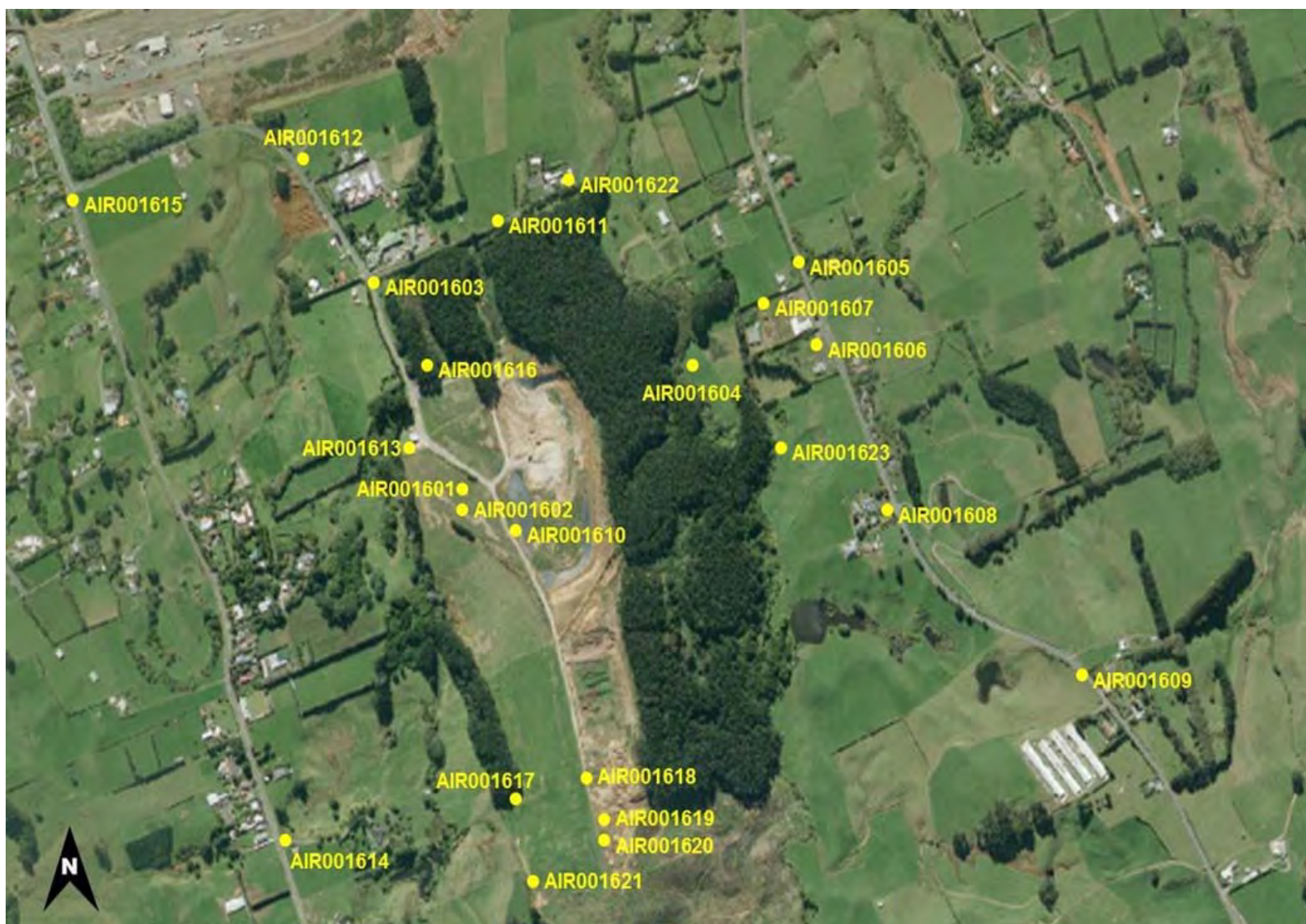


Figure 4 Aerial view showing the positions of air quality monitoring sites at and around Colson Road landfill

2 Results

2.1 Water

2.1.1 Inspections

Twelve routine inspections were undertaken during the 2017-2018 monitoring period, along with a follow-up visit in relation to an inspection undertaken in the previous monitoring period. The site was inspected on: 5 July (follow-up), 11 July, 30 August, 4 October, 9 November, and 20 December 2017, and 19 February, 6 March, 28 March, 3 May, 23 May, 6 June and 26 June 2018.

5 July 2017

A follow up inspection was undertaken in relation to rips found in the liner at the routine compliance monitoring inspection undertaken on 27 June 2017. It was found that repairs were in progress at the time of the re-inspection. The area of the liner containing the majority 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 Warner'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. There was also an area where it was not clear if the liner was intact and/or extended past the edge of the leachate drainage channel. The HSE Manager was asked to ensure that this rip was also repaired and asked to confirm that the liner was intact and extended beyond the leachate drain. Warner staff alerted the inspecting officer to the fact that there was some refuse present under a row of old sandbags that had been found placed under the edge of the original liner. The extent of the refuse was not identified at the time of inspection and Warners staff were instructed to contact the consent holder to ensure that this was also investigated and remediated as required.

11 July 2017

A routine compliance monitoring inspection was undertaken prior to the neighbourhood liaison group (NLG) meeting, to check on the action items from the previous inspection and to check the receiving waters for potential visible environmental effect following the notification of a pump station overflow from the leachate system to the Puremu Stream during the very heavy rainfall on Saturday 8 July. The inspection was undertaken in dry weather with a light changeable wind (southwest to northwest). There had been 79 mm of rain recorded at the wastewater treatment plant, and 94 mm recorded at the Hillsborough rainfall station the weekend prior to this inspection.

The Puremu Stream was checked prior to going on site. It was found that the stream had been very high recently and although receded, the stream flow was still relatively high. There were no visible signs of any adverse effects at the time of inspection and the stream was found to be running clean and clear below the SPCA driveway culvert. The grate at the inlet to the culvert under the SPCA driveway was obstructed and needed clearing.

The cap of stages 1 and 2 was not walked, but the vegetation appeared to be showing a little improvement when compared to the previous inspection. However, the cap was still pugged and the badly rutted gateway is likely to remain an issue. This was discussed at the NLG meeting and the consent holder advised that remediation work on the cap would be undertaken when the cap dried out a bit. This non-compliance was logged on the Council's unauthorised incidents register and is discussed further in Section 2.8.

There was no activity in the compost area at the time of inspection. It was noted that the amount of greenwaste stockpiled and the number of compost windrows was significantly less than at the previous

inspection. The compost ponds were full with a trickle flow discharge to the eastern stormwater drain. The contents of the ponds were dark brown in colour.

There were strong intermittent landfill gas odours between the landfill and the compost area and on the eastern side of the landfill.

There was only one special waste pit in operation, with all the other excavations found at the previous inspection having been filled.

There was ponding of leachate/stormwater present on the western side of the special waste pit. Fugitive landfill gas emissions were occurring from small holes under the ponded surface.

The liner repairs in the eastern side of the landfill looked good and all leachate breakouts appeared to be contained at the time of the inspection. The location of the leachate breakouts indicated that there was likely to be a lot of leachate/stormwater backed up in the landfill. It was noted that the cap on a leachate pipe alongside the eastern litter fence had been damaged and there were very strong landfill gas odour in this area. The gas levels recorded at the broken cap were methane LEL: > 99%, H₂S: 67 ppm, VOC: 21 ppm, NH₃: 4 ppm, CO: 3 ppm. This non-compliance with consent was logged on the Council's unauthorised incidents register and is discussed further in Section 2.8. There were also very strong localised landfill gas odours present in the vicinity of the other leachate pipe to the south of this one.

It was noted that the grass seed was starting to sprout on the covered areas on the eastern side of the landfill.

The tipping pit and compactor were in operation at the time of inspection, and appeared to be well managed. The area of exposed refuse was estimated to be less than the 900 m² limit given in the site management plan.

There was a lot of sediment on the site roadways especially in the vicinity of the ponds. This had the potential to cause dust issues when it dries out. It was found that although there were silt fences in some places, there was a lot of silt below the fences, and evidence that this was washing over the bank into the area of the leachate pond. There were signs out advising that the area should not be entered due to the discharge from the pump station at the top of the road to the leachate and small silt ponds, along with a gravel barrier, so the condition of the ponds and pond discharges were not checked.

Again there was very little wind-blown refuse evident.

The following action was to be undertaken:

- Clear the grate at the inlet to the SPCA driveway culvert
- Repair the damaged cap on the leachate line
- 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. Improved silt control measures are recommended to prevent surface run off of silt entering the pond
- Continue to ensure that damage to the cap from farming activities is prevented, and that the cap remediation is carried out when weather permits.

30 August 2017

The receiving water tributaries downstream of the site were checked prior to inspection. It was found that there were still heterotrophic growths present in the eastern tributary, however the amount and area affected had reduced significantly. There were no growths present in the western tributary or downstream of the confluence.

There was tracking of silt present on Colson Road just outside the gate, and localised dust clouds were generated with passing vehicles. There were no offensive or objectionable odours off site.

The vegetation was re-establishing on the cap of Stage 2, but there was still pugging and wheel ruts present. The cap was not walked. The inspecting officer was informed that it had still been too wet to undertake any remediation on the cap. Therefore the cap remained non-compliant. It was found that a dish drain had been dug across the access road just south of the compost area to direct stormwater from the Stage 2 cap to the compost ponds to prevent flooding on the access road.

The compost area was quite full, with minor amounts of non-green waste present in the drop-off area. The compost piles were estimated to contain less than 5 % non-plant derived material. The consent holder was asked to continue to ensure that this material is removed and disposed of appropriately prior to shredding. The compost ponds were full of dark brown stormwater/leachate, and were discharging at a trickle flow. There were low level compost odours between the compost area and the landfill.

The special waste pit was well covered and was considered to be well managed at the time of the inspection. There was a reduced amount of ponding and fugitive landfill gas emissions observed on the southern flat to the west of the special waste pit. There were minor amounts of exposed/partially exposed refuse present, likely to be due to effects of the recent winds and torrential rain either carrying wind-blown litter or washing off some of the cover. This was to be addressed when weather permitted.

The leachate and stormwater drains on the eastern side of the landfill were well formed and appeared to be effective. The broken cap on the leachate line had been repaired.

There was also ponding and some partially exposed refuse present on the northern flat. The inspecting officer was informed that the contractors would be using that area for landfilling soon.

Again there was a lot of silt present on the northern access road and in the ponds due to the heavy rain in the preceding few days (30 mm of rain in 4 hours, with a maximum intensity of 2 mm in 5 minutes, two days prior to the inspection). There was also silt deposition observed in the tributary below the eastern small silt pond. Road sweeping, pond cleaning and potential methods of silt retention (e.g. silt fencing, compaction etc) were discussed as possible means of trying to prevent silt from getting into more critical areas such as the ditch at the northern toe of the landfill and the leachate pond. It was acknowledged that good soil compaction cannot be achieved with Taranaki Ash in the prevailing weather conditions. The drain at the northern toe, small silt pond(s) and the large silt pond weir and inlet end needed to be de-silted when it was safe to access the areas with heavy machinery.

The water level in the leachate pond was relatively high. The contractor's staff advised that he had been adjusting the flows to the pond regularly and had reduced the volumes in the landfill a lot prior the latest heavy rain. Adjustments were still being made, and it was found that the manhole cover was not in place over the leachate line south of the large silt pond so that the flows to the leachate pond could be monitored. Although not an issue at the time of inspection, staff were advised that this was the manhole from which there can be a reasonable amount of fugitive landfill gas emission, and needs to be managed carefully to avoid contributing to potential off site effects.

The following action was to be undertaken:

- Continue to remove inorganic and non-plant derived material from the compost drop off area, and dispose of appropriately to ensure compliance with consent 4622;
- 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. Improved silt control measures are recommended to prevent surface run off of silt entering the ditch at the northern toe and the pond; and
- Continue to ensure that damage to the cap from farming activities is prevented, and that the cap remediation is carried out when weather permits.

4 October 2017

The site was inspected in overcast conditions with a fresh south-westerly breeze. There had been 13.5 mm of rain recorded at the New Plymouth wastewater treatment plant in the four days prior to the inspection.

The Puremu Stream and tributaries were visually assessed prior to entering the landfill site. It was found that there was a slight iron oxide turbidity to the flow of all three waterbodies, and they were all flowing over heavy iron oxide beds. It was observed that there was a "tongue" of iron oxide deposits present extending just beyond the outlet from the eastern tributary that would need to be monitored and removed if it looked like it was likely to break off. There were no heterotrophic growths present in the western tributary or the Puremu Stream itself, downstream of the confluence. The grate at the inlet to the culvert that runs under the SPCA driveway was unobstructed. There was a reduced amount of heterotrophic growths present in the eastern tributary within the mixing zone. The growths were present both upstream and downstream of the track culvert. The track culvert was unobstructed.

On entry to the site there was a strong domestic sewage odour present as a Gas and Plumbing truck entered the site and stopped at the weighbridge. It was noted that the material on the truck was not covered. Although the odour was very strong, it was localised and dissipated quickly after the truck left the weighbridge.

The site inspection was undertaken with the Contractor's acting site supervisor.

It was found that, although there was grass re-establishment on the Stage 2 cap, there was still pugging, erosion and localised ponding present, and it was therefore still non-compliant. It was recommended that the cap be rolled to flatten the affected areas and prevent the ponding that was occurring in the hoof prints before the ground hardens. The larger depressions and eroded gateway would need to be reinstated as soon as weather permitted. The plan NPDC had for removing the fencing, but leaving the posts in place was discussed with the acting site supervisor.

The old Return2Earth compost area was now being used to store stockpiled cover material. There was no activity occurring in the Revital compost area at the time of inspection. The area was approximately half full of compost windrows, and it was noted that there was very little non-plant derived material visible in the windrows. It was observed that with the increase in heavy traffic movements occurring on the compost area pad, it had become quite damaged, with rutting and some large areas of ponded compost leachate present. This may have the potential to impact on groundwater quality, and consideration may need to be given to installing a groundwater monitoring bore between the compost area and landfill to detect any changes that might be occurring. The compost ponds were full of dark brown stormwater/leachate, with a trickle flow discharge occurring from the last pond to the eastern stormwater drain. There was no litter present in or around these ponds.

At the landfill it was found that the leachate system was likely to be quite full of stormwater/leachate as there were leachate breakouts still occurring at relatively elevated areas at the southern end of the landfill. There were also areas of ponding present on both the special waste flat and on the lower flat on which filling was currently occurring. The inspecting officer was informed that drainage work was scheduled to drain the ponding that was present adjacent to the new special waste pit. At the time of inspection, all other leachate breakouts were being appropriately captured and directed to the leachate system.

Varying degrees of cover was present over all but the working area, which was within the 900 m² required by the landfill management plan. However, in contrast to recent previous inspections, it was found that there were minor amounts of partially exposed and/or windblown refuse present across a lot of the filled area. It was also found that along the eastern batter there were areas where the cover had slumped exposing refuse, or there had been insufficient cover applied. This non-compliance was recorded on Council's unauthorised incidents register and is discussed further in Section 2.8. The inspecting officer was advised that staff had been instructed to apply additional cover on the flats earlier that day, and this work

was in progress. The difficulties being experienced moving the heavy vehicles across the temporary caps were evident at the time of the inspection, with deep tracks in the cover material around the digger being used to undertake this work. The difficulties in achieving cover compaction with the saturated peaty material and Taranaki ash were discussed. It was recommended to both the acting site supervisor and NPDC staff that the Contractor's Site Manager be contacted to request additional resources to ensure that the daily cover requirements were being met.

It was found that there was a lot of silt present in the bunded trench at the northern toe, the small silt ponds, the tributary below the small silt ponds, and in and below the weir at the large silt pond. The acting site supervisor was advised that the onsite trenches, weir and ponds needed desilting to ensure adequate retention times and treatment of the site discharges. It was found that the level in the leachate pond was relatively high, and the discharge to this pond was being managed appropriately. It was requested that the silt content of the pond be monitored to ensure that the outlet grate remained unobstructed.

It was observed that stone traps had been placed in the open drain on the eastern side of the main access road to aid in silt retention, however it was noted that the silt socks at the stormwater grates near the weighbridge were not positioned correctly.

The concrete pad to accommodate the landfill gas flare had been installed.

The contents of the large silt pond were dark brown, and it was noted that the discharge and tributary was also discoloured dark brown. At the end of the inspection NPDC staff were shown the areas of the eastern tributary (within the mixing zone) that were affected by the heterotrophic growths. The NPDC staff undertook to investigate the matter further.

The following action was to be undertaken:

- Ensure that the cover requirements of the Colson Road Landfill Management Plan are being complied with at all times as required by abatement notice EAC-20881;
- Monitor iron oxide deposits and heterotrophic growths in the eastern tributary and address if required;
- Address pugging on the cap of Stage 2 and continue to ensure that damage to the cap from farming activities is prevented;
- Remediate the eroded areas of the Stage 2 cap as soon as the weather permits;
- Continue to ensure that leachate breakouts are managed appropriately;
- De-silt the leachate trench at the northern toe of the landfill, the weir at the large silt pond and the small and large silt ponds;
- Re-position the silt socks at the drains grates near the weighbridge;
- 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.

9 November 2017

The site was inspected in fine conditions with a light south westerly breeze. There had been 18 mm of rain recorded at the Hillsborough weather station in the four days prior to the inspection.

The Puremu Stream and tributaries were flowing at a low, steady flow. An iron oxide layer was present on the bed of each stream. The "tongue" of iron oxide deposits extending from the eastern tributary (noted in the previous inspection) appeared to show no change in size or position, and the oxide deposits appeared to be attached to vegetation in the substrate of the stream. There were no heterotrophic growths observed in either the Puremu Stream downstream of the confluence or its western tributary. The heterotrophic growths observed in the eastern tributary in the previous inspection were still present, although they did not appear to have increased in size. The growths were present both upstream and downstream of the track

culvert. The track culvert and the grate at the inlet to the culvert under the SPCA driveway were both unobstructed.

No trucks were using the weighbridge at the time of entry, and no localised odours were noted.

Although still non-compliant, the Stage 2 cap was in the process of being re-contoured and remediated following the removal of all stock and the termination of the lease with the farmer. The cap had been tilled and additional cover appeared to have been placed in low-lying areas. All existing fences and gateways on the cap had been removed, in preparation for maize cropping following the completion of earthworks. Stormwater drains on either side of the cap were still in place, with no obstructions to flow apparent. There were no signs of overland flow or runoff from the area, and no dust or odour was noted. The batters were intact, with no slumping, cracking or exposed refuse.

The former Return2Earth compost area was still being utilised to stockpile cover material. Composting activity was underway in the Revital compost area at the time of inspection. The area was approximately two-thirds full of compost windrows, with very little non-plant derived material noted. Previous issues with heavy traffic damage and localised ponding in the area appeared to have been addressed, with only a minor amount of ponding observed in the southwestern edge of the compost site. No odour associated with the composting activity was detected. The compost ponds were half-full of dark brown stormwater/leachate, with no discharge occurring from the last pond to the eastern stormwater drain. There was no litter present in or around these ponds.

At the landfill it was found that the leachate system was still likely to be quite full of stormwater/leachate as there were a few minor leachate breakouts noted at the south-eastern end of the landfill. Areas of ponding previously observed on both the special waste flat and on the lower flat on which filling was occurring had been addressed, and no ponding was observed in these locations. At the time of the inspection, all leachate breakouts were being appropriately captured and directed to the leachate system.

Varying degrees of cover were present over all but the working area, which was within the 900 m² required by the landfill management plan. The minor amounts of partially exposed and/or windblown refuse present across a lot of the filled area in the previous inspection were now restricted to the active fill area only.

Although additional cover material had been applied to some of the areas on the eastern batter where insufficient cover and/or slumping and exposed refuse had been noted in the previous inspection, a portion of the eastern batter, towards the south-eastern corner, was still non-compliant with consent conditions, showing no visible improvement in cover since the previous inspection.

The localised area in the bunded drain at the northern toe was found to still be containing refuse and large amounts of silt. This area requires de-silting to ensure that there is adequate storage capacity for leachate in the drain, and to minimise the potential for overflow to the Manganaha Stream.

The large silt pond, the two smaller silt ponds, and the tributary below the discharge point of all three ponds all showed signs of silt accumulation. The large silt pond had been emptied, although it was unclear if this was in preparation of de-silting work.

It was found that the level in the leachate pond was moderately high, and the discharge to this pond was being managed appropriately. It was requested that the silt content of the pond continue be monitored to ensure that the outlet grate remained unobstructed.

The silt sock at the stormwater grates near the weighbridge had been re-positioned correctly, following the advice from the previous inspection.

The following action was to be undertaken:

- Ensure that the cover requirements of the Colson Road Landfill Management Plan are being complied with at all times as required by abatement notice EAC-20881;

- Monitor iron oxide deposits and heterotrophic growths in the eastern tributary and address if required;
- Continue to ensure that leachate breakouts are managed appropriately;
- De-silt the leachate trench at the northern toe of the landfill, the weir at the large silt pond and the small and large silt ponds;
- 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.

20 December 2017

The inspection was undertaken in fine weather. There had been 9.5 mm of rain recorded at the Hillsborough monitoring station in the two days prior to the inspection.

There were minor amounts of refuse present on Colson Road. No off site odours or dust issues were found. There was clear flow in both tributaries over heavy iron oxide beds. There were some small patches of heterotrophic growths in the eastern tributary, but none in the western tributary or downstream of the confluence. The culvert grate was clear.

The inspecting officer was accompanied by a Warner's staff member, who was picking up the few windblown plastic bags encountered on site during the inspection. A staff member was also observed undertaking a litter pick around the site.

There was some top soils on site containing concrete, wood etc. that the inspecting officer was informed was to be sifted and used as top soil cover. The Warner's staff member was unsure of where this soil had come from. The Contractor was informed that it needed to be confirmed that the soil was uncontaminated for it to be used as top soil in the final cap.

It was observed that there was maize growing on the re-contoured cap of Stage 2. The inspecting officer was informed that the re-contouring went smoothly, however there were some patches of the in-situ cover that were contaminated with refuse. These were removed to landfill and then backfilled with clean cover. The cap was compliant with consent conditions at the time of inspection.

The compost area was relatively full, with no activity occurring at the time of inspection. There were intermittent landfill gas odours on the southern side of the cap, just inside the litter fence. It was noted that, in the dry weather, cracks were opening up. There was no landfill gas (LFG) detectable at most of the cracks, although at some ammonia at up to 1 ppm and methane at up to 5 % LEL were detected. There was a localised strong intermittent aged refuse odour present at the southern end of the landfill where trenches had been dug to install the gas capture lines. It was observed that there were approximately 12 taps in the line to enable the control of the gas flow to the flare. There were leachate line ends open to enable the work. There were no localised odours at this point due to the wind conditions, however there was methane at 100 % LEL; hydrogen sulphide at 5 ppm, VOC at 1.2 ppm, with no ammonia or carbon monoxide detected.

It was observed that there was still a minor amount of refuse exposed at the location previously advised to Warner and the consent holder, and was therefore still non-compliant.

The inspecting officer was informed that after Christmas, the open leachate drain was to be dug out, piped and enclosed as per the western side. The consent holder was informed that the stormwater from within the landfill can only go to the eastern stormwater drain (and into the tributary after treatment in the big silt pond) once there is good interim cover and grassing or other suitable stabilisation done.

The inspecting officer was advised that there was work to be done on the eastern (eroded) end of the leachate bund at the northern end of the toe, which would be starting later that day to ensure adequate cover and make a new temporary drainage channel.

There were intermittent LFG odours at the eastern and north eastern sides of the landfill. Localised dust was being generated with traffic movements. It was found that the leachate pond was empty and free of silt. The small sediment ponds were in satisfactory condition.

It was found that the flare was in place and all the gas capture lines had been plumbed in, and it was hoped that the system could be commissioned soon.

The following action was to be undertaken:

- Ensure that the cover requirements of the Colson Road Landfill Management Plan are being complied with at all times as required by abatement notice EAC-20881;
- Monitor iron oxide deposits and heterotrophic growths in the eastern tributary and address if required;
- Ensure adequate dust control measures are employed to prevent off site effects;
- Ensure that there is a good intermediate standard cover in place (as per the management plan) and that this is grassed or otherwise stabilised before any stormwater from within the footprint is allowed to go to the stream; and
- Continue to 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.

19 February 2018

The inspection was undertaken in fine, hot weather with calm wind conditions. There had been no rain recorded at the Hillsborough monitoring station in the six days prior to the inspection.

It was found that there was a lot of litter present on Colson Road, most of which was between the transfer station and the landfill main gate. A number of truckloads of refuse were observed at the site during the inspection. There were a variety of waste contractors' trucks, and it was noted that all but three arrived with covers over the refuse. The three uncovered vehicles had waste visible above the sides of the truck and were all EnviroWaste trucks.

All stormwater ponds and the leachate pond appeared satisfactory. It was noted that the water level in the tributary below the big silt pond was quite high, indicating that the water may be getting impounded somewhere in the wetland/tributary. Heterotrophic growths were again present in the eastern tributary and absent from the western tributary. The SPCA driveway culvert was unobstructed, but it looked like heterotrophic growths may be starting to form at the culvert grate. There were no heterotrophic growths found downstream of the culvert at PMU000113.

The odour mitigating sprays were active on arrival, and stopped at about 9.30am. The LFG flare was also in operation. There had been light intermittent LFG odours present off site prior to inspection and intermittent aged waste type odours present at the Puremu Stream culvert outlet to the left of the northern (pond) access road.

The filter sock around the stormwater drain on the eastern side of the kiosk needed to be repositioned as it did not extend all the way across the gutter drain. This was done at the time of inspection.

It was found that the manhole cover was off the leachate drain by the big silt pond. The inspecting officer was informed that this was due to work being carried out to prevent a back flow of air from this drain to the LFG flare when the leachate drain valve was opened. There was no one present in the area of this manhole at the time of inspection, and staff were reminded that this cover needs to be replaced whenever access is not required to minimise LFG emissions.

The clean stormwater drain alongside the northern (pond) access road contained quite a lot of silt, and it was noted that there was a significant area of the northern toe that was covered with uncompacted soil. As the leachate drain at the northern toe had been filled stormwater flow from this area would be likely to flow

north and/or west along the road. Additional silt controls and/or stabilisation was advised prior to the heavy rainfall event expected the following day. Concern over the amount of uncompacted material in the light of the expected bad weather was discussed both with Warner's and NPDC following the inspection. There was an adequate amount of cover over the refuse on site and the area of exposed refuse was estimated to be within the area required by the landfill management plan. The special waste pit was well managed, with the waste in the pit covered. Vegetation was starting to establish well on the western batter.

The composting area was satisfactory, although it is recommended that the fuel trailer be moved to further away from the stormwater drains.

There was quite a lot of what appeared to be reclaimed cover at the southern end of the landfill. To the east of the track that at one time serviced the southern special waste pits, there were fissures in the cover that had been applied during wet weather. There were no LFG components detected. To the west of this track there were some strong intermittent aged refuse type odours. The source of the odour could not be found at inspection. This was discussed with Warner's staff post inspection, who undertook to investigate further and remediate if necessary.

The metal tracks on site were very dry and dusty at the time of inspection. A lot of dust was mobilised with both light and heavy vehicle movements. The dust was drifting towards the south, and it appeared that the majority of it settled and/or dispersed within the site boundary. However, the tracks should be kept damp in these dry weather conditions to minimise the potential for off site effects if stronger winds develop. The sealed tracks were well maintained and dust free.

There were strong LFG odours found in the immediate vicinity of the white stand pipe that the inspecting officer was informed was to allow cleaning of the leachate lines. The pipe end was sealed, but the LFG was escaping from the stones to the north of the pipe. The LFG components detected were 9.3 ppm H₂S, over range (>99 %) methane LEL and 2.4 ppm VOC. There were also strong aged refuse odours in the vicinity of the wheel wash pit. The contents of the pit were discoloured, bubbling and had some refuse present.

The LFG flare commissioning progress was discussed with NPDC staff. The inspecting officer was informed that the flare is being run, but that there were a few bits of work that needed to be undertaken before the draw off from various parts of the landfill could be balanced.

The following action was to be undertaken:

- Address litter on Colson Road;
- Clean out wheel wash pit and ensure that the contents remain of acceptable quality to drain to surface water, or ensure that there are no discharges to surface water from this facility;
- Monitor iron oxide deposits and heterotrophic growths in the eastern tributary and address if required;
- Ensure adequate dust control measures are employed to prevent off site effects;
- Ensure uncompacted cover is stabilised so that adequate cover is maintained and to minimise stormwater contamination; and
- It is recommended that the fuel trailer at the composting area is moved further from stormwater drainage.

6 March 2018

The inspection was undertaken in fine, hot weather with very light to light westerly wind conditions. There had been no rain recorded at the Hillsborough monitoring station in the 6 days prior to the inspection. An air monitoring survey was conducted prior to and during the inspection. The maximum off site suspended particulate concentration recorded was 0.02 mg/m³ at the north eastern boundary of the site. Higher suspended particulate readings (up to 0.50 mg/m³ instantaneous) were recorded on site, approximately 50 metres away from a refuse truck travelling on the gravel track to the tipping area. There were no LFG

components detected off site or at the specific on site monitoring locations checked. The only odours detected off site were low level LFG odours and vegetative type odours noted on Egmont Road at the entrance to 210 Egmont Road.

There was again a lot of refuse observed on Colson Road between the transfer station and the outer landfill gates. The heterotrophic growths were still present in the eastern tributary, and it appeared that growths may have started to establish at the inlet to the SPCA driveway culvert, however there were no growths observed downstream of the mixing zone (site PMU000130). The socks were observed to be in place at the stormwater grates by the weighbridge.

An EnviroWaste vehicle was observed entering the site, uncovered, and with waste visible above the sides of the truck. A lot of dust was being generated by vehicle movements on the gravel tracks on site, which took some time to settle. Due to the wind conditions at the time of the inspection, the dust clouds did not appear to be extending past the site boundary. However the surface of the tracks were predominantly made up of very fine material that was very dry and mobilised easily. This was occurring even when the vehicles were moving at speeds of less than the 20 km/hr limit. There was no water truck observed on site at the time of inspection.

The Revital area appeared to be full, with a reasonable amount of greenwaste stock piled for shredding. There was no activity occurring in this area at the time of inspection, and it was observed that the fuel trailer was still close to the stormwater drainage channels.

The maize was still standing on the Stage 2 cap, and the inspecting officer was informed that this would be harvested soon. It was noted that an agricultural contractor had signed in at the site earlier that day.

Cover was continuing to establish well on the western batter, and this area looked very tidy. The working area was very compact and estimated to be within the 900 m² required by the management plan. Saw dust and soil had been used to cover most of the waste material present in the special waste pit. Objectionable sewage/rotting vegetation type odours were found on the southern end of the tip access road. Although the source could not be identified, the odours were strongest close to a pile of what appeared to be rich organic material that looked to have been disturbed recently. At the end of the inspection the weighbridge staff was notified of this and the inspecting officer recommended that the operators try to identify and remediate the source of the odours to prevent potential for off site effects.

There were strong LFG odours present at the white stand pipe at the edge of the tip access track. This area was identified as a point source for fugitive landfill gas emissions at the previous inspection as well as at this current inspection.

The pit below the wash pad was still found to be unsuitable for discharge to natural waters. There were odours present in the immediate vicinity of this pit.

The other treatment/collection ponds on site appeared to be in satisfactory condition, with none appearing to contain excessive amounts of silt or any wind-blown refuse.

Placement of cover was continuing on the northern batters. It was again noted that there were large areas of un-compacted cover, which could be mobilised by rainfall.

The flare was operating at the time of inspection with only what appeared to be a heat haze visible coming from the stack.

The following action was to be undertaken:

- Address litter on Colson Road;
- Clean out wheel wash pit and ensure that the contents remain of acceptable quality to drain to surface water, or ensure that there are no discharges to surface water from this facility;

- Monitor iron oxide deposits and heterotrophic growths in the eastern tributary and address if required;
- Ensure adequate dust control measures are employed to prevent off site effects;
- Ensure un-compacted cover is stabilised so that adequate cover is maintained and to minimise stormwater contamination;
- Identify source of and use appropriate mitigation measures to prevent the objectionable odours found on site from causing off site effects; and
- It is recommended that the fuel trailer at the composting area is moved further from stormwater drainage.

28 March 2018

The site was inspected in wet weather with a gentle north westerly breeze. There had been 92 mm of rain in the week preceding the inspection.

There was a moderate amount of refuse present on Colson Road between the outer site gates and the transfer station.

Monitoring of the flare inflow gases was being undertaken at the time of inspection. It was outlined that the riser had been put in place in the leachate manhole to prevent the draw back of air occurring when the leachate drain valve was opened. This now meant that this line could be left partially open again to drain leachate without causing the flare to shut down due to an increased oxygen concentration. It was noted that the system had a number of real time sensors in place monitoring the landfill gas in-flows and the flare temperature. There was a hydrogen sulphide eliminating filter on the line to the monitoring equipment to protect them from corrosion. The monitoring information was sent straight through to "water outlook" and was therefore available to staff to check on the performance of the flare. It was outlined that NPDC staff undertook some of the maintenance required, however, any "intrusive" maintenance was carried out by the supplier due to the gas certification requirements. Balancing of the draw off from the various leachate lines was being undertaken approximately weekly by NPDC staff under advisement from Tonkin and Taylor. NPDC undertake measurements on the separate lines, report the results to Tonkin and Taylor, and Tonkin and Taylor advise NPDC staff of the adjustments required. It was outlined that there were further adjustments to be undertaken to increase the draw off from the southern end of the landfill as the methane concentrations in this area were up to 69%. Tonkin and Taylor have also advised surface emissions monitoring to check whether the fugitive cap emissions have been addressed by the Stage 1 gas capture system pipework.

At inspection it was found that silt controls on the southern side of the access road to the flare were in need of cleaning out. The silt ponds and the leachate pond were in satisfactory condition, and the outlet from the Puremu Stream culvert was unobstructed. Although the sock was in place on the eastern side of the road at the kiosk, sediment laden stormwater was still entering the stormwater drain.

The maize had been harvested from the Stage 2 cap and grass was beginning to establish. The fuel trailer was still close to the stormwater drain at the Revital compost area.

Grass was establishing well on the western side of the landfill below where they were filling at the time of inspection. There were cracks present in the intermediate cap on the upper south eastern level that would have the potential to allow fugitive LFG emissions. NPDC were asked to monitor these and adjust gas draw-off to the flare if required.

Litter picking was occurring at the time of inspection, and there were only very minor amounts of windblown refuse observed on site. There were strong LFG odours present on the access road to the tip head. These were strongest in the vicinity of the white pipe on the western side of this road, and LFG was observed bubbling up through the small areas of ponded stormwater next to this pipe.

The special waste pit was full and the material was not covered at the time of inspection. It was noted that there were a couple of double bagged asbestos like roofing material in the pit with the bags split open. Warner's staff were alerted to this immediately, and they undertook to have the matter addressed straight away.

Refurbishment of the metal covers was being undertaken. The vehicle wash was not in use at the time of inspection, but it was noted that there was bit of refuse present on the metalled area just in front of the pad. The contents of the pit below the pad were much cleaner, and were rubbish free.

The following action was to be undertaken:

- Ensure effective silt controls are in place across the site;
- Ensure special waste is managed according to the landfill management plan;
- It is recommended that the fuel trailer at the composting area is moved further from stormwater drainage.

3 May 2018

The site was inspected in fine weather with calm to light westerly to north westerly wind conditions. There had been 17 mm of rainfall in the week preceding the inspection.

There were no off site odours or dust issues found prior to going on site. There was a moderate amount of refuse present on Colson Road between the transfer station and the landfill gates.

There were quite extensive growths present in the eastern tributary, however the orange/red colouration appeared to be more consistent with iron oxide, rather than the white/grey growths observed at previous inspections.

There was no vegetative growth present on Stage 2, with the exception of some small isolated patches of weed/corn seedlings. In a discussion with Warner's staff, the inspecting officer was informed that further remediation works had recently taken place to improve the contouring and that grass seed had been put down the previous week. The inspecting officer was also informed that during the post harvesting work, it had been found that there were a few areas where the cap was only approximately 150-200mm deep, and that it was proposed that further contouring, fertilising and planting of another maize crop be carried out to further remediate the cap. The Warner's representative was advised that the consent requires that vegetative cover be maintained and that the maize cropping was permitted as a one off activity associated with remediation of the stock pugging and erosion. A consent variation was likely to be required for cropping to occur again and that the matter of the thin areas of the cap and what, if any, remedial work would need to be undertaken would be discussed with NPDC.

It appeared that the composting area had expanded into the flats to the east created by the extraction of cover material. It appeared that the stormwater run-off from this area may drain straight into the eastern landfill stormwater drain, avoiding the composts stormwater treatment ponds. All stormwater from the composting area needs to be directed through the compost treatment ponds.

Filling was now occurring from the highest level, approximately a third of the way towards the northern end. The tipping pit was being accessed from the track between the southern litter fence and the compost ponds. It appeared that there may be potential for there to be run-off from the areas being filled to the clean stormwater areas. The inspecting officer was informed that bunding and drainage was being worked on to contain the contaminated stormwater/leachate from the current disposal areas.

There were strong intermittent fresh and aged refuse odours present at the southern end of the landfill.

There were light LFG odours present on the mid-level access road (that was the level fill was currently being filled on). The landfill gas components measured at the point of discharge where the white pipe protruded from the landfill were >99 % methane LEL and 2.2 ppm H₂S. This was the only point source discharge

identified, and there were no ambient LFG components measured during the inspection. There were also small dust clouds with vehicle movements, however these settled within the landfill boundary.

There was good cover over the material in the special waste pit.

The flare was in operation at the time of inspection, with no visible emissions except for a heat haze.

The stormwater and leachate ponds were generally in acceptable condition, however the small western pond needed to be de-silted and there were nightshade trees starting to grow in the eastern small pond. It was recommended that Warner contact the Council's biosecurity staff for advice on controlling this weed. The Puremu Stream outlet grate was clear of obstructions.

The vehicle wash was in use at the time of inspection. The outside of a utility vehicle was being washed, which would have had no contact with refuse. The contents of wheel wash pit appeared to be in an acceptable condition.

The following action was to be undertaken:

- Address litter on Colson Road;
- Assess cap on Stage 2 to ensure that the cap depth is adequate, and monitor to ensure that grass establishment occurs prior to the onset of winter weather;
- Ensure that contaminated stormwater/leachate from the compost area and active filling areas is captured and directed to the appropriate disposal routes;
- De-silt the western small silt pond and remove nightshade trees from the eastern small silt pond.

23 May 2018

The site was inspected in weather alternating between light drizzle and clear skies, with a light westerly wind. There had been heavy rain overnight, with approximately 40 mm of rainfall recorded at the Hillsborough monitoring station in the week preceding the inspection.

There were no off site odours or dust issues observed prior to going on site. There was very little refuse present on Colson Road between the transfer station and the landfill gates.

The streams below the site were both running fairly high and were slightly cloudy due to the heavy rain overnight. No heterotrophic growths were observed.

The odour mitigating sprays were active on arrival. Silt socks were observed to be in place at the stormwater grates by the weighbridge. Very mild odours were observed in the area between Stages 2 and 3.

Grass was beginning to establish on Stage 2 (approx 5 cm long). There were a couple of areas where water was ponding due to the way the ground had been contoured. Rilling was also observed and the soil was extremely soft/muddy and sufficiency of capping and/or compaction may need to be addressed as per special conditions 2, 8 and 10 of consent 2370-3. The cap was considered to be non-compliant with the conditions of consent 2370-3 and this was therefore logged on Council's unauthorised incidents register and is discussed further in Section 2.8.

The composting area was relatively full, with no activity occurring at the time of the inspection. There were no odours around the composting area and all stormwater exiting the area was passing through the compost treatment ponds. There was very little litter present around the compost area and none on the netting drain covers.

There were very mild refuse odours present at the southern end of the landfill. No dust was noted at any stage during the inspection.

Filling continued to occur from the highest level. The tipping pit was being accessed from the track between the southern litter fence and the compost ponds. The working area was compact and estimated to be within the 900 m² required by the management plan.

There were noticeable landfill gas odours present at the white stand pipe at the edge of the tip access track, however these odours were mild compared to the strong odours observed during the previous inspection. This area has been identified as a point source for fugitive landfill gas emissions at previous inspections.

There was a new contour/bund present around most of the north-eastern side of the tip face down the side of the roadway (not in place during the previous inspection) and below this a trench had been dug to trap any run-off coming down the roadway. This was overflowing in one part and the overflow was captured below in another bund. Some stormwater/silt was flowing through the fence and down into the stormwater pond. Grass cover was beginning to establish along the northern and western sides of the site.

The flare was in operation at the time of inspection, with no visible emissions except for a heat haze. No odours were observed around the flare. Staff were observed picking up litter in this area.

The stormwater and leachate ponds were generally in acceptable condition and no odours or litter were observed around these. It was noted that the water level in the tributary below the big silt pond was quite high, indicating that the water may be getting impounded somewhere in the wetland/tributary. The Puremu Stream outlet grate was clear of obstructions.

The vehicle wash was in use at the time of inspection. The contents of wheel wash pit appeared to be in an acceptable condition.

The following action was to be undertaken:

- Address cap on Stage 2 to ensure that the contour is adequate to prevent ponding/run off (rilling), and monitor to ensure that satisfactory grass establishment has occurred prior to the onset of winter weather;
- Ensure cap depth is adequate on Stage 2;
- Continue to ensure that contaminated stormwater/leachate from the active filling areas is captured and directed to the appropriate disposal routes.

6 June 2018

The site was inspected after showers earlier in the morning, however no rain fell during the inspection. There was a light south easterly wind. Only 8 mm of rainfall was recorded at the Hillsborough monitoring station in the week preceding the inspection.

There were no off site odours or dust issues observed prior to going on site. There was very little refuse present on Colson Road between the transfer station and the landfill gates.

The streams below the site were slightly cloudy. No heterotrophic growths were observed.

The odour mitigating sprays were active on arrival. Mild odours were noted around the weighbridge.

Grass was continuing to establish on Stage 2 (approx 5 cm long) although there were some patchy areas where the ground was quite bare. The cap was therefore considered to still be non-compliant with the conditions of the consent. No ponding was observed, however the areas where ponding had previously occurred were now muddy patches. The areas where rilling had been observed in the previous inspection had not worsened and the soil was not as soft/muddy, although sufficiency of capping and/or compaction may need to be addressed as per special conditions 2, 8 and 10 of consent 2370-3.

The composting area was relatively full, with no activity occurring at the time of the inspection. There were no odours around the composting area. There was very little litter present around the compost area and none on the netting drain covers.

There were very mild refuse odours present at the southern end of the landfill. No dust was noted at any stage during the inspection.

Filling continued to occur from the highest level. The tipping pit was being accessed from the track between the southern litter fence and the compost ponds. The working area was compact and estimated to be within the 900 m² required by the management plan. Metal covers were in place around the active face.

There were very mild landfill gas odours present at the white stand pipe at the edge of the tip access track. The special waste pit was partially full and most of the area was covered with soil.

Grass was beginning to establish on the new contour/bund present around most of the north-eastern side of the tip face. The bunds and drainage channels along the northern side had been tidied up and stormwater was no longer able to flow directly through the fence and down into the stormwater pond.

The flare was in operation at the time of the inspection, with no visible emissions except for a heat haze. No odours were observed around the flare.

The stormwater and leachate ponds were generally in acceptable condition and no odours or litter were observed around these. It was noted that the water level in the tributary below the big silt pond was quite high, indicating that the water may be getting impounded somewhere in the wetland/tributary. The Puremu Stream outlet grate was clear of obstructions.

The vehicle wash was not in use at the time of inspection. The contents of wheel wash pit appeared to be in an acceptable condition.

The following action was to be undertaken:

- Address cap on Stage 2 to ensure that the contour is adequate to prevent ponding/run off (rilling), and monitor to ensure that satisfactory grass establishment has occurred prior to the onset of winter weather;
- Ensure cap depth is adequate on Stage 2;
- Continue to ensure that contaminated stormwater/leachate from the active filling areas is captured and directed to the appropriate disposal routes.

26 June 2018

It was very cold during the inspection, with a moderately strong south-westerly wind. In the week preceding the inspection 23 mm of rainfall was recorded at the Hillsborough monitoring station, with the majority of this falling in the three days prior to the inspection. Showers were intermittent during the inspection.

There were no off site odours or dust issues observed prior to going on site. There was very little refuse present on Colson Road between the transfer station and the landfill gates.

The streams below the site were slightly cloudy. No heterotrophic growths were observed.

The odour mitigating sprays were operating on arrival. No odours were noted around the weighbridge. Silt socks were observed to be in place at the stormwater grates by the weighbridge.

The ground on Stage 2 was soft/muddy. Grass was continuing to establish, although it was still very patchy in places. Ponding was observed in three main areas with water running in channels from the higher ponded area to the two lower ones. Rilling was noted in two areas (from the largest ponded area and from one of the smaller 'ponds'). The cap was still considered to be non-compliant and therefore, as discussed previously, NPDC was instructed that the sufficiency of contouring, capping and/or compaction needed to be addressed as per special conditions 2, 8 and 10 of consent 2370-3.

The composting area was relatively full, the majority of this was aged product with a small amount of fresh vegetation observed. No activity was occurring at the time of the inspection. There were no odours around the composting area. There was very little litter present in and around the compost area, and none on the

netting drain covers. Run off was being directed to the stormwater ponds with the exception of a small amount flowing overland from the north-eastern corner. This flow was mainly clear (as opposed to the distinctive dark liquid associated with compost) and was directed via bunds down the hill with the other stormwater flowing along the northern side.

There were very mild refuse odours present at the southern end of the landfill and along the northern side. No dust was noted at any stage during the inspection.

Filling continued to occur from the highest level. The tipping pit was being accessed from the track between the southern litter fence and the compost ponds. The working area was compact and estimated to be within the 900 m² required by the management plan. Metal covers were in place around the active face.

There were mild landfill gas odours present at the white stand pipe at the edge of the tip access track. The special waste pit was almost at capacity and this was only partially covered with soil, however there was a digger in operation next to the pit and it was assumed that this was about to be covered.

Additional work had occurred on the new contour/bund present around most of the north-eastern side of the tip face. Grass was establishing on this. Additional work had also been carried out on the bunds and drainage channels along the north and eastern sides.

No odours were observed around the flare.

The stormwater, silt and leachate ponds were generally in acceptable condition and no odours or litter were observed around these. It was noted that the small eastern pond contained a lot of silt. The Puremu Stream outlet grate was clear of obstructions.

The vehicle wash was not in use at the time of inspection. The contents of the wheel wash pit appeared to be in an acceptable condition.

The following action was to be undertaken:

- Address cap on Stage 2 to ensure that the contour is adequate to prevent ponding/run off (rilling), and monitor to ensure that satisfactory grass establishment is occurring;
- Ensure cap depth is adequate on Stage 2;
- Continue to ensure that contaminated stormwater/leachate from the active filling areas is captured and directed to the appropriate disposal routes.
- De-silt small eastern pond.

2.2 NPDC monitoring results

2.2.1 Leachate

The NPDC collected six samples of leachate during the 2017-2018 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	Date					
		3-Jul-17	11-Oct-17	12-Oct-17	17-Jan-18	2-May-18	24-May-18
pH	pH	7.5	7.4	7.5	7.8	7.7	7.3
BOD	g/m ³	450	190	70	99	60	37
Suspended solids	g/m ³	78	72	24	36	18	25
Conductivity	mS/m	360	507	733	1,006	-	503
Alkalinity	g/m ³	-	1,990	2,910	4,227	2,630	2,070
Ammoniacal N	g/m ³	255	450	590	880	548	375
Chromium	g/m ³	-	0.10	0.10	0.14	<0.10	<0.10
Copper	g/m ³	0.02	<0.04	<0.04	<0.04	<0.05	<0.05
Iron	g/m ³	12.8	7.3	8.8	7.6	6.7	9.6
Lead	g/m ³	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	g/m ³	3.3	1.9	1.3	0.93	1.2	1.9
Nickel	g/m ³	<0.03	0.03	<0.03	0.05	<0.05	<0.05
Zinc	g/m ³	0.9	0.09	<0.04	<0.04	<0.05	<0.05

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 four 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.

Table 4 Results of analysis of under liner drainage

Parameter	Unit	Date			
		19-Jul-17	15-Nov-17	18-Apr-18	21-Jun-18
pH	pH	6.6	6.6	6.5	6.6
CBOD	g/m ³	<8	11	8	<10
Suspended solids	g/m ³	7	22	6	<5
Faecal coliforms	/100ml	<20	<5	170	17
Conductivity	mS/m	49.0	46.7	45.2	44.2

Parameter	Unit	Date			
		19-Jul-17	15-Nov-17	18-Apr-18	21-Jun-18
Turbidity	N.T.U.	49	105	22	-
Alkalinity	g/m ³	136	135	131	126
Ammoniacal nitrogen	g/m ³ -N	2.9	2.9	2.7	2.3
Cadmium	g/m ³	<0.02	<0.02	<0.02	<0.02
Chromium	g/m ³	<0.1	<0.1	<0.1	<0.01
Chloride	g/m ³	61.0	60.0	56.7	60.0
Copper	g/m ³	<0.02	<0.04	<0.05	<0.05
Iron	g/m ³	7.1	13.0	7.8	11.0
Lead	g/m ³	<0.1	<0.1	<0.1	<0.1
Manganese	g/m ³	2.0	2.4	1.8	2.2
Nickel	g/m ³	<0.03	<0.03	<0.05	<0.05
Zinc	g/m ³	<0.04	<0.04	<0.05	<0.05

Historically, drainage analysis has shown that little, if any, contamination has been occurring in the groundwater immediately below the liner. Although the level of key indicator species such as zinc and chloride (Figure 5) are relatively stable over the last five years, the results for the year under review indicate that some contaminant concentrations such as ammoniacal nitrogen may have increased (Figure 6).

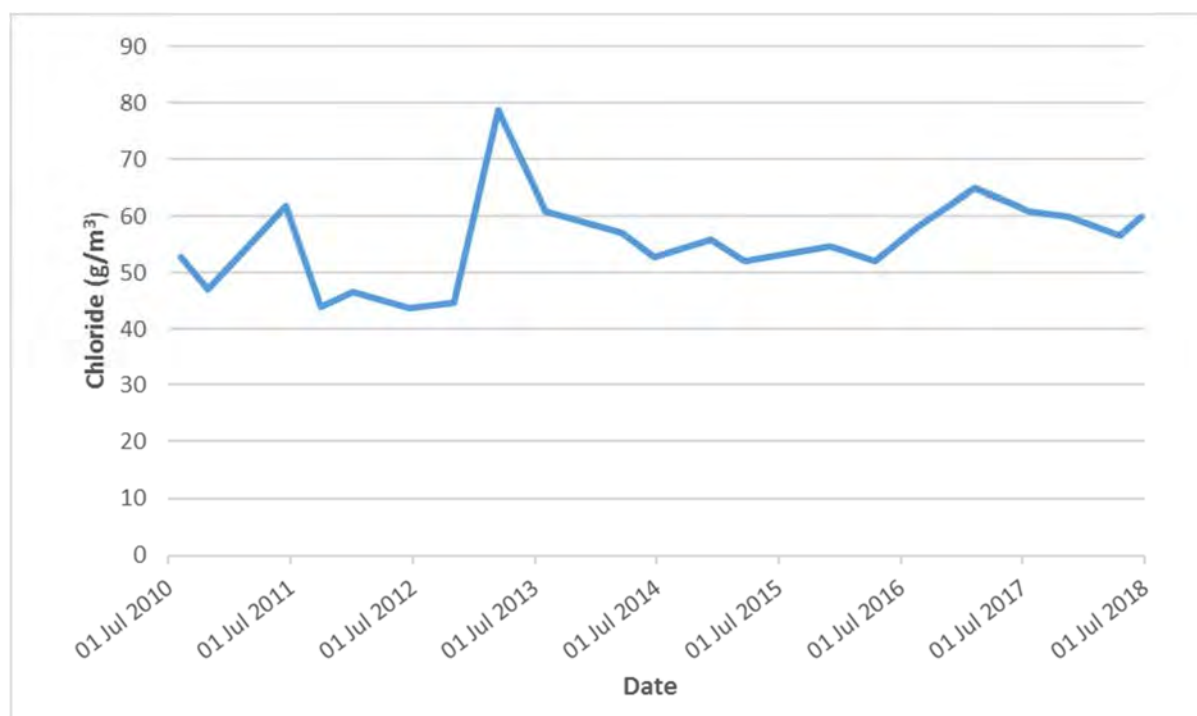


Figure 5 Chloride concentration in the under liner drainage

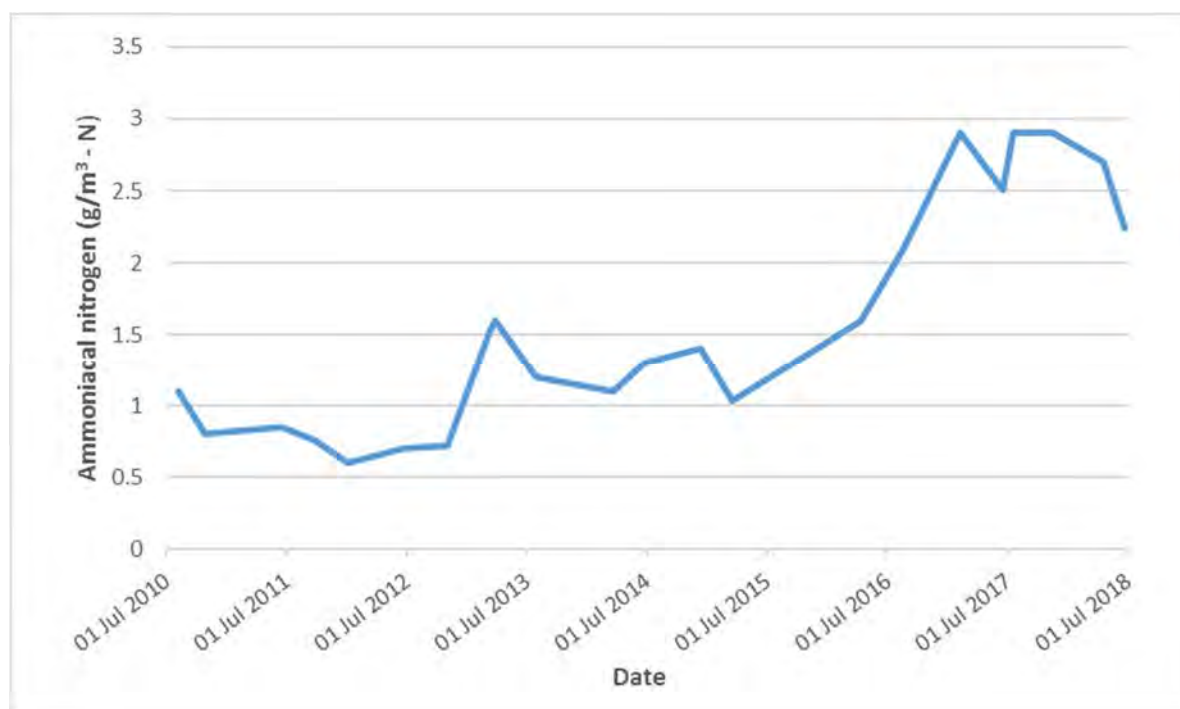


Figure 6 Ammoniacal nitrogen concentration in the under liner drainage

The levels are not currently of environmental concern as they remain within normal ranges for Taranaki groundwater. Monitoring of the contaminant concentrations in the under liner drainage will continue.

Results obtained during the 2017-2018 year continue to indicate 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/ 100 ml) was likely to have been as a result of sample contamination, rather the start of an on-going issue.

2.3 Results of dry weather stormwater and receiving environment monitoring

2.3.1 Dry weather stormwater monitoring

Samples of the discharge from the compositing area (IND0003009), stormwater from below the large silt pond (STW002054), and discharge from the small eastern silt pond (STW001006) were collected if they were discharging during dry weather runs. The sites are shown in Figure 7 and the results of the sampling are presented in Table 5 below.

Table 5 Chemical analysis of site discharges during dry weather

Parameter	units	IND0003009		STW001006		STW002054	
		2-May-18*	31-May-18	2-May-18	31-May-18	2-May-18	31-May-18
Alkalinity	g/m ³ CaCO ₃	-	-	240	240	124	167
Ammoniacal nitrogen	g/m ³ -N	-	0.83	20.0	17.9	3.5	18.0
Unionised ammonia	g/m ³	-	0.0032	0.049	0.031	0.040	0.168
Conductivity	mS/m@25°C	-	43.7	68.7	70.7	46.4	64.6
Faecal coliforms	cfu/100ml	-	11,000	120	<1	1,000	1,800

Parameter	units	IND003009		STW001006		STW002054	
		2-May-18*	31-May-18	2-May-18	31-May-18	2-May-18	31-May-18
pH		-	7.4	6.9	6.8	7.5	7.6
Suspended solids	g/m ³	-	34	36	59	<3	15
Temperature	Deg.C	-	6.5	14.5	13.6	14.8	10.0
Turbidity	NTU	-	50	-	-	-	-
Acid soluble iron	g/m ³	-	-	18.6	34	1.24	3.60
Dissolved zinc	g/m ³	-	-	<0.0010	<0.0010	<0.0010	0.0017
Nitrate+Nitrite-N	g/m ³	-	-	0.151	0.53	1.19	0.126
Sulphate	g/m ³	-	-	-	-	12.2	36
BOD (total)	g O ₂ /m ³	-	-	<2	2	<2	4

* Sample not collected as no discharge occurring

It was found that the compost pond discharge was the major source of faecal coliforms on 31 May 2018. The number of faecal coliforms had reduced, but was still elevated in the discharge from the from the large stormwater pond through which the composting ponds drain. Although it was above the receiving water limit at this point, the conditions of the consent were complied with at the receiving water compliance point (Table 8).

Other contaminants of note in the pond discharges are alkalinity, ammoniacal nitrogen and iron, which tended to be higher in the discharge from the small eastern silt pond, with the alkalinity and ammoniacal nitrogen found to be at a comparable levels in the discharge from the large silt pond on 31 May 2018. The biochemical oxygen demands of the discharges were relatively low, with the results obtained being below the historical medians.

2.3.2 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 driveway to the landfill entrance, 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 the 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 7).

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 6-8 give the results of the dry weather freshwater sampling undertaken during the period under review.

2.3.2.1 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 2 May. An upstream sample was not able to be collected on 31 May as the access track to the sampling site had been affected

by tree debris brought down by a recent storm. It is noted that the downstream receiving water results on this occasion were fairly similar to those found on 2 May and do not indicate any issues. All results were comparable to background levels, and were similar to those found over the last six years.

Table 6 Chemical analysis of the Manganaha Stream

Parameter	Units	2-May-2018		31-May-2018	
		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	26	27	-	23
Conductivity	mS/m@25°C	16.1	16.2	-	14.9
Acid soluble iron	g/m ³	0.40	0.49	-	0.35
Ammonia (unionised)	g/m ³	0.00009	0.00007	-	0.00009
Ammoniacal nitrogen	g/m ³ -N	0.014	0.017	-	0.035
pH	pH	7.3	7.1	-	7.0
Suspended solids	g/m ³	<3	<3	-	<3
Temperature	Deg C	14.1	14.3	-	11.2
Dissolved zinc	g/m ³	0.0044	<0.0010	-	0.0023

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.

2.3.2.2 Puremu Stream

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

The downstream sampling sites are shown in Figure 7. The results for the general parameters are given in Tables 7 and 8, with the dry weather metals analysis covered in Section 2.3.2.3.

Table 7 Chemical analysis of the Puremu Stream, sampled on 2 May 2018

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	26	103	66	51	NA
BOD	g/m ³	<2	<2	<2	<2	NA
Conductivity	mS/m@25°C	15.3	38.2	28.4	24.4	NA
Dissolved oxygen	g/m ³	9.38	4.26	8.03	8.50	≥ 8.38 (≥ 5.0)
DRP	g/m ³	<0.004	<0.004	<0.004	<0.004	NA
Faecal coliforms	cfu/100 ml	460	940	620	470	≤1,000

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**)
Unionised ammonia	g/m ³ N	0.00080	0.01029	0.00613	0.00084	NA
Ammoniacal N	g/m ³ N	0.038	1.63	1.22	1.02	1.3 (2.5)
Nitrate/nitrite N	g/m ³ N	0.126	0.74	1.16	1.33	10 (100)
Oxygen saturation	%	94.4	42.0	79.0	83.7	NA
pH	pH	7.8	7.3	7.2	7.3	≥6.5 & ≤8.5
Sulphates	g/m ³	8.2	8.0	9.1	8.3	1,000 (500)
Suspended solids	g/m ³	<3	5	<3	<3	12
Temperature	Deg C	15.4	14.5	14.5	14.5	(≤17.4)

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

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

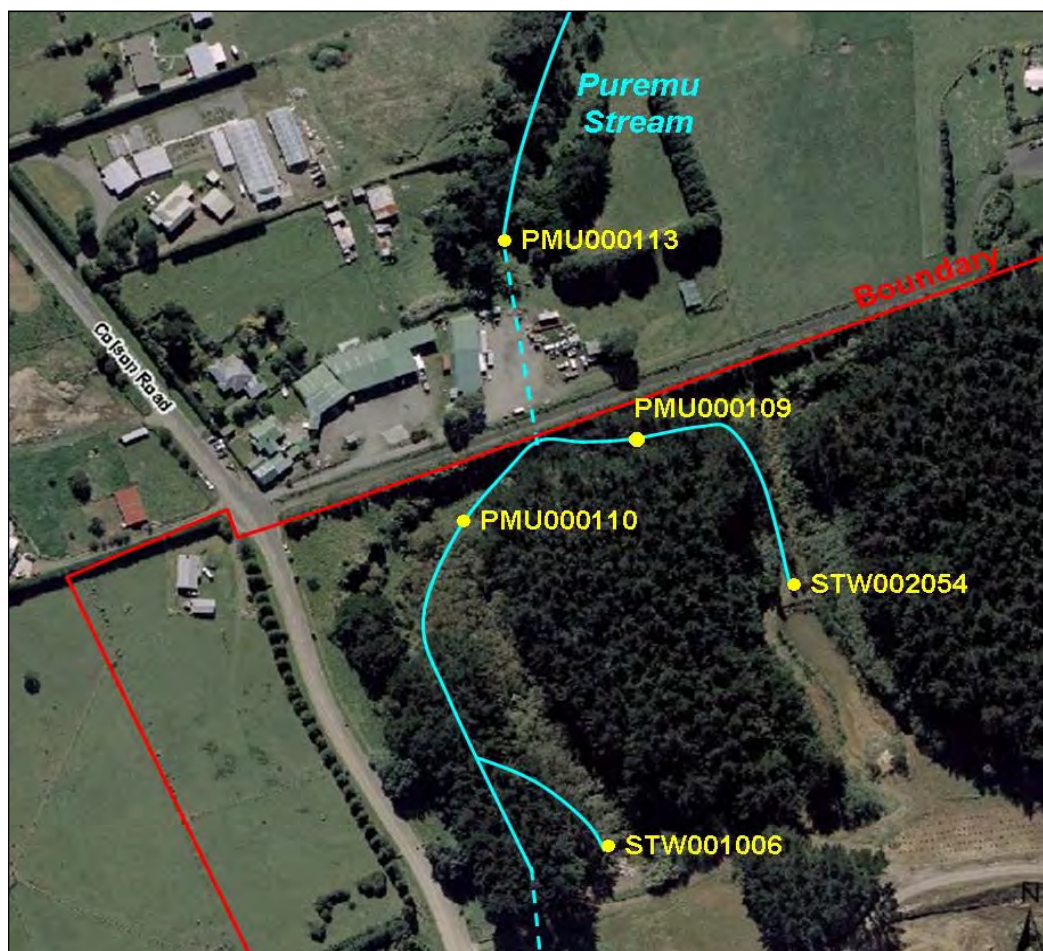


Figure 7 Sampling sites on the Puremu Stream downstream of the landfill

Table 8 Chemical analysis of the Puremu Stream, sampled on 31 May 2018

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	22	124	44	42	NA
BOD	g/m ³	<2	2	<2	<2	NA
Conductivity	mS/m@25°C	14.2	47.6	22.4	21.2	NA
Dissolved oxygen	g/m ³	10.98	4.61	10.29	10.35	≥9.98 (≥5.0)
DRP	g/m ³	<0.004	<0.004	<0.004	<0.004	NA
Faecal coliforms	cfu/100 ml	190	200	320	310	≤1,000
Unionised ammonia	g/m ³ N	0.00009	0.04651	0.00566	0.00754	NA
Ammoniacal N	g/m ³ N	0.048	10.2	1.88	1.57	2.0 (2.5)
Nitrate/nitrite N	g/m ³ N	0.57	0.100	0.87	0.90	10 (100)
Oxygen saturation	%	98.7	40.7	92.1	92.9	NA
pH	pH	6.9	7.3	7.1	7.3	≥6.5 & ≤8.5
Sulphates	g/m ³	8.1	22	11.3	10.1	1,000 (500)
Suspended solids	g/m ³	<3	6	6	3	12
Temperature	Deg C	10.7	10.1	10.7	10.8	(≤12.7)

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

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

The samples taken during the year under review complied with the consent conditions of both 2370 and 4619 for the parameters listed in the above table.

2.3.2.3 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 a 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 9 and 10.

Table 9 Results of metal analysis undertaken on 2 May 2018

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Dissolved aluminium	g/m ³	0.005	<0.003	<0.003	<0.003	0.105
Total aluminium	g/m ³	0.025	0.0106	0.022	0.0172	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	<0.011	<0.011	<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	0.018	0.031	0.030	0.029	NA
Total boron	g/m ³	0.0192	0.032	0.031	0.030	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	0.0003	0.0012	0.0007	0.0004	NA
Total cobalt	g/m ³	0.00048	0.00135	0.00072	0.00039	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	<0.00053	<0.00053	<0.00053	1.0 (0.1)
Dissolved copper	g/m ³	<0.0005	<0.0005	<0.0005	<0.0005	0.002
Total copper	g/m ³	0.00056	<0.00053	<0.00053	<0.00053	0.5 (0.2)
Dissolved iron	g/m ³	0.51	0.17	0.50	0.53	0.81
Total iron	g/m ³	1.24	2.1	1.42	1.17	10.0 (5.0)
Dissolved manganese	g/m ³	0.086	4.5	1.87*	0.97	NA
Total manganese	g/m ³	0.111	4.5	1.85*	0.98	5.0 (1.0)

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Dissolved lead	g/m ³	<0.00010	<0.00010	<0.00010	<0.00010	0.002
Total lead	g/m ³	<0.00011	<0.00011	<0.00011	<0.00011	0.1 (0.1)
Dissolved selenium	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010	0.001
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	0.0020	<0.0010	0.0010	<0.0010	0.0320
Total zinc	g/m ³	0.0025	0.0013	0.0014	0.0016	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 10 Results of metal analysis undertaken on 31 May 2018

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Dissolved aluminium	g/m ³	0.009	<0.003	0.004	0.004	0.109
Total aluminium	g/m ³	0.031	0.039	0.046	0.088	5.0 (5.0)
Dissolved arsenic	g/m ³	<0.0010	0.0016	<0.0010	<0.0010	0.05
Total arsenic	g/m ³	<0.0011	0.0024	<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	0.018	0.078	0.028	0.028	n/a
Total boron	g/m ³	0.0181	0.082	0.030	0.027	5.0 (0.5)
Dissolved cadmium	g/m ³	<0.00005	<0.00005	<0.0005	<0.00005	0.001

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113	Consent limit at PMU000113 (PMU000110)
Total cadmium	g/m ³	<0.000053	<0.000053	<0.000053	<0.000053	0.001 (0.01)
Dissolved cobalt	g/m ³	0.0002	0.0023	0.0005	0.0005	NA
Total cobalt	g/m ³	0.00031	0.0025	0.00065	0.00061	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	0.00071	<0.00053	<0.00053	1.0 (0.1)
Dissolved copper	g/m ³	<0.0005	0.0006	<0.0005	<0.0005	0.002
Total copper	g/m ³	<0.00053	0.00095	0.00066	0.00065	0.5 (0.2)
Dissolved iron	g/m ³	0.30	0.36	0.42	0.41	0.60
Total iron	g/m ³	0.65	3.2	1.34	1.38	10.0 (5.0)
Dissolved manganese	g/m ³	0.046	4.1	0.59	0.56	NA
Total manganese	g/m ³	0.053	4.2	0.60	0.56	5.0 (1.0)
Dissolved lead	g/m ³	<0.00010	<0.00010	<0.00010	<0.00010	0.002
Total lead	g/m ³	<0.00011	<0.00011	<0.00011	<0.00011	0.1 (0.1)
Dissolved selenium	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010	0.001
Total selenium	g/m ³	<0.0011	0.0013	<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	0.0037	0.0015	0.0023	0.0019	0.0337
Total zinc	g/m ³	0.0043	0.0023	0.0028	0.0026	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 the majority of 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. The level of manganese exceeded consent conditions at site PMU000110 on 3 May 2018, however the result was still just below the ANZECC default guideline for freshwater offering protection to 95 % of species (1.9 mg/m³), and when resampled at the end of the month the manganese concentration was found to be compliant with consent conditions. The results from the dry weather sampling during the year under review indicate that discharges from the landfill were not resulting in any significant adverse effect at the time of the surveys.

2.4 Results of wet weather stormwater and receiving environment monitoring

A survey was conducted during a rainfall event and the results are given in the tables below. Table 11 shows the results for discharges and receiving water into which the discharges from within the landfill catchment flow (Puremu Stream). Table 12 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.

The Puremu Stream system receives discharges from two stormwater ponds on the site. STW001006 discharges stormwater and leachate from Stages 1 and 2, 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. The small eastern silt pond was again found to be the main contributor of ammoniacal nitrogen, however, 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.

Table 11 Results of rain event monitoring – discharge and Puremu Stream samples, 28 June 2018

Site	Alkalinity g/m ³ CaCO ₃	Conductivity mS/m @25°C	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
IND003009	-	85.3	140,000	0.031	3.5	7.7	21	8.4	28
STW001006	210	65.5	5	0.019	14.5	6.7	52	13.0	151
STW002054	109	47.7	33,000	0.014	2.7	7.4	14	10.2	30
PMU000100	21	14.2	110	<0.010	0.040	7.6	<3	10.7	1.93
PMU000109	87	37.2	-	<0.010	<0.010	7.0	4	11.1	15.2
PMU000110	37	20.2	-	<0.010	0.91	7.0	<3	11.2	4.4
PMU000113	38	20.5	610	<0.010	0.95	7.1	<3	11.2	4.6

In line with the findings of the dry weather survey, the compost ponds were again the major contributor of faecal coliforms. However, the levels had decreased by over one quarter between the compost pond and the discharge point from the relevant stormwater pond (STW002054), and the level was within consent conditions at the compliance point (PMU000113).

Table 12 Results of rain event monitoring - Manganaha Stream, 28 June 2018

Parameter	Unit	Site	
		MNH000190	MNH000250
Conductivity	mS/m@25 °C	14.9	15.0
Unionised ammonia	g/m ³	<0.010	<0.010
Ammoniacal nitrogen	g/m ³ -N	0.038	0.040
pH	-	7.3	7.1
Suspended solids	g/m ³	<3	<3
Temperature	Deg C	12.4	12.2
Turbidity	NTU	2.4	2.2

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 13 and their locations are shown in Figure 8.

Table 13 Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road landfill

Stream	Site No.	Site Code	Location	Sampling method	
				26-Oct-2017	8-Feb-2018
Puremu Stream	1	PMU000104	Upstream of the landfill	Kick-sampling	Kick-sampling
	2	PMU000110	400 m downstream landfill	Kick-sweep	Kick-sampling
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 m upstream of the confluence with Puremu Stream	Kick-sampling	Kick-sampling
Manganaha Stream	M4	MNH000190	10 m downstream of an unnamed tributary of the Manganaha Stream	Kick-sampling	Kick-sampling
	M6	MNH000260	500 m downstream of site M4	Kick-sweep	Kick-sampling

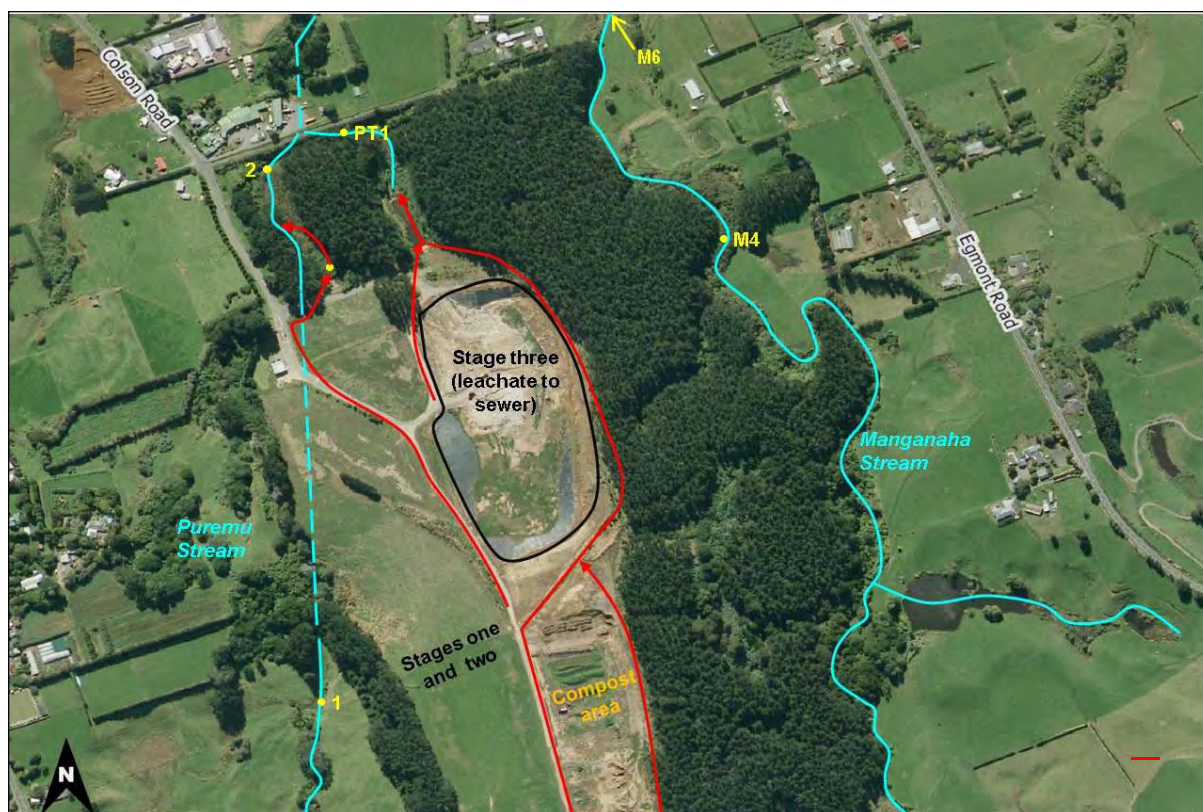


Figure 8 Biomonitoring sites related to the Colson Road landfill, New Plymouth

26 October 2017

The Council's standard 'kick-sampling' technique was used at three sites (1, PT1 and M4), and a combination of the 'sweep-sampling' and 'kick-sampling' techniques was used at two sites (2 and M6) to collect streambed macroinvertebrates from the Puremu and Manganaha Streams and unnamed tributary of the Puremu Stream on 26 October 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.

The MCI score recorded at the upstream control site 1 on the Puremu Stream was higher than the score recorded in the preceding survey, and significantly higher than the median score for this site. The SQMCI_s score was also higher than the median score for this site. Lower than usual taxa richness was recorded. These results were indicative of 'fair' biological health and were reflective of reasonable preceding water quality at these sites.

Site 2 in the Puremu Stream recorded significantly lower MCI and SQMCI_s scores compared with site 1. Both results were similar to historical median scores. The MCI score was similar to that recorded in the preceding survey, while the SQMCI_s increased significantly since the previous survey. As was the case at site 1, lower than usual taxa richnesses were recorded.

Site PT1 in the unnamed tributary of the Puremu Stream recorded a MCI score of 48, the lowest recorded to date at this site. This score is a highly significant 24 and 23 units lower than the historical median and the score recorded in the preceding survey, as well as being 39 and 25 units lower than the scores at sites 1 and

2 respectively. A low SQMCI_s was recorded. This was also significantly lower than the scores recorded at sites 1 and 2 (by 2.3 and 1.4 units respectively), but was only slightly lower than the historical median and had increased since the preceding survey. This site also recorded a very low taxa richness, substantially lower than the historical median and the preceding result. This was the lowest taxa richness recorded at this site to date, by a substantial six taxa. The results at this site indicate poor physicochemical water quality and/or habitat quality. This is likely to be influenced by the landfill stormwater, which is discharged into this tributary, in conjunction with the iron oxide and high proportion of silt substrate recorded at this site which reduces the habitat quality.

The upstream site on the Manganaha Stream (M4) recorded MCI and SQMCI_s scores slightly above the historical median for the site. The MCI score was slightly lower than that recorded in the preceding survey, while the SQMCI_s score increased significantly. At site M6 (downstream of the landfill), the recorded MCI score was higher than the historical median, but had decreased slightly since the preceding survey. The SQMCI_s score was also slightly higher than the median, and showed a slight decrease since the previous survey. The MCI score was slightly higher and the SQMCI_s score slightly lower when compared with site M6. Lower than usual taxa richnesses were recorded at both sites. The results at these two sites were indicative of reasonable preceding water quality, and the minor differences between sites are most likely related to subtle differences in habitat and sampling techniques between the two sites.

No undesirable biological growths were detected at any of the sites during the survey.

Overall, the results of this survey indicate that the discharge of treated stormwater and leachate discharges from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams. However, the Puremu Stream tributary recorded poor results, may be caused by either landfill leachate or poor quality physical habitat. Further investigation of this site may be warranted.

8 February 2018

The Council's standard 'kick-sampling' technique was used at six sites to collect streambed macroinvertebrates from the Puremu and Manganaha Streams and unnamed tributary of the Puremu Stream on 8 February 2018. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was significantly lower than the score recorded in the preceding survey, but similar to the median score for this site. The SQMCI_s score was also similar to the median score for this site. Lower than usual taxa richness was recorded. These results were indicative of 'poor' biological health.

Site 2 in the Puremu Stream recorded a slightly lower MCI score and significantly lower SQMCI_s score compared with site 1. Both results were similar to historical median scores and to those recorded in the preceding survey. As was the case at site 1, lower than usual taxa richnesses were recorded.

Site 3 was monitored in response to the poor results recorded in the Puremu Stream tributary in the preceding survey. This site recorded the lowest MCI, taxa richness and SQMCI_s scores of the three sites in main stem of the Puremu Stream. The MCI and SQMCI_s scores were significantly lower than those at sites 1 and 2. This may be due to impacts from the landfill, but due to slight habitat differences between the sites it is not possible to definitively conclude that this is the case. The slower flow at this site compared to the upstream sites affecting habitat, and increasing sediment deposition. It was also noted during sampling that the streambed sediment had a slight anaerobic odour. Furthermore, the culvert upstream of this site also has the potential to influence conditions at this site. The taxa richness and MCI score were also lower than has previously been recorded at this site. However, with only two previous samples taken at this site, the most recent of which was thirteen years ago, there is insufficient information available to draw any conclusions about any possible changes in the biological health at this site. Further, although the scores

indicate possible impacts, the influence of the culvert upstream has the potential to confound the results. Physicochemical water quality sampling carried out in conjunction with the biological monitoring may assist with interpretation of the results.

Site PT1 in the unnamed tributary of the Puremu Stream recorded a MCI score of 73, a significant recovery since the previous (October 2017) survey which recorded a MCI score of 48 units which was the lowest MCI score recorded to date at this site. This score is a slight two units higher than the historical median, as well as being similar to the scores at sites 1 and 2 respectively. The SQMCI_s score was also significantly lower than the scores recorded at sites 1 and 2 (by 1.8 and 1.5 units respectively), and was an insignificant 0.4 unit lower than the score at site 3. This SQMCI_s score was only slightly lower than the historical median and had increased since the preceding survey. This site also recorded a very low taxa richness, substantially lower than the historical median but one taxon more than the preceding result (which was the lowest result recorded at this site to date). The results at this site indicate poor physicochemical water quality and/or habitat quality. 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 sites in the Manganaha Stream (M4 & M6) recorded identical MCI scores of 72 units, both of which were significantly lower than their respective historical medians. SQMCI_s scores at both sites were similar, and scores were slightly lower than historical medians for the respective sites. MCI and SQMCI_s scores at both sites had decreased significantly since the preceding survey. Taxa richnesses were low, with the lowest richness to date recorded at site M4 and equal to the lowest richness to date recorded at site M6. The results at these two sites were indicative of reasonable preceding water quality, and the very minor differences between sites are most likely related to subtle differences in habitat and sampling techniques between the two sites.

No undesirable biological growths were detected at any of these sites during the survey.

Overall, the results of the survey indicated that the discharge of treated stormwater and leachate discharges from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Manganaha Stream. However, the results in the Puremu Stream and tributary indicate there may be impacts in this stream. Site PT1 showed some recovery from the poor results recorded in the previous survey. Results at site 3 were poorer than other sites in the Puremu Stream, which may be a result of habitat differences between sites, or may result from landfill discharges. It is recommended that future biological monitoring is carried out in conjunction with physicochemical water quality monitoring, in order to assist with determination of the causes of the poor results. Given the anaerobic nature of the streambed sediment and the historical results indicating low dissolved oxygen levels in the Puremu Stream and tributary, consideration should be given to more intensive dissolved oxygen monitoring in this Stream.

2.6 Groundwater

Groundwater was sampled from six bores on either the 30 or 31 May 2018. The results of the analyses are given in Table 14.

Like the NPDC subsurface drainage samples (Table 4, Section 2.2.2), 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 9 and Figure 10).

Table 14 Chemical analysis of Colson Road landfill groundwater sampled May 2018

Parameter	Unit	GND0573	GND02	GND057	GND02	GND05	GND13	GND13
Alkalinity	g/m ³ CaCO ₃	27	36	84	47	-	30	93
Chloride	g/m ³	84	52	55	21	-	27	37
Filtered COD	g/m ³	<6	<6	<6	<6	-	<6	<6
Conductivity	mS/m @ 25 °C	36.1	25.2	34.3	16.7	-	18.0	30.4
Water level	m	4.69	10.36	8.20	13.50	-	13.17	8.76
Unionised ammonia	g/m ³ N	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010
Ammoniacal N	g/m ³ N	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010
Nitrate/nitrite N	g/m ³ N	0.71	2.00	1.34	0.174	-	1.83	0.69
Nitrite N	g/m ³ N	<0.002	<0.002	<0.002	<0.002	-	<0.002	0.003
pH	pH	6.0	6.2	6.3	6.3	-	6.5	7.0
Sulphate	g/m ³	7.1	2.3	2.2	4.1	-	6.9	10.0
Temperature	Deg C	14.7	14.8	14.7	13.1	-	13.3	14.2
Dissolved aluminium	g/m ³	<0.003	0.003	<0.003	0.008	-	0.013	<0.003
Dissolved arsenic	g/m ³	<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
Dissolved boron	g/m ³	0.025	0.019	0.018	0.016	-	0.021	0.021
Dissolved cadmium	g/m ³	<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
Dissolved chromium	g/m ³	<0.0005	<0.0005	0.0012	0.0008	-	<0.0005	<0.0005
Dissolved copper	g/m ³	<0.0005	<0.0005	<0.0005	0.0007	-	0.0009	<0.0005
Dissolved Iron	g/m ³	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02
Dissolved lead	g/m ³	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010	<0.00010
Dissolved manganese	g/m ³	0.0047	0.0129	0.0061	0.0049	-	0.0078	0.148
Dissolved selenium	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010

Parameter	Unit	GND0573	GND02	GND057	GND02	GND05	GND13	GND13
Dissolved vanadium	g/m ³	<0.0010	<0.0010	0.0081	0.0013	-	0.0011	0.0062
Dissolved zinc	g/m ³	0.0019	0.024	0.0050	0.0179	-	0.020	0.023

Notes: Bore GND0598 could not be located and hence was not sampled.

Bores GND0255, GND0575 and GND1301 were sampled on 30 May, while GND0251, GND0573 and GND1300 were sampled on 31 May.

Bore GND0598 was not sampled during the year under review. Despite numerous visits by Council and NPDC staff, debris on the access tracks and forest floor undergrowth prevented this sampling site from being located. At the time of writing this report NPDC had engaged a drilling company to relocate the bore and undertook works to clear the access tracks, so that the bore can be sampled in the next survey. Historically, 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 are 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.

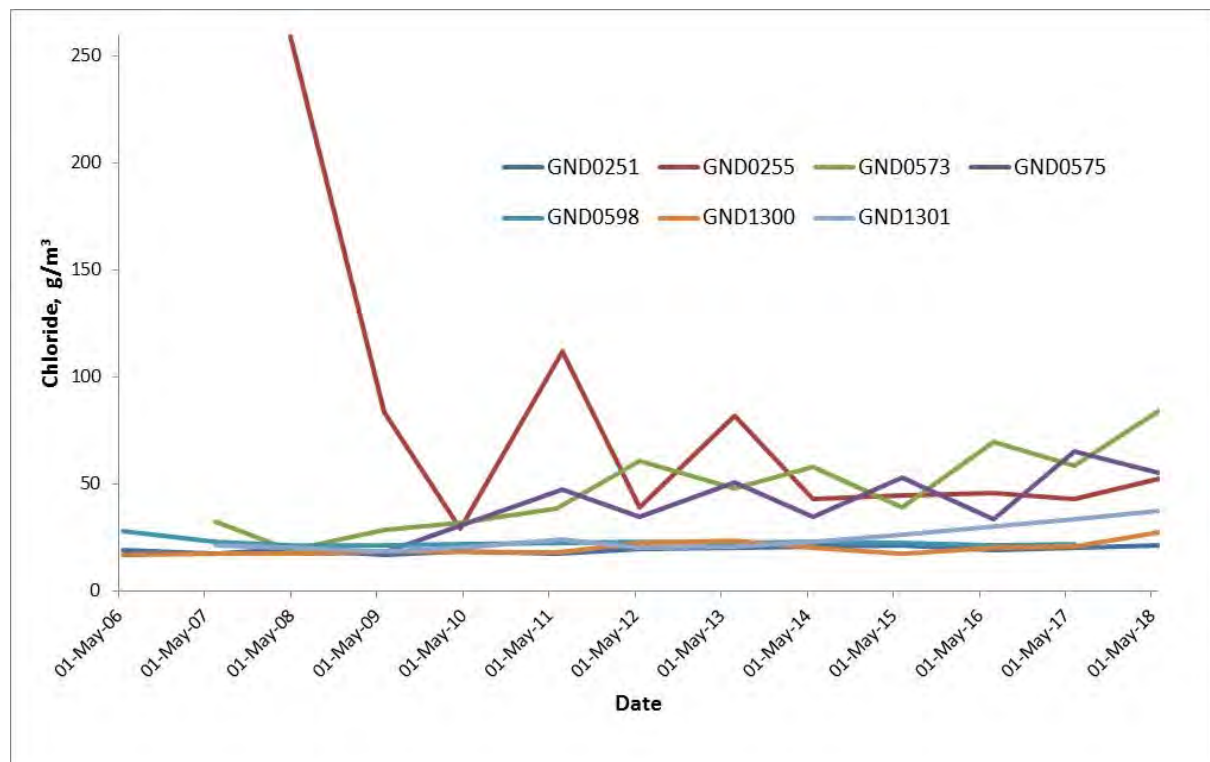


Figure 9 Chloride concentrations in the Colson Road groundwater bores, June 2006 to date

It can be seen that the chloride concentration in bore GND0255 (up gradient of the landfill) have been stabilising at a decreased level 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 also be an emerging trend of increasing nitrate/nitrite nitrogen concentrations in some of these bores, that is, GND0575 (north east of the landfill) and GND1300 (north

east of the composting area and east of the southern end of the landfill). This finding is consistent with the potential emerging trend of increasing nitrate/nitrite nitrogen in the under liner drainage results provided by NPDC (2.2.2, Figure 6). In contrast, it is noted that the nitrate/nitrite nitrogen results obtained at GND1301 (further east of the landfill than GND0575) during the year under review had reduced by about one third, following the higher results obtained in the 2014-2015, 2015-2016 and 2016-2017 years.

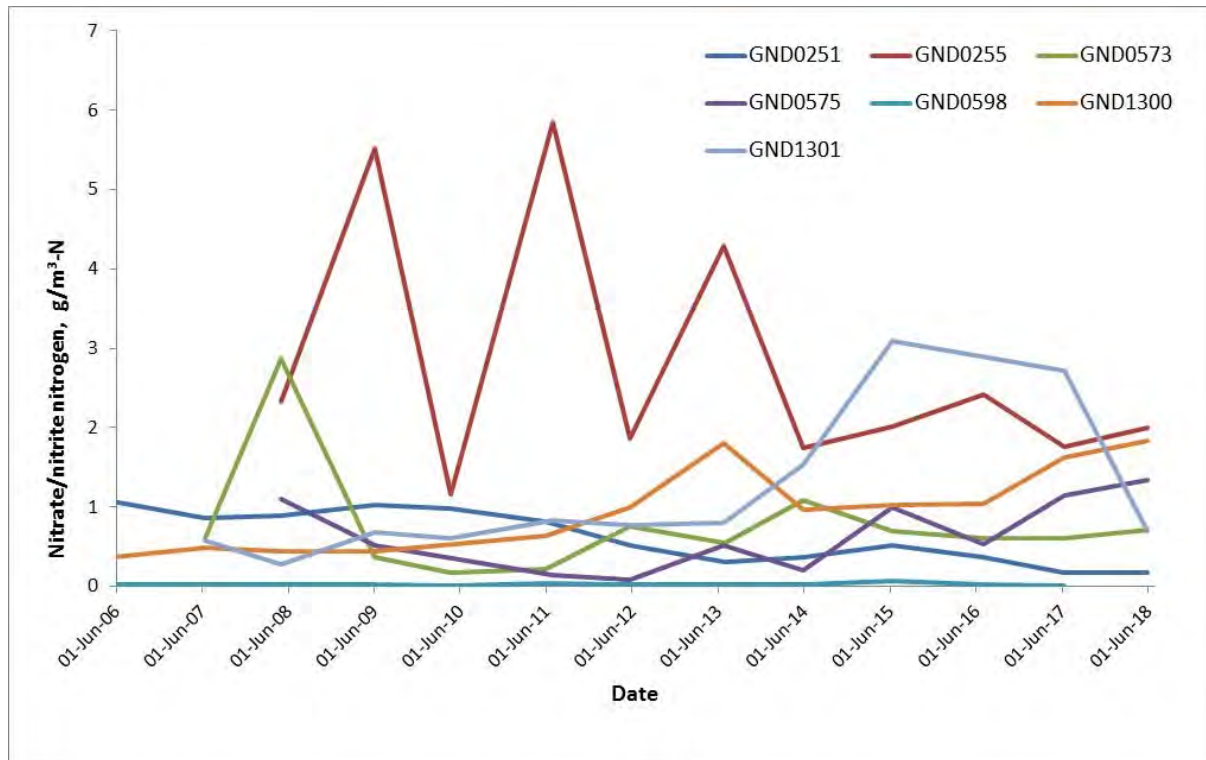


Figure 10 Nitrate/nitrite nitrogen concentrations in the Colson Road groundwater bores, June 2006 to date

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 Data review

Conditions on the varied consent 4779-1.1 require that:

1. Within three months of the first operation of any landfill gas flare, the consent holder shall provide the Chief Executive, Taranaki Regional Council with a measurement of the temperature of the flare together with a measurement of the concentrations of methane and of hydrogen sulphide in the flare feedstock. Thereafter the consent holder shall annually provide updated information on flare temperature and feedstock composition.
2. Within three months of the first operation of any landfill gas flare, the consent holder shall provide the Chief Executive, Taranaki Regional Council with a copy of 'as built' drawings for the flare, including a figure to scale showing the location of the flare relative to the boundaries of the landfill property, and a copy of the supplier's or manufacturer's operating instructions.
3. The first revision of the landfill management plan, described in condition 9(c) following installation of any landfill gas flare shall describe, variously, methods of, schedules for, and/or the recording of: observations and inspections of the flare, its operation, and its effects, including downwind odour and

smoke plume details; a calibration schedule; records of maintenance; and any complaints. Information gathered under these provisions shall be made available to the Chief Executive, Taranaki Regional Council upon request.

Condition 1

Commissioning of the flare was completed on 28 March 2018, with testing undertaken by an independent consultant on the same day.

The information required to satisfy special condition 1 was received within the three months required by consent conditions, on 16 April 2018.

Testing was undertaken on 28 March 2018 with the report issued by CRL Energy Ltd on 13 April 2018, and forwarded to Council on 16 April 2018.

The report included a comparison between the monitoring results integrated into the flare system for real time assessment and adjustments to optimise operational performance of the flare (methane, carbon monoxide and oxygen). The results are shown in Tables 15-17, with the full report presented in Appendix IV.

Table 15 Colson Road landfill gas flare display data, 28 March 2018

Time	Flare temp °C	Flow NM ³ /hr	Inlet pressure mbar	CH ₄ %	CO ₂ %	O ₂ %
11:19	783	65	-14	48.4	29.6	3.96
11:21	800	70	-15	48.8	29.7	3.89
11:23	769	72	-15	48.9	29.8	3.83

Table 16 Colson Road landfill gas feedstock analysis by GC-TCD and Drager Tube, 28 March 2018

Time	H ₂ S ppm	H %	CO %	CH ₄ %	CO ₂ %	O ₂ %
11:19	<0.2	<0.01	<0.04	49.2	29.4	4.6
11:21	<0.2	<0.01	<0.04	49.3	27.8	5.0
11:23	<0.2	<0.01	<0.04	49.2	27.2	5.1

Table 17 Colson Road landfill gas flare feedstock analysis by Testo 350, 28 March 2018

Sample period start	Sample period stop	Average O ₂ %	Average NO _x mg/m ³ *	Average NO mg/m ³	Average NO ₂ mg/m ³
11:41	12:11	5.6	1.1	0.7	0

* Expressed as NO₂

In addition to the above, the hydrogen sulphide concentration of the feedstock gas was also determined. No hydrogen sulphide was detected. Although, it is noted that the detection limit of the method employed was relatively high (0.2 ppm) when compared to the concentrations at which this gas is likely to result in odour complaints (0.005 ppm), the flare is expected to effectively treat any hydrogen sulphide that is present.

Condition 2

Information required by special condition 2 was provided, in the form of:

- A Design Report, Windsor (August 2017), which covers the mechanical and structural design. It was confirmed at this time that the flare had been built as per design on 28 March 2018.
- An as built issue of a series of 12 drawings showing details of the construction and location of the stage 1 gas collection system and flare (Figure 11) was provided to Council on 30 April 2018.
- A copy of the suppliers Operation and Maintenance Manual was provided on 17 May 2018.



Figure 11 As built drawing of the stage 1 landfill gas collection system

Condition 3

The Colson Road Regional Landfill Management Plan was most recently updated in June 2018, which included a general description of the flare, outlines that the flare's performance is continually monitored by means of real time electronic data. The plan also clarifies that NPDC, with the support of external contractors, have responsibility for the maintenance, inspections and calibration of the flare. The plan references a separate specific NPDC procedure for the management and operation of the flare that must be adhered to. NPDC accidentally omitted to forward this to the Council along with the revised management plan, but this has now been received. It can be confirmed that the plan was in place within the required timeframe and covers the required procedures, schedules and records keeping information.

2.7.2 Results of receiving environment monitoring

2.7.2.1 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 $\text{g}/\text{m}^2/\text{day}$.

Guideline values used by the Council for dust deposition are $4 \text{ g}/\text{m}^2/30 \text{ days}$ or $0.13 \text{ g}/\text{m}^2/\text{day}$ 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 18.

Table 18 Air deposition monitoring results for 9 January- 29 January 2018

Site code	Site description	Days deployed	Particulate $\text{g}/\text{m}^2/\text{day}$	
			9-29 Jan 2018	7-27 Feb 2018
AIR001604	Adjacent to Manganaha Stream, behind rose nursery	20	0.22	0.05
AIR001608	124 Egmont Road, paddock boundary, west of house	20	0.17	0.06
AIR001622	At rear of RSPCA building	20	0.17	0.04
AIR001603	At entrance to landfill	20	0.12	0.04
AIR001613	Grass lawn, behind work shed	20	0.06	0.08
AIR001623	Behind 194 Egmont Road	20	0.11	0.01

Key: Bold = exceeded guideline value of $0.13 \text{ g}/\text{m}^2/\text{day}$

The guideline value was exceeded at three off site locations during the January survey. During this survey the prevailing wind directions were from the north (21 percent of the time) and the west (18 percent of the time). None of the three sites would have been downwind during a northerly, however all three would be downwind of the main landfilling activities during westerly winds. The samples collected from these

locations were reported to be contaminated with organic matter, including vegetation and bugs, which is consistent with stronger winds carrying debris from the forestry area that lies between the landfill and the monitoring sites.

It is noted that site AIR001603 exceeded the guideline level during both surveys in the 2016-2017 year and was just below the guideline level during the current monitoring period. This site was not generally 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 results.

All results of the February 2018 survey were well below guideline values.

2.7.2.2 Ambient suspended particulate and landfill gas component monitoring

Ambient monitoring of suspended particulates (dust) and/or 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. The particulate (dust) monitoring was undertaken using a DustTrak, and the methane and H₂S monitoring was undertaken using a MultiRae. The results are shown in Table 19, Table 20 and Table 21.

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 two occasions at seven monitoring locations on, and in the neighbourhood of, the landfill. On one of the occasions monitoring was scheduled to be undertaken the DustTrak had been returned to the supplier for repairs, so only the methane and H₂S monitoring was able to be carried out.

Landfill gas components

The landfill gas components monitored during the ambient surveys in the year under review were methane and H₂S.

The monitoring showed that the PM₁₀ guideline was not exceeded during the March or June surveys, and there were no landfill gas components detected at the time of any of the surveys.

Table 19 Ambient PM₁₀ and methane survey results 6 March 2018

Site	Methane (%LEL)	H ₂ S (ppm)	PM ₁₀ µg/m ³
210 Egmont Road	0	0	2
AIR001606	0	0	1
134 Egmont Road	0	0	8
AIR001603	0	0	20
AIR001619	0	0	18

Site	Methane (%LEL)	H ₂ S (ppm)	PM ₁₀ µg/m ³
AIR001610	0	0	24
AIR001613	0	0	9
Averages	0	0	12

Table 20 Ambient PM₁₀ and methane survey results 5 May 2018

Site	Methane (%LEL)	H ₂ S (ppm)	PM ₁₀ µg/m ³
AIR001609	0	0	-
AIR001608	0	0	-
AIR001603	0	0	-
AIR001618	0	0	-
AIR001610	0	0	-
AIR001616	0	0	-
AIR001614	0	0	-
Averages	0	0	-

Table 21 Ambient PM₁₀ and methane survey results 28 June 2018

Site	Methane (%LEL)	H ₂ S (ppm)	PM ₁₀ µg/m ³
AIR001614	0	0	0
AIR001612	0	0	0
AIR001611	0	0	0
AIR001610	0	0	3
AIR001616	0	0	0
AIR001613	0	0	1
AIR001603	0	0	0
Averages	0	0	0.57

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 causes 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 individual/company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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

In the 2017-2018 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 were four incidents recorded, which related to breaches of consent conditions found during routine compliance monitoring inspections, and one unsubstantiated odour complaint received prior to the installation of the flare. The non-compliances are discussed below, with a summary of the outcomes in relation to each of the incident register entries (including the unsubstantiated odour complaint) is given in Table 22.

8 July 2017

Notification was received from NPDC on 10 July 2017 that there had been an overflow of leachate from the Colson Road pump station to the Puremu Stream due to a high rainfall event. The overflow was discovered by the reticulation contractor during a routine maintenance visit on 10 July 2017. The NPDC monitoring system for the site had gone off line at 10:47 on 8 July 2017, so it is not known when the discharge commenced or ceased.

There was 56 mm of rain recorded at the Hillsborough rainfall station on 8 July 2017. 40 mm of this fell within a two hour period, with a peak rainfall intensity of 4 mm in 5 minutes, and 15 mm in 30 minutes. At this kind of rainfall intensity it is expected that the high flow rates in the stream would reduce the potential for adverse effects occurring as a result of the pump station overflow. The site was visited on 11 July 2017, and it was confirmed that there was evidence of very high flows in the preceding days. At the time of inspection the Puremu Stream was running clean and clear and there was no evidence of any significant adverse effects (e.g. fish kills) having occurred. As the stream was running clear, and the overflow had occurred two days prior to notification being received, it was considered that there would be no benefit in samples being collected for analysis.

There were two consent non-compliances found at the routine compliance monitoring inspection on this day. One was related to the Stage 2 cap (consent 2370), the other related to fugitive gas emissions from Stage 3 (consent 4779).

11 July 2017 - 2370

At the time of the inspection it was found that the cap had suffered damage as a result of stock management practices over the winter that were not compliant with the site management plan. The cap was badly pugged over a significant area of the cap, which was allowing ponding, with rutting from agricultural vehicles present at the base of the eastern batter. This was non-compliant with condition 1 ("best practicable option"), condition 7 (management plan), condition 8 (capping barrier and vegetative cover), condition 9 (management plan) and condition 10 (maintain contours to minimise ponding). However, it was accepted that remediation of the cap would have to wait until the cap had dried out sufficiently for it to be safe to use heavy machinery on the Taranaki Ash surface. At the time of the August inspection it was noted that the cap was still non-compliant and that remediation was to be undertaken when weather permitted. At the October inspection it was noted that the cap was still non-compliant and stated that the pugging was to be addressed as soon as possible (for example by rolling before the surface dried out too much), and that the eroded areas should be addressed when weather permitted. A letter of explanation was requested from NPDC. On 31 October the Council was advised that the grazing lease had been terminated with the Grazier, and the cattle have been removed from the area. An agreement had been put in place with a new Grazier, which incorporated remediating the cap and using and maintaining the land in accordance with the conditions of consent 2370. On 1 November 2017 a request was made to the

Council regarding a one off cropping of maize on the cap during the remediation process. Given that the cap would have to be turned, relevelled and re-vegetated to resolve the pugging and the eroded areas, this was agreed to as a one off activity as part of the cap remediation strategy. NPDC was also advised that as far as on-going activities were concerned, any leasee would have to limit activities to grazing the cap with sheep, and having silage or hay as the only cropping type activity.

At the time of the November inspection it was found that remediation works had been undertaken on the cap following advice from the previous inspection. Additional cover material had been applied to low-lying areas, and recontouring was underway prior to maize cropping.



Photo 4 Stage 2 cap condition at inspection on 4 October 2018

At the time of the inspection on 20 December 2017 it was found that the cap had been revegetated with maize (Photo 5), which was found to still be present at the inspections on 19 February and 6 March 2018. On 28 March 2018 grass was found to be re-establishing after the maize harvest (Photo 6).

A letter of explanation was received and accepted. As the matter was resolved without any significant adverse effects being detected, no further enforcement action was considered necessary.



Photo 5 Re-vegetated Stage 2 cap at inspection on 20 December 2017



Photo 6 Grass establishing after maize harvest, 28 March 2018

11 July 2017 - 4779

During a routine compliance monitoring inspection it was found that there were landfill gas emissions from a broken cap on one of the leachate lines (Photo 7) and fugitive landfill gas emissions from areas of leachate breakout on the eastern side and from the ponded area (Photo 8) on the western side of the special waste pit level. As the cap had been repaired by the time of the following inspection (30 August 2017), and no significant off site effects were found, no further enforcement action was considered necessary.



Photo 7 Broken leachate line cap, 11 July 2017



Photo 8 Fugitive landfill gas emissions, 11 July 2018

4 October 2017

At a routine compliance monitoring inspection it was found that there was insufficient cover on the landfill (Photo 9, Photo 10 and Photo 11), in contravention of the resource consent condition that requires the cover to be within the management plan specifications. At the time of inspection staff were instructed to improve the cover to comply with the management plan requirements. It is noted that the site is the subject of an abatement notice (EAC-20881), also requiring that cover is in compliance with the management plan.



Photo 9 Cover slumping, 4 October 2017



Photo 10 Insufficient cover, 4 October 2017



Photo 11 Insufficient cover, 4 October 2017

The matter had not been fully resolved by the time of the November or December (Photo 12) inspections, but was at the time of the February inspection.



Photo 12 Insufficient cover, 20 December 2017

An explanation was received and accepted. As no significant off site effects were found, no further enforcement action was considered necessary.

Table 22 Summary of incident investigations during the period under review

Date of complaint	Incident notes	Investigation details	Outcomes
8-Jul-17	Wastewater overflow from the pump station at Colson Road	High rainfall caused a wastewater overflow from the pump station into the Puremu Stream	No adverse effects found
11-Jul-17	During routine compliance monitoring it was found that grazing was not being managed as per the management plan on the capped area of the Colson Road landfill	At the time of inspection the consent holder was informed that a vegetative cover needed to be maintained on the capping area and that grazing was to be managed to prevent erosion and ponding	This was done
	During routine compliance monitoring it was found that landfill gas was discharging to air from a broken cap on a leachate line	At the time of the inspection the consent holder was informed of the broken cap and undertook repairs prior to the August inspection	Repairs undertaken, no further action required
18-Sep-17	A complaint was received regarding odour from the NPDC Colson Road Landfill, at Pohutukawa Place, Bell Block	At the time of investigation there was no odour detected at the complainant's property	Unsubstantiated
4-Oct-17	During a routine monitoring inspection it was found that there was insufficient cover on the landfill, in contravention of the resource consent condition that requires the cover to be within the management plan specifications	At the time of inspection staff were instructed to improve the cover to comply with the management plan requirements. The site is the subject of an abatement notice, also requiring compliance with the management plan.	An explanation was received and accepted
23-May-18	During routine monitoring it was found that capping, compaction and vegetative cover in the Stage 2 area was insufficient to comply with resource consent conditions	A letter was sent requesting explanation and advising that capping, contouring, compaction and vegetative cover in the area needs to be addressed	A letter was received advising measures to be undertaken to address the issue, including investigating the cap depth. Their investigation found that the cap depth did not meet the management plan requirements in some places. At the time of writing this report, a remediation plan was being developed

23 May 2018

At a routine compliance monitoring inspection it was found that although grass was beginning to establish on the Stage 2 cap, the cap was non-compliant with conditions 2, 8 and 10 of consent 2370. These conditions require that the activity is undertaken as per the information submitted with application (condition 2), that there is an adequate capping barrier and vegetative cover (condition 8), and that the contouring is maintained in order to minimise ponding (condition 10). It was found that there were areas of inadequate vegetative cover (Photo 13) and ponding (Photo 14). An area of rilling was also found (Photo 15), indicating that the vegetative cover and compaction was not sufficient. In light of the ponding, rilling and conversation with the contractor on the previous inspection where he stated that the cap was relatively thin in places (Section 2.1.1, 3 May 2018), NPDC advised that the ground contour, capping depth and compaction needed to be assessed and addressed as necessary to ensure compliance with the conditions of this consent



Photo 13 Areas of poor grass strike, 23 May 2018



Photo 14 Depression where some ponding remains, 23 May 2018



Photo 15 Area of riling, 23 May 2018

This remained non-compliant through to the end of the year under review with NPDC agreeing to undertake investigations to ensure that the cap depth, contouring and re-establishment of vegetative cover was undertaken prior to the return of wet weather.

At the time of writing this report it had been confirmed that the compaction and cap depth in some areas did not meet the specifications given in the management plan and due to the scale of the remediation works required, it would not be possible to meet this timeframe. As there were no significant adverse effects occurring as a result of the non-compliances, an abatement notice was issued requiring that works be undertaken to ensure compliance with the consent by 15 March 2020. This will be discussed in more detail in the 2018-2019 Annual Report.

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 June 2018, whilst the contingency plan was updated in November 2017.

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 landfill. The purpose of the committee is to facilitate the raising of concerns by the neighbours in relation to the landfill operations 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 11 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 July and 14 November 2017, and 6 March 2018. 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 2018-2019 monitoring period.

2.9.3 Independent consultant's reports

Site inspections were undertaken by WAI Environmental (independent consultants) on 20 October 2017, 21 February 2018 and 25 May 2018.

20 October 2017

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 little free litter on the site and the continued vigilance by the contractor to maintain a tidy compliant site was encouraging.

In particular, the report of the 20 October 2017 visit noted that:

- Cattle had been removed from Stages 1 and 2 and there were plans to repair the surface damage caused by the stock and plant a nursery crop of corn for animal consumption before re-grassing.
- The deodorising system was not in operation during the consultant's visit. Odour was still detected on the landfill itself although the occurrence of this was infrequent and minor.
- Litter was being collected at the time of the visit and the reduction of litter on the site was significant.
- Despite previous recommendations to remove silt from the silt pond this had not been done and the area before the weir was completely full of silt.
- Works were continuing on the gas collection and flaring project. The consultant was sceptical that the project would be a success but hoped he would be proved wrong.
- An area of refuse on the eastern boundary was being covered, this appeared to have been left uncovered for some time. The consultant was of the opinion that this should have been dealt with sooner and noted that this was the first time he had seen management standard slip a little.
- A number of leachate breakouts were observed on the sloping sides of the landfill. These were being collected in a small drain to the side and controlled. There were also a number of places where gas was bubbling out of the ground around the edges of the filled area.

- Growths were observed in the stream below the site, however it was unclear as to whether these had any relationship to contamination and it was suggested that these be tested to determine the cause of its presence.

On this occasion the condition of the landfill was of high quality. This was the fifth consecutive occasion 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.

21 February 2018

The report of the 21 February 2018 inspection noted that:

- All previously planned capital works associated with the foundation of Stage 3 had been completed and it was not expected that further lining or major leachate collection pipework would need to be installed.
- The gas collection system and flare had been installed and appeared to be working as no landfill gas odours were detected around the site.
- Litter control on the site was very good with very little litter noted. Litter was being collected and the netting placed over drainage ditches had been cleaned and appeared to be working well.
- The landfill working face was approximately 600 m², well within that allowed by the management plan.
- Some of the silt mentioned in previous reports had been removed from the silt pond but there was still work to be done in this regard.
- The number of historical leachate breakouts appeared to be considerably reduced since the gas flare had been in the commissioning phase.
- A water cart was on site and was being used regularly to help prevent dust.
- No heterotrophic growths were noted downstream of the site.

On this occasion the condition of the landfill was of a high quality. This was the sixth 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.

25 May 2018

The report of the 25 May 2018 inspection noted that:

- The area of exposed refuse was estimated to be approximately 400 m², well within the 900 m² allowed by the management plan.
- The leachate breakouts regularly observed on the sloping sides of the landfill appear to be considerably reduced since the gas flare had been commissioned.

The condition of the landfill was yet again of a high quality. This was the seventh 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.

The volumes of green waste composted at the site remained high during the period under review. There was an acceptable volume of non-plant derived matter contained in the green waste received at the site. During a couple of the inspections it was noted that heavy traffic movements occurring on the compost area pad during wet weather had caused damage with rutting and some large areas of ponded compost leachate present.

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 working face being kept consistently within the 900 m² requirement contained in the management plan;
- Continued improved litter control;
- The installation of a gas flare system which has significantly reduced odours around the site and has, so far, been successful in eliminating odour complaints received from the public.

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 may currently be very minor contamination occurring at the present time in the form of increasing nitrate nitrogen, improved management of the leachate and contaminated stormwater to reduce the volume of leachate within the landfill has begun. Steps have been taken towards this with the improvements to intermediate cover in some areas, allowing additional stormwater to be diverted from the leachate system to the silt ponds.

However, this has caused some on site issues with sediment control. At a number of inspections it was found that there was a lot of silt on the access roads, and that the sediment ponds required de-silting. The need for better compaction of the intermediate cover and/or improvements to silt controls or the maintenance thereof. It was noted that it appeared that the amount of silt in the tributaries immediately downstream of the pond discharges appeared to have increased, and that it was possible that some impoundment may be happening.



Photo 16 Silt on access road, 5 July 2017



Figure 12 Silt between landfill northern batter and the leachate pond area, 23 May 2018



Photo 17 Silt below small silt pond, 4 October 2017



Photo 18 Tributary water level below the big silt pond, 3 May 2018

Although this is on site and within the mixing zone, there is, never the less, potential for adverse effects if not brought under control.

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 there does appear to be an emerging trend of increasing ammoniacal nitrogen and manganese concentrations in the discharge from the small eastern silt pond and in PMU000110. The management of the Stage 2 cap was a minor issue first raised in February 2015. Attempts to improve the cap and stock management were made periodically. The issue was thought to have been resolved with the stock being removed in November 2017 and the cap recontoured and vegetated (with maize as per Council agreement) at the inspection on 20 December. However, following the harvesting of the maize, it was found that the recontouring had not been as successful as anticipated, with ponding occurring in places, issues with grass strike in some areas, and the landfill operational contractors indicating that the cap depth may not have been sufficient in some small places. This has led to a full investigation of the cap depth being undertaken after the end of the year under review to ensure that when any necessary remediation is undertaken the cap fully complies with the conditions of the consent and the Colson Road Landfill Management Plan. Although work sometimes has to be delayed due to weather conditions and the practicality and safety of heavy equipment working on the Taranaki Ash cap, it is noted that the first attempt at remediation was not fully successful and so this matter has taken some time to resolve.

At inspection it was also found that there were some areas directly below the working faces on the eastern side of the landfill where insufficient cover had been applied and/or the cover had slumped. This is non-compliant with the management plan and an abatement notice requiring that the cover requirements specified in the management plan be adhered to. Although no significant adverse effects were found as a result of this non-compliance, it was first found at inspection on 3 October 2017, and was not resolved until after the second subsequent inspection at the end of December 2017.

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 very localised and in fewer places than have been found in the 2014-2017 years. There was one occasion on which the source was found to be a broken cap on a leachate line that was discovered at the time of compliance monitoring inspection. This was found to have been resolved at the following inspection. No offensive or objectionable odours were found off site at any of the routine compliance monitoring inspections, and no substantiated odour complaints were received.

3.2 Environmental effects of exercise of consents

Chemical sampling found that there were no significant adverse effects found in the Puremu Stream during the period under review. With the exception of one manganese result, the parameter concentration limits at both of the Puremu Stream compliance points were met at the time of the three sampling surveys. Manganese has been monitored at this point only since the 2013-2014 year, and given that the following sampling result was compliant, it is too early to confidently comment on whether this is part of an emerging trend of increasing concentrations.

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 the Manganaha Stream from the discharges from the Colson Road landfill at the time of either survey. However, results from the Puremu Stream tributary indicated there may be impacts in this stream. Further monitoring is required to determine if the lowered abundance and diversity obtained downstream was due to habitat differences between sites, or if this was a result of landfill discharges.

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 and in the underliner drainage.

With exception of three results, all ambient deposited particulate levels obtained were below the Council guideline level for dust deposition in residential areas (0.13 g/m²/day). The samples contained organic matter including vegetation and bugs, 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 PM₁₀. There were no dust related complaints received by Council during the year under review.

Only one unsubstantiated odour complaint was received, and this prior to the installation of the flare. There were no offensive or objectionable odours found of site at the time the inspections were undertaken.

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 23 to Table 30.

Table 23 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 24 Summary of performance for contaminated stormwater and leachate consent 2370-3

Purpose: To discharge up to 1,000 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	No – Following attempted remediation , cap still needs to be re-contoured to prevent ponding and rilling, and bare patches addressed
2. Consent undertaken in accordance with information supplied in the application	Site inspection and review of documentation on file	No – grazing not managed in accordance with management plan supplied with application
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

Purpose: To discharge up to 1,000 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?
7. Management and site contingency plan	Site inspection and review of documentation on file	No – grazing not being managed according to the management plan resulting in cap damage
8. Maintain a landfill capping barrier and vegetative cover	Site inspection (Stages 1 & 2)	No – on going non-compliance (5 months) related to pugging, rutting and sparse vegetation followed by on-going non-compliance related to ponding, rilling and sparse vegetation after attempt at remediation
9. Area is closed and managed in accordance with the management plan	Site inspection and review of documentation on file	Yes
10. Maintain drains, ponds and contours on site to minimise unwanted water movement and ponding on site	Site inspections	No – pugging and rutting followed by ponding and rilling on Stage 2
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	One manganese result above limits

Purpose: To discharge up to 1,000 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?
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
Overall assessment of environmental performance and compliance in respect of this consent		Improvement required
Overall assessment of administrative performance in respect of this consent		Improvement required

N/A = not applicable

Table 25 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	Yes

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?
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 June 2018	No – Insufficient cover in some areas on three consecutive inspections. Also contravenes previous abatement notice
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	Consent exercised	N/A
7. Optional review provision re environmental effects	No further opportunity for review prior to consent expiry	N/A
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 26 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

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?
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
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 June 2018	No – some areas of exposed refuse outside of working area on some of the flats and on the eastern batter on three consecutive inspections – also contravenes previous abatement notice
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	No further opportunity for review prior to consent expiry	N/A
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 27 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
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 June 2018	No – some areas of exposed refuse outside of working area on some of the flats and on the eastern batter on three consecutive inspections – also contravenes previous abatement notice
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	No further opportunity for review prior to consent expiry	N/A
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 28 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
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	No further opportunity for review prior to consent expiry	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 29 Summary of performance for air discharge consent 4779-1

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	Data provided	Yes
2. Provision of as built plans and suppliers operating instructions within three months of operation of the flare	Data provided	Yes
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	Management plan revised, and is supported by a separate flare specific document (SW-G-20)	Yes
4. Best practicable option (BPO) to prevent or minimise adverse effects on the environment	Site inspection, air surveys, complaint response	No - Landfill gas emissions from a broken cap on one of the leachate lines and fugitive landfill gas emissions from areas of leachate breakout on the eastern side and from the ponded area on the western side of the special waste pit level
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 June 2018	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	No further opportunity for review prior to consent expiry	N/A
14. Optional review provision re landfill gas combustion	No further opportunity for review prior to consent expiry	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		Good

N/A = Not applicable

Table 30 Summary of performance for earthworks stormwater consent 6177-1

Purpose: 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		
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

Purpose: 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 management and site contingency plans	Review of Council records and liaison with consent holder	Yes
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
Overall assessment of administrative performance in respect of this consent		High

N/A = Not applicable

Overall, NPDC demonstrated a good level of environmental performance, however an improvement is required in their administrative performance and compliance with the resource consents as defined in Section 1.1.4. During the year under review there were on-going, and still unresolved, issues with the compliance of the cap on Stage 2. Although there may be some changes occurring in the receiving water quality below this area with regard to the manganese concentration, with one consent non-compliance recorded, it is not considered to be a significant adverse effect at this point in time. There was also insufficient cover found on areas at the edge of recent disposal at Stage 3. This was in contravention of an abatement notice, and took some time to resolve (three non-complaint inspections), however, there were no resultant adverse effects found during the year under review. In relation to air discharge matter, there was one minor non-compliance due to a broken cap on a leachate line, but it is noted there has been a significant improvement in the environmental performance at the site following the installation of the landfill gas flare.

Table 31 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2012-13	0226-1, 2370-3, 4622-1, 4779-1	4			
	6177-1		1		
	4619-1, 4620-1, 4621-1			3	
2013-14	0226-1, 4779-1, 4620-1, 4619-1, 2370-3, 4622-1, 4621-1, 6177-1	8			
2014-15	0226-1, 2370-3, 4619-1, 4622-1	4			
	4620-1, 4621-1, 6177-1		3		
	4779-1		1		
2015-16	0226-1, 4622-1, 6177-1	3			
2015-16	2370-3		1		
	4619-1, 4620-1, 4621-1			3	
	4779-1				1
2016-17	0226-1, 4620-1, 4621-1, 4622-1, 6177-1	5			
	2370-3, 4619-1, 4779-1 (4779-1.1)		3		
Totals		24	9	3	1

3.4 Recommendations from the 2016-2017 Annual Report

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

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.

These recommendations were implemented.

3.5 Alterations to monitoring programmes for 2018-2019

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

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

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

It is proposed that for 2018-2019 monitoring of discharges from the Colson Road regional landfill remains unchanged from that of 2017-2018. However, it is recommended that future biological monitoring is carried out in conjunction with physicochemical water quality monitoring, in order to assist with determination of the causes of the poor results. Given the anaerobic nature of the streambed sediment and the historical results indicating low dissolved oxygen levels in the Puremu Stream and tributary, consideration should also be given to more intensive dissolved oxygen monitoring in this stream in the weeks leading up to the biomonitoring surveys.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2018-2019.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the Colson Road regional landfill in the 2018-2019 year continue at the same level as in 2017-2018, but that that future biological monitoring is carried out in conjunction with physicochemical water quality monitoring.
2. THAT consideration should be given to more intensive dissolved oxygen monitoring in the Puremu Stream in the weeks leading up to the biomonitoring surveys
3. THAT should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

The following abbreviations and terms may be 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.
LFG	Landfill gas, a complex mixture of gaseous components produced as the refuse decomposes.
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).
NLG	Neighbourhood liaison group.
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	<i>Resource Management Act 1991</i> and subsequent amendments.

SS	Suspended solids.
SVOC	Semi-volatile organic compounds
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
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 a Science Services Manager.

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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.

TRK750226

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.

TRK750226

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.

Consent 2370-3

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.

TRK994620

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.

TRK994620

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



DISCHARGE PERMIT

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

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

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

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

Name of
Consent Holder: New Plymouth District Council
Private Bag 2025
New Plymouth 4342

Decision Date 24 January 2017
(Change):

Commencement Date 24 January 2017 (Granted Date: 21 March 1999)
(Change):

Conditions of Consent

Consent Granted: To discharge contaminants into the air associated with
operation of the municipal landfill at Colson Road, New
Plymouth

Expiry Date: 1 June 2025

Review Date(s): June 2018 and in accordance with special condition 14

Site Location: Colson Road, New Plymouth

Grid Reference (NZTM) 1697239E-5676071N (approx. centre of landfill)
1697127E-5676249N (approx. location of flare)

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

General condition

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

Special conditions

1. Within 3 months of the first operation of any landfill gas flare, the consent holder shall provide the Chief Executive, Taranaki Regional Council with a measurement of the temperature of the flare together with a measurement of the concentrations of methane and of hydrogen sulphide in the flare feedstock. Thereafter the consent holder shall annually provide updated information on flare temperature and feedstock composition.
2. Within 3 months of the first operation of any landfill gas flare, the consent holder shall provide the Chief Executive, Taranaki Regional Council with a copy of 'as built' drawings for the flare, including a figure to scale showing the location of the flare relative to the boundaries of the landfill property, and a copy of the supplier's or manufacturer's operating instructions.
3. The first revision of the landfill plan, described in condition 9(c) following installation of any landfill gas flare shall describe, variously, methods of, schedules for, and/or the recording of: observations and inspections of the flare, its operation, and its effects, including downwind odour and smoke plume details; a calibration schedule; records of maintenance; and any complaints. Information gathered under these provisions shall be made available to the Chief Executive, Taranaki Regional Council upon request.
4. 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 13 and 14 of this consent and having regard to the requirements of condition 9 of this consent.
5. 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.
6. That no material is to be burnt at the landfill site with the exception of landfill gas in a flare.
7. 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.

Consent 4779-1.1

8. That no extraction venting of untreated landfill gases be located closer than 200 metres to any boundary of the landfill property site.
9. That the operation of the landfill shall give effect to:
 - (a) the 'Air Discharge Consent Application Supporting Documentation' July 1995, prepared for the New Plymouth District Council by Woodward Clyde;
 - (b) *Variation to Air Discharge Consent – Colson Road Landfill*, prepared by Tonkin & Taylor Ltd and dated December 2016; and
 - (c) 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 Chief Executive, Taranaki Regional Council.
10. 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, and any subsequent application to change the conditions of 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 Chief Executive, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.
11. 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 Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of this consent, and in order to facilitate ongoing consultation.
12. 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 Chief Executive, Taranaki Regional Council.
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.

Consent 4779-1.1

14. That in addition to the review provisions of condition 13 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:

- (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 purposes of:

- (i) considering the options of collecting, extracting, venting or combusting landfill gas; and/or
- (ii) monitoring landfill gas combustion and its effects.

Signed at Stratford on 24 January 2017

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

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

Name of
Consent Holder: New Plymouth District Council
Private Bag 2025
NEW PLYMOUTH

Consent Granted
Date: 11 June 2003

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 Environmental Scientist, Katie Blakemore
Document 2030527
Report No KB036
Date 29 March 2018

Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, October 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 26 October 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 eleventh 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 kick-sampling' technique was used to collect streambed macroinvertebrates from site 1 in the Puremu Stream, site PT1 in an unnamed tributary of the Puremu Stream and 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).

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 and site M6 in the Manganaha stream. This 'sweep-sampling' technique is very similar to Protocol C2 (soft-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	Kick-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-sampling
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 based on the abundance categories in Table 3.

Table 3 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

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 difference of 11 units or more in MCI values is considered significantly different (Stark 1998). A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985; Boothroyd and Stark, 2000) (Table 4).

Table 4 Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
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, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

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.

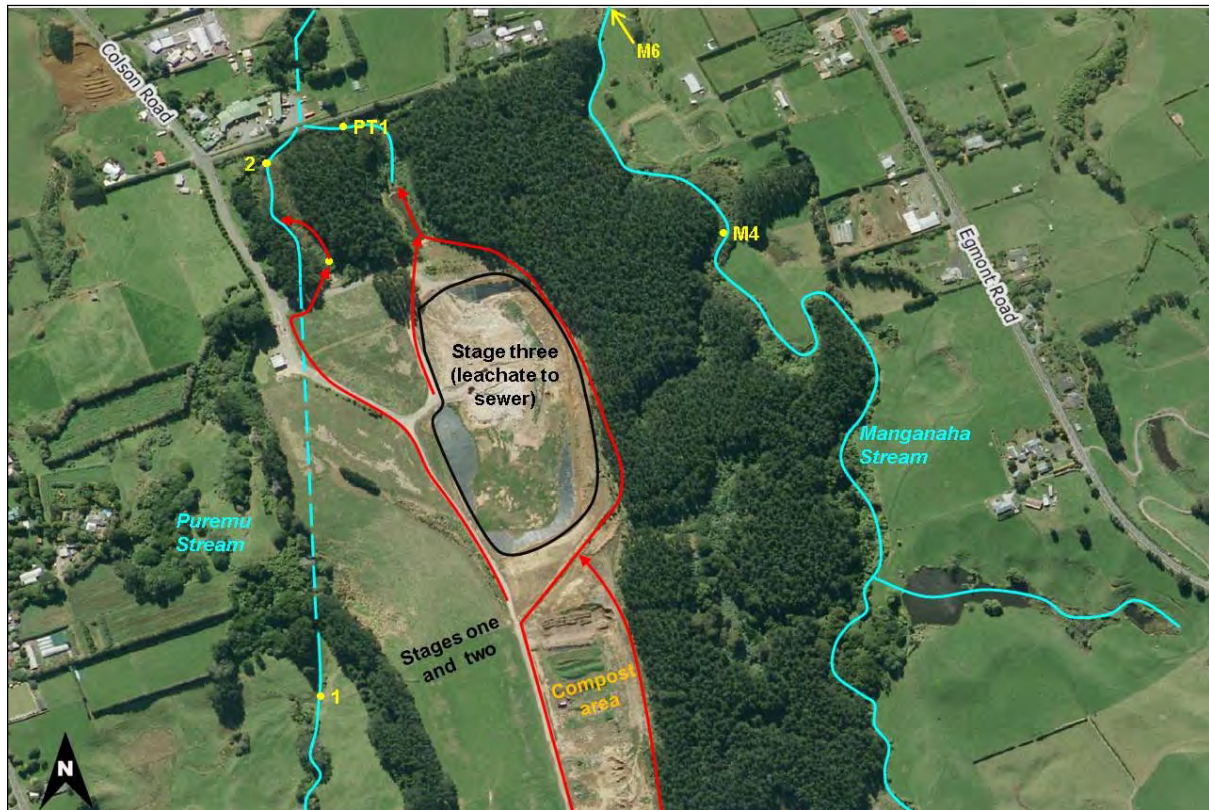


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the landfill site.

Results

At the time of this October 2017 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 15.1 °C to 17.6 °C. Site 1 in the Puremu Stream had an uncoloured, clear, moderate and steady flow. At site PT1 in the unnamed tributary of the Puremu Stream and site 2, the stream had a cloudy, grey, moderate and steady flow. Iron oxide accumulations were present at sites 2 and PT1 but not site 1.

At site 1 the substrate was predominantly gravel with some silt and sand. Substrate at sites PT1 and 2 was dominated by silt, with some sand, gravel, hard clay and wood/root present. 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 site 2, while sites 1 and PT1 had patchy filamentous periphyton. Site 1 also had slippery periphyton mats. Macrophytes were present on the stream margins at site 1, while no macrophytes were recorded growing at site 2 or site PT1. Leaves and wood were patchy on the streambed at sites PT1 and 2, but were absent at site 1. 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 October 2017 survey.

The Manganaha Stream had a cloudy, grey, moderate and steady flow at both sites M4 and M6. The water temperature at site M4 was 14.8 °C and 15.3 °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 and wood/root. The substrate at site M6 was predominantly sand and gravels with some silt, hard clay and wood/root. No periphyton was present at either site. Macrophytes were present on the stream margins at site M4, but were absent at site M6, while leaves and wood on the streambed were widespread at site M6 and absent at site M4. 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 55, together with current results.

Table 5 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	49	8-27	19	14	60-90	75	87	35	1.4-5.0	3.8	4.3
2	61	7-24	17	12	51-87	73	73	35	1.2-3.9	3.0	3.4
PT1*	34	11-22	16	5	55-80	72	48	33	1.2-3.7	2.5	2.0
M4	44	11-25	19	12	76-104	90	90	35	2.3-6.9	4.6	4.9
M6	38	12-27	19	13	58-100	85	95	35	2.8-6.8	4.1	4.7

* 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 6 below.

Table 6 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 26 October 2017

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB17338	FWB17340	FWB17339
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	-	-
NEMERTEA	Nemertea	3	R	-	-
ANNELIDA (WORMS)	Oligochaeta	1	A	C	A
MOLLUSCA	<i>Potamopyrgus</i>	4	A	A	-
	Sphaeriidae	3	R	R	-
CRUSTACEA	Ostracoda	1	C	R	R
	<i>Paracalliope</i>	5	VA	-	-
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	C	-	-
	<i>Zephlebia group</i>	7	R	-	-
COLEOPTERA (BEETLES)	Dytiscidae	5	R	-	-
TRICHOPTERA (CADDISFLIES)	<i>Polypsectropus</i>	6	R	R	-
	<i>Triplectides</i>	5	R	R	-
DIPTERA (TRUE FLIES)	Hexatomini	5	-	R	-
	<i>Paralimnophila</i>	6	R	-	C
	<i>Chironomus</i>	1	-	-	A
	<i>Polypedilum</i>	3	-	A	A
	Tanypodinae	5	-	R	-
	Ceratopogonidae	3	-	R	-
	<i>Austrosimulium</i>	3	-	R	-
ACARINA (MITES)	Acarina	5	R	R	-
No of taxa			14	12	5
MCI			87	73	48
SQMCIs			4.3	3.4	2.0
EPT (taxa)			4	2	0
%EPT (taxa)			29	17	0
'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 14 taxa was recorded at site 1 (Table 5 and Figure 2). This result was five taxa less than the historical median and six taxa less than the previous survey result of 20 taxa.

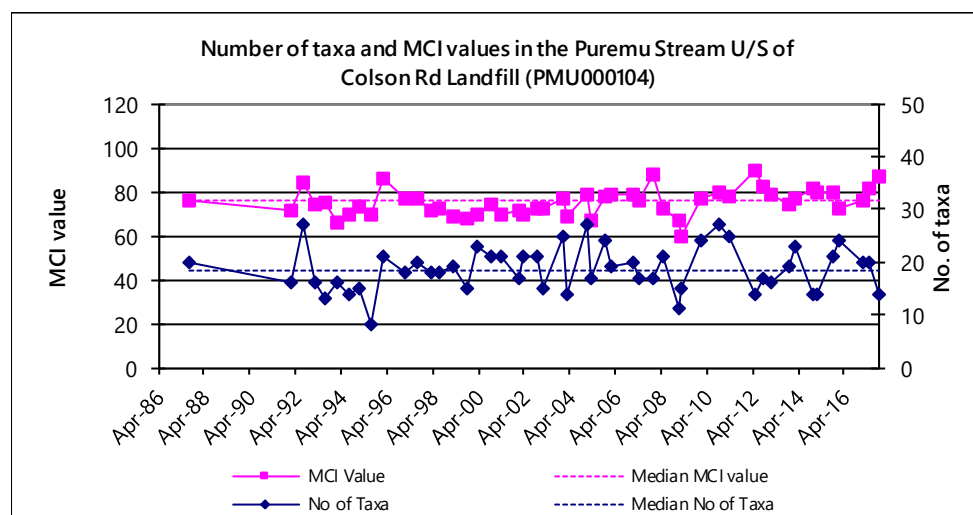


Figure 2 Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

The community at this site was characterised by the 'moderately sensitive' taxon [amphipods (*Paracalliope*)] and two 'tolerant' taxa [(*Potamopyrgus*) snails and oligochaete worms] (Table 6).

In this survey a similar proportion of 'tolerant' and 'sensitive' taxa were recorded in the macroinvertebrate community which resulted in the MCI score of 87 units, a significant (Stark 1998) 12 units more than the median score recorded at this site previously and six units more than that recorded by the previous survey (Table 5 and Figure 2). This MCI score indicated 'fair' biological health. The numerical dominance by one 'sensitive' taxon and two 'tolerant' taxon resulted in the SQMCI_s score of 4.3 units (Table 6). This score was slightly lower than that recorded by the previous survey (by 0.1 unit), and was 0.5 units more than the median score recorded by previous surveys for the site (Table 5).

Site 2 (PMU000110)

A total taxa richness of 12 taxa was recorded at this site, which was five taxa less than the median recorded by previous surveys at this site, and four taxa less than the richness recorded by the previous survey (Table 5 and Figure 3). The macroinvertebrate community was characterised by two 'tolerant' taxa [snails (*Potamopyrgus*) and midge larvae (*Polypedilum*)] (Table 6).

A slightly higher proportion of 'tolerant' taxa recorded at this site (58%) resulted in the MCI score of 73 units, which indicated 'poor' biological health. This MCI score was equal to the historical median for the site and two units more than score recorded in the preceding survey (Table 5, Figure 3). The SQMCI_s score of 3.4 units was above the historical median for the site and equal to the score recorded in the preceding survey (Table 5).

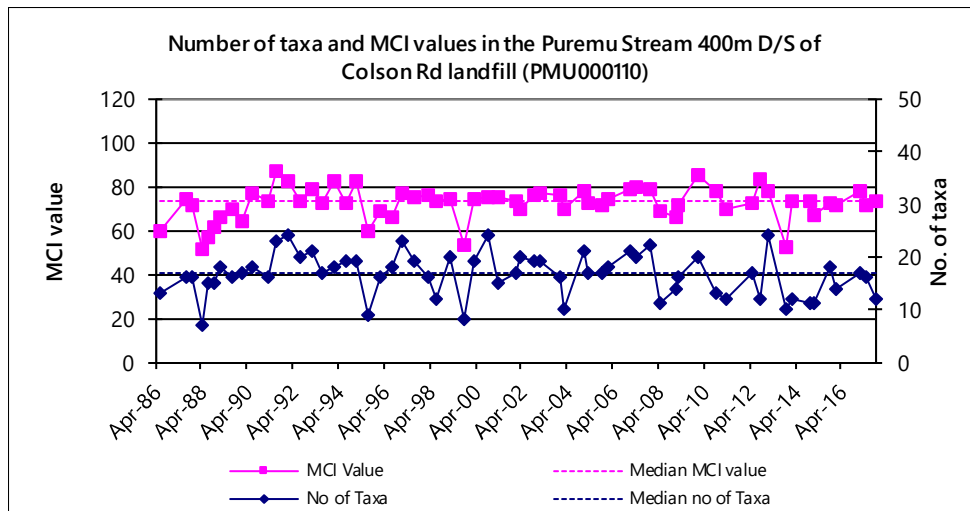


Figure 3 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

Site PT1 (PMU000108)

A total of five taxa was recorded at site PT1 in the unnamed tributary of the Puremu Stream, which was 11 taxa less than the historical median for the site and ten taxa less than that recorded in the preceding survey. It was also the lowest richness recorded at this site to date by six taxa, and was a substantial nine taxa less than that recorded at the 'control' site 1 (Table 5 and Table 6).

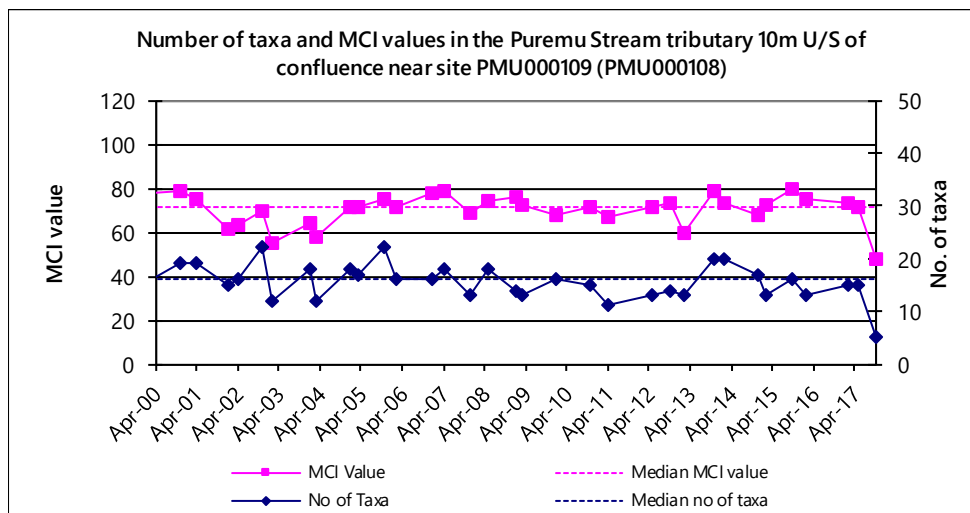


Figure 4 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Road Landfill

The community at site PT1 was characterised by three 'tolerant' taxa [oligochaete worms and midge larvae (*Chironomus* and *Polypedilum*)] (Table 6).

A higher proportion of 'tolerant' (80%) taxa in the macroinvertebrate community was reflected by the MCI score of 48 units, which indicated 'very poor' biological health. This MCI score was a significant (Stark 1998) 24 units lower than the median MCI score for the site, and 23 units lower than the score recorded in the preceding survey (Table 5, Figure 4). This was also the lowest MCI score recorded at this site to date (Table 5, Figure 4).

A SQMCI_s score of 2.0 units was recorded at this site, a non-significant (Stark 1998) 0.5 units lower than the historical median and 0.8 units higher than the score recorded in the preceding survey.

Manganaha Stream

The results for the current survey of the Manganaha Stream are presented in Table 7 below.

Table 7 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 26 October 2017

ON 15 October 2017

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB17341	FWB17342
ANNELIDA (WORMS)	Oligochaeta	1	R	R
MOLLUSCA	<i>Potamopyrgus</i>	4	A	A
CRUSTACEA	<i>Paracalliope</i>	5	A	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	A	A
	<i>Coloburiscus</i>	7	R	R
	<i>Zephlebia group</i>	7	-	R
PLECOPTERA (STONEFLIES)	<i>Zelandobius</i>	5	R	-
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	R	-
	<i>Hydrobiosis</i>	5	-	R
	<i>Psilochorema</i>	6	-	R
	<i>Triplectides</i>	5	R	R
DIPTERA (TRUE FLIES)	Hexatomini	5	-	R
	Orthocladiinae	2	C	R
	<i>Austrosimulium</i>	3	C	A
	Tanyderidae	4	R	-
ACARINA (MITES)	Acarina	5	R	R
No of taxa			12	13
MCI			90	95
SQMCIs			4.9	4.7
EPT (taxa)			5	6
%EPT (taxa)			42	46
'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 12 taxa was recorded at site M4 in this survey which was seven taxa less than the historical median for the site and two taxa less than was recorded in the preceding survey (Table 5 and Figure 5). The community at this site was characterised by two 'moderately sensitive' taxa [amphipods (*Paracalliope*) and mayfly (*Austroclima*)] and one 'tolerant' taxon [snail (*Potamopyrgus*)] (Table 7), which was indicative of reasonable preceding water quality.

A higher proportion of 'sensitive' taxa in the macroinvertebrate community resulted in the 'fair' MCI score of 90 units, which was equal to the historical median and an insignificant (Stark 1998) 3 units lower than the previous survey results for this site (Table 5 and Figure 5).

The numerical dominance by two 'sensitive' taxa was tempered by the dominance of one 'tolerant' taxon which resulted in the SQMCI_s value of 4.9 units, slightly higher than the median score recorded for this site, but a significant (Stark 1998) 0.9 unit higher than that recorded by the previous survey (Table 5).

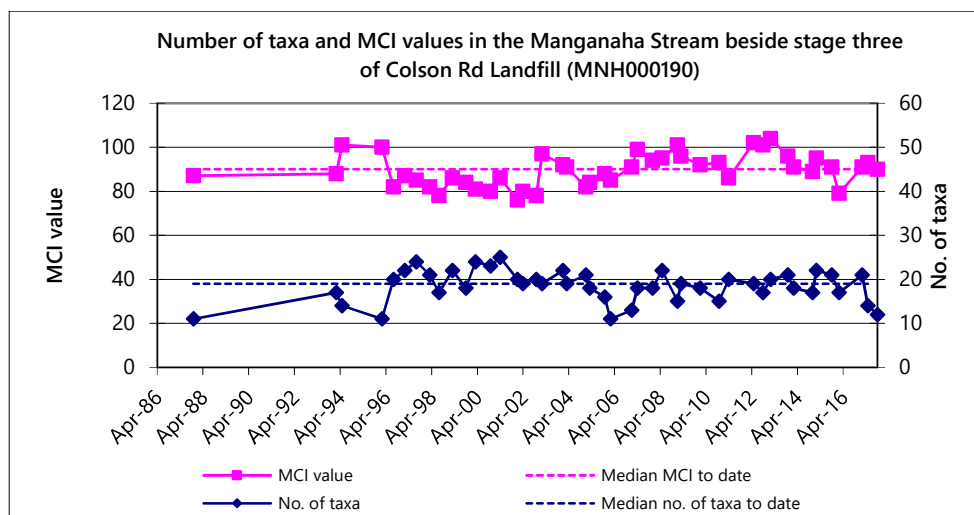


Figure 5 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

Site M6 (MNH000260)

A total of 13 taxa was recorded at site M6, six taxa less than the median for the site and seven taxa less than that recorded in the preceding survey (Table 5 and Figure 6). The community at this site was characterised by one 'moderately sensitive' taxon [mayfly (*Austroclima*)] and two 'tolerant' taxa [snail (*Potamopyrgus*) and sandfly larvae (*Austrosimulium*)] (Table 7).

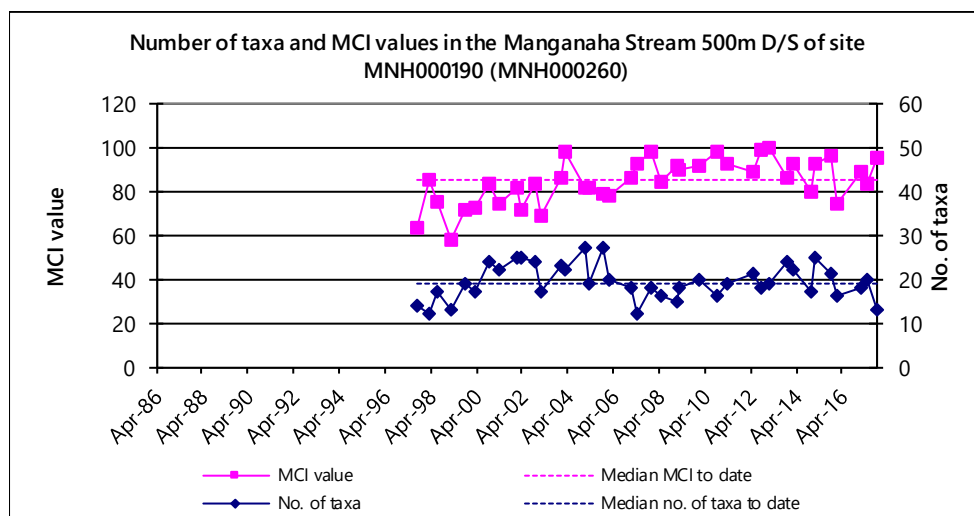


Figure 6 Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

The high proportion (75%) of 'sensitive' taxa in the macroinvertebrate community resulted in the 'fair' MCI score of 95 units, which was an insignificant (Stark, 1998) 10 units lower than the historical median MCI, and a significant (Stark 1998) 12 units higher than the score recorded in the preceding survey (Table 5 and Figure 6).

The SQMCI_s score of 4.7 units was a non-significant 0.6 units higher than the median for this site and 0.6 units lower than the score recorded in the preceding survey (Table 5).

Discussion and conclusions

The Council's standard 'kick-sampling' technique was used at three sites (1, PT1 and M4), and a combination of the 'sweep-sampling' and 'kick-sampling' techniques was used at two sites (2 and M6) to collect streambed macroinvertebrates from the Puremu and Manganaha Streams and unnamed tributary of the Puremu Stream on 26 October 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.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was higher than the score recorded in the preceding survey, and significantly higher than the median score for this site. The SQMCI_s score was also higher than the median score for this site. Lower than usual taxa richness was recorded. These results were indicative of 'fair' biological health and were reflective of reasonable preceding water quality.

Site 2 in the Puremu Stream recorded significantly lower MCI and SQMCI_s scores compared with site 1. Both results were similar to historical median scores. The MCI score was similar to that recorded in the preceding survey, while the SQMCI_s increased significantly since the previous survey. As was the case at site 1, lower than usual taxa richnesses were recorded.

Site PT1 in the unnamed tributary of the Puremu Stream recorded a MCI score of 48, the lowest recorded to date at this site. This score is a highly significant 24 and 23 units lower than the historical median and the score recorded in the preceding survey, as well as being 39 and 25 units lower than the scores at sites 1 and 2 respectively. A low SQMCI_s was recorded. This was also significantly lower than the scores recorded at sites 1 and 2 (by 2.3 and 1.4 units respectively), but was only slightly lower than the historical median and had increased since the preceding survey. This site also recorded a very low taxa richness, substantially lower than the historical median and the preceding result. This was the lowest taxa richness recorded at this site to date, by a substantial six taxa. The results at this site indicate poor physicochemical water quality and/or habitat quality. This is likely to be influenced by the landfill stormwater, which is discharged into this tributary, in conjunction with the iron oxide and high proportion of silt substrate recorded at this site which reduces the habitat quality.

The upstream site on the Manganaha Stream (M4) recorded MCI and SQMCI_s scores slightly above the historical median for the site. The MCI score was slightly lower than that recorded in the preceding survey, while the SQMCI_s score increased significantly. At site M6 (downstream of the landfill), the recorded MCI score was higher than the historical median, but had decreased slightly since the preceding survey. The SQMCI_s score was also slightly higher than the median, and showed a slight decrease since the previous survey. The MCI score was slightly higher and the SQMCI_s score slightly lower when compared with site M6. Lower than usual taxa richnesses were recorded at both sites. The results at these two sites were indicative of reasonable preceding water quality, and the minor differences between sites are most likely related to subtle differences in habitat and sampling techniques between the two sites.

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

Overall, the results of this survey indicate that the discharge of treated stormwater and leachate discharges from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams. However, the Puremu Stream tributary recorded

poor results, are likely to be caused by a combination of landfill leachate and poor quality physical habitat. Further investigation of this site may be warranted.

Summary

Overall, the results of this October 2017 survey were indicative of 'poor' to 'fair' biological health in the Puremu Stream and 'very 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. 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. However, the poor results in the unnamed tributary, with the lowest taxa richness and MCI score recorded at this site to date, may require further investigation.

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Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, February 2018

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 8 February 2018 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 eleventh survey undertaken at this site. Site 3 was also monitored in this survey, as a result of the poor results recorded at site 2 in the preceding survey. This site is downstream of the missing zone specified in the consents held in relation to Colson Road landfill. This site is routine monitored in chemical sampling and has been included in the survey on two previous occasions, in 2004 and 2005 following the collapse of sediment controls during earthworks on the landfill 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. Site 3 is located downstream of the site boundary. 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 kick-sampling' technique was used to collect streambed macroinvertebrates from all six sites in the current survey. 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	Streambed kick
	2	PMU000110	400 metres downstream landfill	Streambed kick
	3	PMU000113	Downstream of the RSPCA driveway	Streambed kick
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Streambed kick
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Streambed kick
	M6	MNH000260	500 downstream of site M4	Streambed kick

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 based on the abundance categories in Table 3.

Table 3 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

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 difference of 11 units or more in MCI values is considered significantly different (Stark 1998). A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985; Boothroyd and Stark, 2000) (Table 4).

Table 4 Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
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, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

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.

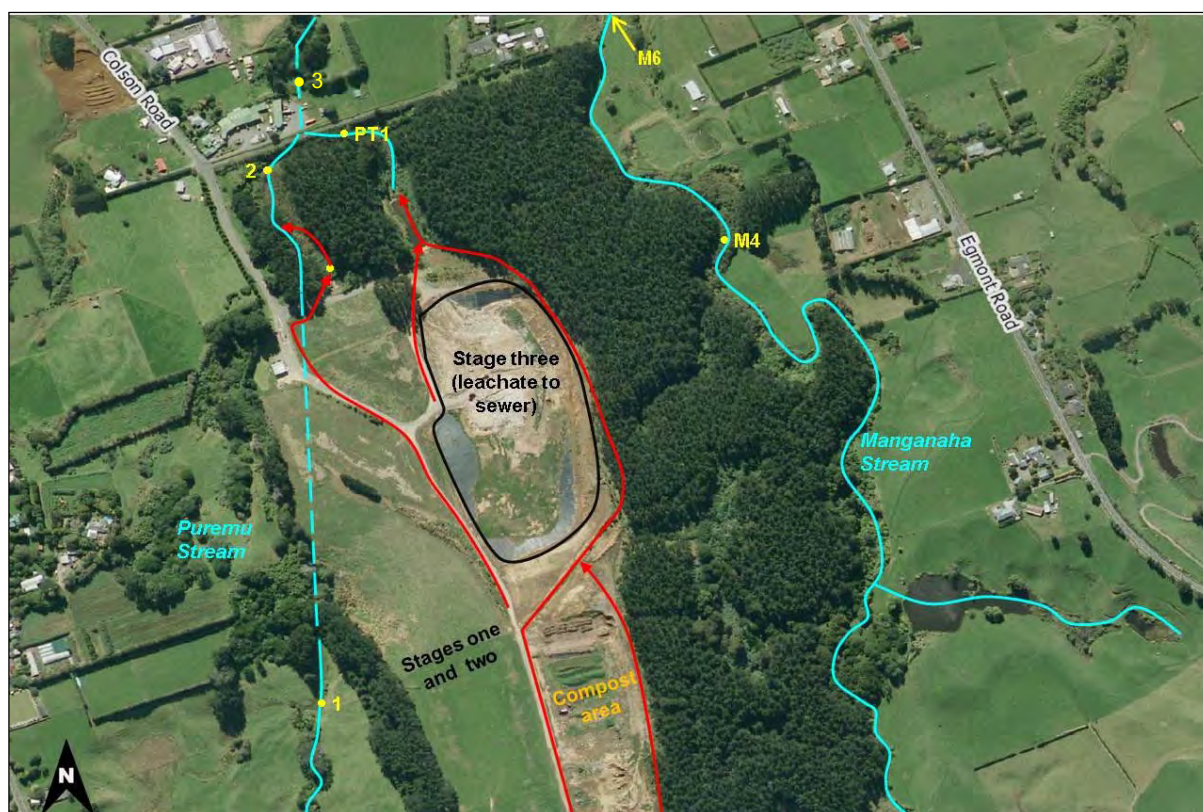


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the landfill site

Results

At the time of this February 2018 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 18.0 °C to 20.3 °C. Site 1 in the Puremu Stream and site PT1 in the unnamed tributary of the Puremu Stream had an uncoloured, clear, very low and slow flow. At site 2, the stream had a cloudy, uncoloured, very low and slow flow. Site 3 had a cloudy, grey, very low and very slow/still flow. Iron oxide accumulations were present at all four sites.

At site 1 the substrate was predominantly gravel with some silt and sand. Substrate at sites PT1 and 2 was dominated by silt and hard clay, with some sand and wood/root present. Site PT1 also had gravels present. Site 3 was dominated by sand and fine gravel, with wood/root and silt present. Complete shading of the streambed was recorded at site 2, while site 1 was unshaded. Sites PT1 and 3 were partially shaded.

No periphyton was recorded at any of the four Puremu Stream sites. Macrophytes were present on the stream margins at sites 1 and 3, while no macrophytes were recorded growing at site 2 or site PT1. Leaves and wood were patchy on the streambed at sites 1, 2 and PT1, and were widespread at site 3. 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 2018 survey.

The Manganaha Stream had a cloudy, grey, very low and very slow/still flow at sites M4 and M6. The water temperature at site M4 was 17.5 °C and 18.0 °C at site M6. Both sites M4 and M6 were partially shaded. The substrate at site M4 consisted mainly of gravels and sand with some silt and wood/root. The substrate at site M6 was predominantly sand and gravels with some silt, hard clay and wood/root.

Patchy filamentous periphyton was present at both sites, while periphyton mats were slippery at site M6 and absent at site M4. Macrophytes were present on the stream margins at site M4, but were absent at site M6. Leaves were patchy on the streambed and wood was widespread at both sites. 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 5, together with current results. Due to site 3 having only two previous surveys carried out, no medians have been calculated for this site.

Table 5 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			
	N	Range	Median	Current survey	Range	Median	Current Survey	N	Range	Median	Current survey
1	50	8-27	19	11	60-90	76	75	36	1.4-5.0	3.8	3.9
2	62	7-24	17	8	51-87	73	65	36	1.2-3.9	3.0	3.6
3	2	8-25		7	69-73		51	2	1.3-2.1		2.5
PT1*	35	5-22	16	6	48-80	71	73	34	1.2-3.7	2.4	2.1
M4	45	11-25	19	10	76-104	90	72	36	2.3-6.9	4.7	3.9
M6	39	12-27	19	12	58-100	85	72	36	2.8-6.8	4.1	3.3

* 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 6 below.

Table 6 Macroinvertebrate fauna of the Puremu Stream (sites 1, 2 & 3) and tributary (site PT1) in relation to the Colson Road landfill sampled on 8 February 2018

Taxa List	Site Number	MCI score	1	2	3	PT1
	Site Code		PMU000104	PMU000110	PMU000113	PMU000108
	Sample Number		FWB18043	FWB18045	FWB18046	FWB18044
COELENTERATA	Coelenterata	3	-	-	R	-
PLATYHELMINTHES (FLATWORMS)	Cura	3	R	-	-	-
ANNELIDA (WORMS)	Oligochaeta	1	C	R	VA	R
HIRUDINEA (LEECHES)	Hirudinea	3	R	-	-	R
MOLLUSCA	Potamopyrgus	4	A	A	VA	R
	Sphaeriidae	3	-	R	A	-
CRUSTACEA	Ostracoda	1	C	-	C	A
	Paracalliope	5	A	-	R	-
HEMIPTERA (BUGS)	Microvelia	3	-	R	-	-
COLEOPTERA (BEETLES)	Scirtidae	8	-	-	-	R
TRICHOPTERA (CADDISFLIES)	Polypsectropus	6	R	C	-	-
	Oeconesidae	5	R	-	-	-
	Tripletides	5	R	R	-	-
DIPTERA (TRUE FLIES)	Chironomus	1	-	C	C	-
	Polypedilum	3	-	C	-	-
	Tanypodinae	5	R	-	-	C
	Sciomyzidae	3	R	-	-	-
No of taxa			11	8	7	6
MCI			75	65	51	73
SQMCIs			3.9	3.6	2.5	2.1
EPT (taxa)			3	2	0	0
%EPT (taxa)			27	25	0	0
'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 11 taxa was recorded at site 1 (Table 5 and Figure 2). This result was eight taxa less than the historical median and three taxa less than the previous survey result of 14 taxa.

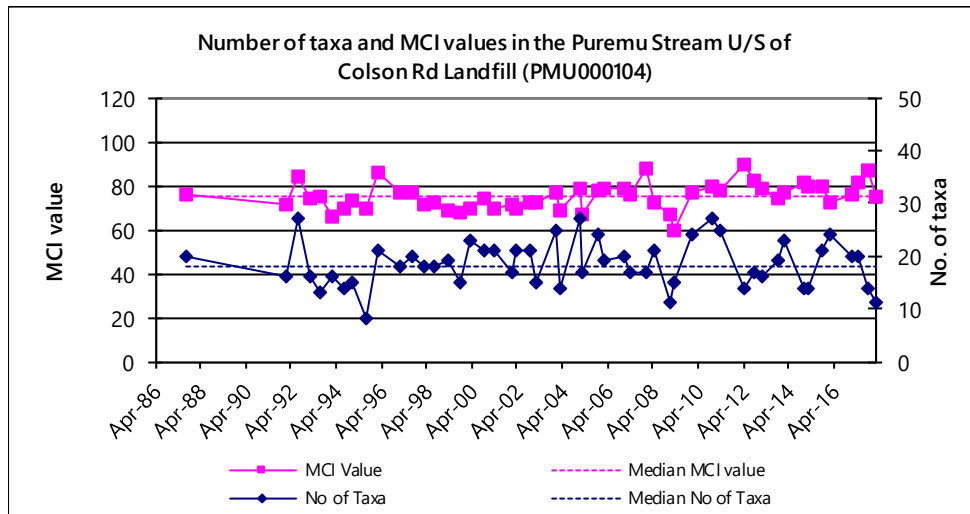


Figure 2 Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

The community at this site was characterised by one 'moderately sensitive' taxon [amphipod (*Paracalliope*)] and one 'tolerant' taxon [mud snail (*Potamopyrgus*)] (Table 6).

In this survey a slightly higher proportion of 'tolerant' taxa (64%) were recorded in the macroinvertebrate community which resulted in the MCI score of 75 units, a significant (Stark 1998) 12 units less than the preceding survey and one unit less than the median score recorded at this site previously (Table 5 and Figure 2). This MCI score indicated 'poor' biological health. The numerical dominance by one 'sensitive' taxon and one 'tolerant' taxon resulted in the SQMCI_s score of 3.9 units (Table 6). This score was slightly lower than that recorded by the previous survey (by 0.4 unit), and was 0.1 units more than the median score recorded by previous surveys for the site (Table 5).

Site 2 (PMU000110)

A total taxa richness of eight taxa was recorded at this site, which was nine taxa less than the median recorded by previous surveys at this site, and four taxa less than the richness recorded by the previous survey (Table 5 and Figure 3).

The macroinvertebrate community was characterised by one 'tolerant' taxon [mud snail (*Potamopyrgus*)] (Table 6).

A slightly higher proportion of 'tolerant' taxa recorded at this site (75%) resulted in the MCI score of 65 units, which indicated 'poor' biological health. This MCI score was eight units less than score recorded in the preceding survey and the historical median for the site (Table 5, Figure 3). The SQMCI_s score of 3.6 units was above the historical median for the site (by 0.6 unit) and 0.2 unit higher than the score recorded in the preceding survey (Table 5).

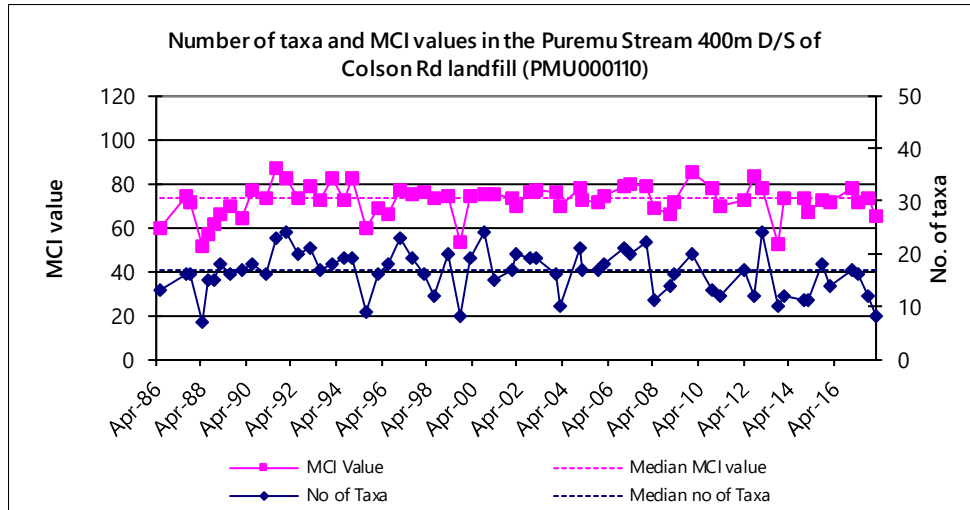


Figure 3 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

Site 3 (PMU000113)

A total of seven taxa was recorded at this site. This was the lowest score recorded at this site, by one taxon. However, only two previous surveys have been carried out at this site, with the most recent previous survey undertaken 13 years prior to the current survey. The macroinvertebrate community was characterised by three 'tolerant' taxa [oligochaete worms, mud snail (*Potamopyrgus*) and pea clam (*Sphaeriidae*)] (Table 6).

A high proportion of 'tolerant' taxa (86%) resulted in the MCI score of 51 units, which indicated 'very poor' biological health. This is the lowest score recorded at this site, however there is very limited previous data for this site. A SQMCI_s score of 2.5 units, the highest score recorded at this site to date (Table 5).

Site PT1 (PMU000108)

A total of six taxa was recorded at site PT1 in the unnamed tributary of the Puremu Stream, which was ten taxa less than the historical median for the site and one taxon more than that recorded in the preceding survey. It was also the second lowest richness recorded at this site to date (Table 5 and Table 6).

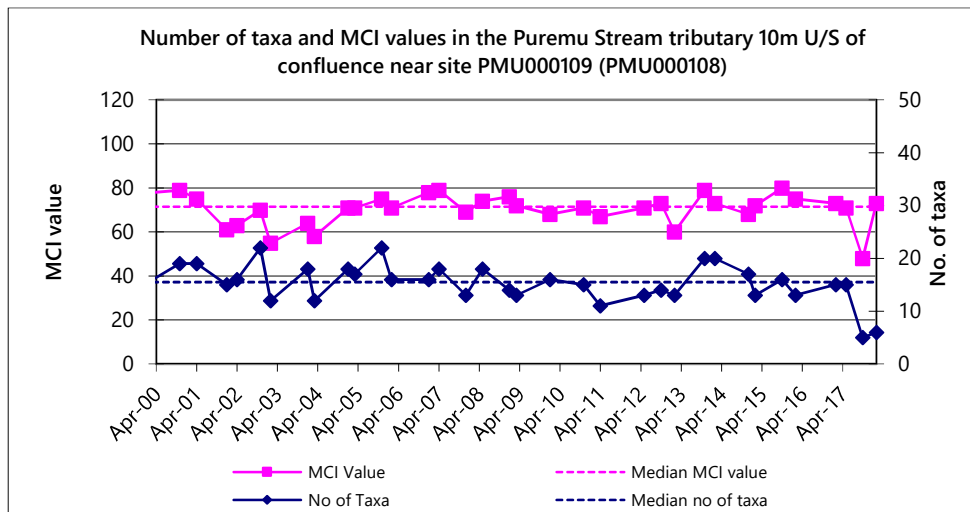


Figure 4 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Road Landfill

The community at site PT1 was characterised by one 'tolerant' taxon [seed shrimps (*Ostracoda*)] (Table 6).

A higher proportion of 'tolerant' (67%) taxa in the macroinvertebrate community was reflected by the MCI score of 73 units, which indicated 'poor' biological health. This MCI score was 2 units higher than the median MCI score for the site, and a significant (Stark 1998) 25 units higher than the score recorded in the preceding survey (Table 5, Figure 4). This showed a significant improvement from the lowest MCI score recorded at this site to date in the preceding survey (Table 5, Figure 4).

A SQMCI_s score of 2.1 units was recorded at this site, a non-significant (Stark 1998) 0.3 unit lower than the historical median and 0.1 unit higher than the score recorded in the preceding survey.

Manganaha Stream

The results for the current survey of the Manganaha Stream are presented in Table 7 below.

Table 7 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 8 February 2018

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB18047	FWB18048
COELENTERATA	Coelenterata	3	-	C
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	-	R
NEMERTEA	Nemertea	3	R	-
ANNELIDA (WORMS)	Oligochaeta	1	A	A
MOLLUSCA	<i>Potamopyrgus</i>	4	VA	VA
	Sphaeriidae	3	-	C
CRUSTACEA	Ostracoda	1	R	VA
	<i>Paracalliope</i>	5	A	VA
	<i>Paranephrops</i>	5	R	-
ODONATA (DRAGONFLIES)	<i>Austrolestes</i>	4	R	-
	<i>Xanthocnemis</i>	4	-	R
TRICHOPTERA (CADDISFLIES)	<i>Triplectides</i>	5	A	A
DIPTERA (TRUE FLIES)	<i>Polypodilum</i>	3	R	-
	Tanypodinae	5	R	C
	Tanyderidae	4	-	R
ACARINA (MITES)	Acarina	5	-	R
No of taxa			10	12
MCI			72	72
SQMCI _s			3.9	3.3
EPT (taxa)			1	1
%EPT (taxa)			10	8
'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 ten taxa was recorded at site M4 in this survey which was nine taxa less than the historical median for the site and two taxa less than was recorded in the preceding survey (Table 5 and Figure 5). This was the lowest richness recorded at this site to date, by only one taxon (Table 5). The community at this site was characterised by two 'moderately sensitive' taxa [amphipods (*Paracalliope*) and caddisfly (*Triplectides*)] and two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)] (Table 7).

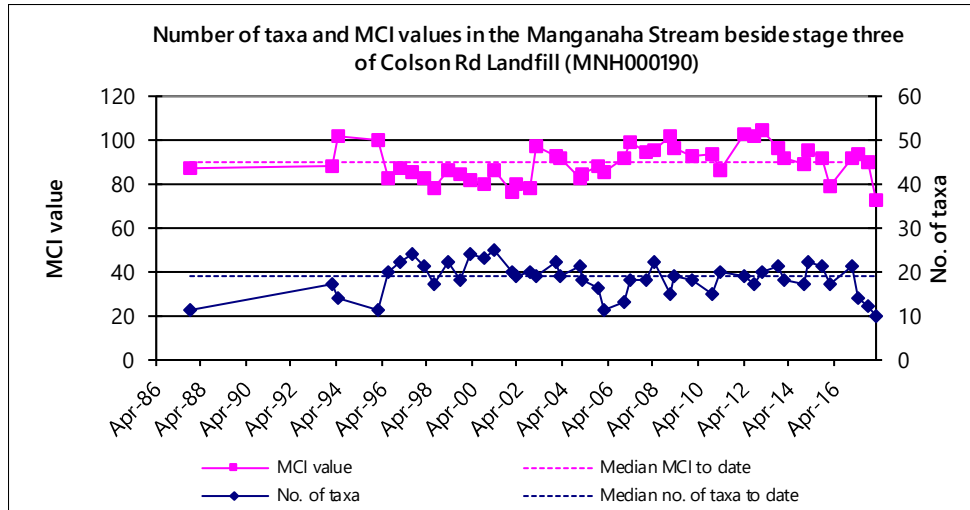


Figure 5 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

A slightly higher proportion of 'tolerant' taxa (60%) in the macroinvertebrate community resulted in the 'poor' MCI score of 72 units, which was a significant (Stark 1998) 18 units lower than the previous survey results and the historical median for this site (Table 5 and Figure 5).

The numerical dominance by two 'sensitive' taxa was tempered by the dominance of two 'tolerant' taxa which resulted in the SQMCI_s value of 3.9 units, slightly lower than the median score recorded for this site, but a significant (Stark 1998) 1.0 unit less than that recorded by the previous survey (Table 5).

Site M6 (MNH000260)

A total of 12 taxa was recorded at site M6, seven taxa less than the median for the site and one taxon less than that recorded in the preceding survey (Table 5 and Figure 6). This was equal to the lowest taxa richness recorded at this site to date (Table 5). The community at this site was characterised by two 'moderately sensitive' taxa [amphipod (*Paracalliope*) and caddisfly (*Triplectides*)] and three 'tolerant' taxa [oligochaete worms, mud snail (*Potamopyrgus*) and seed shrimp (Ostracoda)] (Table 7).

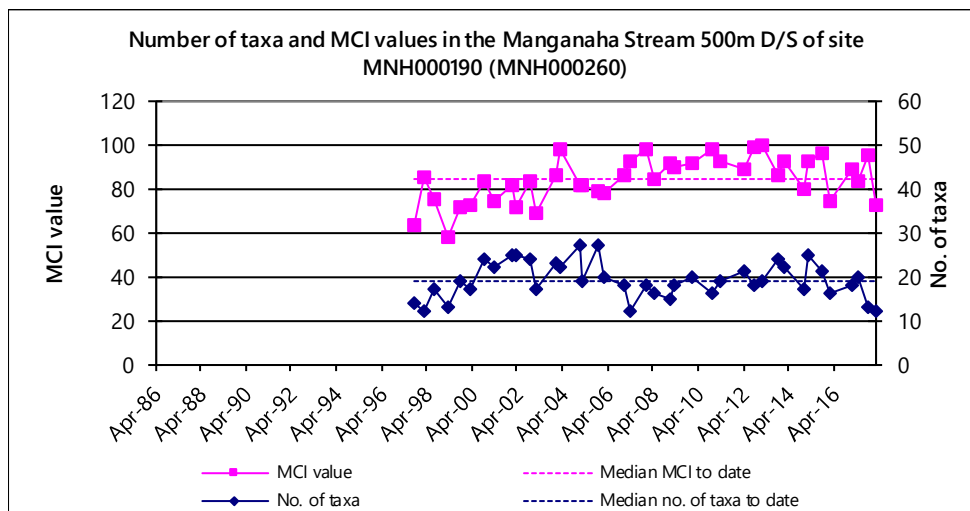


Figure 6 Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

The high proportion (67%) of 'sensitive' taxa in the macroinvertebrate community resulted in the 'poor' MCI score of 72 units, which was a significant (Stark, 1998) 13 units lower than the historical median MCI, and 23 units lower than the score recorded in the preceding survey (Table 5 and Figure 6).

The SQMCI_s score of 3.3 units was a non-significant 0.8 units lower than the median for this site and a significant (Stark 1998) 1.4 units lower than the score recorded in the preceding survey (Table 5).

Discussion and conclusions

The Council's standard 'kick-sampling' technique was used at six sites to collect streambed macroinvertebrates from the Puremu and Manganaha Streams and unnamed tributary of the Puremu Stream on 8 February 2018. 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.

In this survey, the MCI score recorded at the upstream control site 1 on the Puremu Stream was significantly lower than the score recorded in the preceding survey, but similar to the median score for this site. The SQMCI_s score was also similar to the median score for this site. Lower than usual taxa richness was recorded. These results were indicative of 'poor' biological health.

Site 2 in the Puremu Stream recorded a slightly lower MCI score and significantly lower SQMCI_s score compared with site 1. Both results were similar to historical median scores and to those recorded in the preceding survey. As was the case at site 1, lower than usual taxa richnesses were recorded.

Site 3 was monitored in response to the poor results recorded in the Puremu Stream tributary in the preceding survey. This site recorded the lowest MCI, taxa richness and SQMCI_s scores of the three sites in main stem of the Puremu Stream. The MCI and SQMCI_s scores were significantly lower than those at sites 1 and 2. This may be due to impacts from the landfill, but due to slight habitat differences between the sites it is not possible to definitively conclude that this is the case. The slower flow at this site compared to the upstream sites affecting habitat, and increasing sediment deposition. It was also noted during sampling that the streambed sediment had a slight anaerobic odour. Furthermore, the culvert upstream of this site also has the potential to influence conditions at this site. The taxa richness and MCI score were also lower than has previously been recorded at this site. However, with only two previous samples taken at this site, the most recent of which was thirteen years ago, there is insufficient information available to draw any conclusions about any possible changes in the biological health at this site. Further, although the scores indicate possible impacts, the influence of the culvert upstream has the potential to confound the results. Physicochemical water quality sampling carried out in conjunction with the biological monitoring may assist with interpretation of the results.

Site PT1 in the unnamed tributary of the Puremu Stream recorded a MCI score of 73, a significant recovery since the previous (October 2017) survey which recorded a MCI score of 48 units which was the lowest MCI score recorded to date at this site. This score is a slight two units higher than the historical median, as well as being similar to the scores at sites 1 and 2 respectively. The SQMCI_s score was also significantly lower than the scores recorded at sites 1 and 2 (by 1.8 and 1.5 units respectively), and was an insignificant 0.4 unit lower than the score at site 3. This SQMCI_s score was only slightly lower than the historical median and had increased since the preceding survey. This site also recorded a very low taxa richness, substantially lower than the historical median but one taxon more than the preceding result (which was the lowest result

recorded at this site to date). The results at this site indicate poor physicochemical water quality and/or habitat quality. 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 sites in the Manganaha Stream (M4 & M6) recorded MCI identical MCI scores of 72 units, both of which were significantly lower than their respective historical medians. SQMCI_s scores were at both sites were similar, and scores were slightly lower than historical medians for the respective sites. MCI and SQMCI_s scores at both sites had decreased significantly since the preceding survey. Taxa richnesses were low, with the lowest richness to date recorded at site M4 and equal to the lowest richness to date recorded at site M6. The results at these two sites were indicative of reasonable preceding water quality, and the very minor differences between sites are most likely related to subtle differences in habitat and sampling techniques between the two sites.

No undesirable biological growths were detected at any of these sites during this February 2018 survey.

Overall, the results of this survey indicate that the discharge of treated stormwater and leachate discharges from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Manganaha Stream. However, the results in the Puremu Stream and tributary indicate there may be impacts in this stream. Site PT1 showed some recovery from the poor results recorded in the previous survey. Results at site 3 were poorer than other sites in the Puremu Stream, which may be a result of habitat differences between sites, or may result from landfill discharges. It is recommended that future biological monitoring is carried out in conjunction with physicochemical water quality monitoring, in order to assist with determination of the causes of the poor results. Given the anaerobic nature of the streambed sediment and the historical results indicating low dissolved oxygen levels in the Puremu Stream and tributary, consideration should be given to more intensive dissolved oxygen monitoring in this Stream.

Summary

Overall, the results of this February 2018 survey were indicative of 'poor' biological health at sites M4 and M6 in the Manganaha Stream. These results were not indicative of any significant adverse effects on the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey. In the Puremu Stream, results were indicative of 'very poor' to 'poor' biological health and 'poor' biological health in the unnamed tributary of the Puremu Stream. Site 3, which was monitored in response to the previous poor results in the unnamed tributary of the Puremu Stream, itself showed poor results. From the available information, it cannot be determined whether these results are due to impacts from the landfill, the influence of the culvert, habitat conditions at this site, or more likely a combination of these factors.

It is recommended that physicochemical water quality monitoring is carried out in conjunction with biological monitoring, in order to provide further information to assist with determining the causes of any potential effects of the landfill. Consideration should also be given to more intensive monitoring of dissolved oxygen levels in the Puremu Stream.

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Appendix III

Groundwater results



Certificate of Analysis

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Client:	Taranaki Regional Council	Lab No:	1992298	SPv1
Contact:	L Smith	Date Received:	31-May-2018	
	C/- Taranaki Regional Council	Date Reported:	18-Jun-2018	
	Private Bag 713	Quote No:	91996	
	Stratford 4352	Order No:		
		Client Reference:	Template 298	
		Add. Client Ref:	Colson Road groundwater	
		Submitted By:	R McDonnell	

Sample Type: Aqueous

Sample Name:	GND0255 30-May-2018 2:10 pm	GND0575 30-May-2018 12:30 pm	GND1301 30-May-2018 11:00 am		
Lab Number:	1992298.1	1992298.2	1992298.3		

Individual Tests

Free Ammonia*	g/m ³ at Client Temperature	< 0.010	< 0.010	< 0.010	-	-
pH	pH Units	6.2	6.6	7.2	-	-
Total Alkalinity	g/m ³ as CaCO ₃	36	84	93	-	-
Electrical Conductivity (EC)	mS/m	25.2	34.3	30.4	-	-
Sample Temperature*	°C	14.8	14.7	14.2	-	-
Dissolved Aluminium	g/m ³	0.003	< 0.003	< 0.003	-	-
Dissolved Arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dissolved Beryllium	g/m ³	< 0.00010	< 0.00010	< 0.00010	-	-
Dissolved Boron	g/m ³	0.019	0.018	0.021	-	-
Dissolved Cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	-	-
Dissolved Chromium	g/m ³	< 0.0005	0.0012	< 0.0005	-	-
Dissolved Cobalt	g/m ³	0.0002	< 0.0002	< 0.0002	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Dissolved Iron	g/m ³	< 0.02	< 0.02	< 0.02	-	-
Dissolved Lead	g/m ³	< 0.00010	< 0.00010	< 0.00010	-	-
Dissolved Manganese	g/m ³	0.0129	0.0061	0.148	-	-
Dissolved Selenium	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dissolved Vanadium	g/m ³	< 0.0010	0.0081	0.0062	-	-
Dissolved Zinc	g/m ³	0.024	0.0050	0.023	-	-
Chloride	g/m ³	52	55	37	-	-
Total Ammoniacal-N	g/m ³	< 0.010	< 0.010	< 0.010	-	-
Nitrite-N	g/m ³	< 0.002	< 0.002	0.003	-	-
Nitrate-N + Nitrite-N	g/m ³	2.0	1.34	0.69	-	-
Sulphate	g/m ³	2.3	2.2	10.0	-	-
Chemical Oxygen Demand (COD)	g O ₂ /m ³	< 6	< 6	< 6	-	-

Haloethers Trace in SVOC Water Samples by GC-MS

Bis(2-chloroethoxy) methane	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Bis(2-chloroethyl)ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Bis(2-chloroisopropyl)ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
4-Bromophenyl phenyl ether	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
4-Chlorophenyl phenyl ether	g/m ³	< 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	-	-
2,6-Dinitrotoluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Nitrobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
N-Nitrosodi-n-propylamine	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Aqueous						
Sample Name:		GND0255 30-May-2018 2:10 pm	GND0575 30-May-2018 12:30 pm	GND1301 30-May-2018 11:00 am		
Lab Number:		1992298.1	1992298.2	1992298.3		
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
N-Nitrosodiphenylamine + Diphenylamine	g/m3	< 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	-	-
alpha-BHC	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
beta-BHC	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
delta-BHC	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
gamma-BHC (Lindane)	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
4,4'-DDD	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
4,4'-DDE	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
4,4'-DDT	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dieldrin	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Endosulfan I	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan II	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan sulfate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Endrin	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Endrin ketone	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Heptachlor	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Heptachlor epoxide	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Hexachlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Acenaphthylene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Anthracene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[a]anthracene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[a]pyrene (BAP)	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[g,h,i]perylene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[k]fluoranthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
1&2-Chloronaphthalene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Chrysene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Dibenzo[a,h]anthracene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Fluoranthene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Fluorene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Indeno(1,2,3-c,d)pyrene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
2-Methylnaphthalene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Naphthalene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Phenanthrene	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
Pyrene	g/m ³	< 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	-	-
2,4-Dichlorophenol	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
2,4,6-Trichlorophenol	g/m ³	< 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	-	-
2,4-Dimethylphenol	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
2-Methylphenol (o-Cresol)	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
2-Nitrophenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Pentachlorophenol (PCP)	g/m ³	< 0.010	< 0.010	< 0.010	-	-
Phenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
2,4,5-Trichlorophenol	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-

Sample Type: Aqueous						
Sample Name:		GND0255 30-May-2018 2:10 pm	GND0575 30-May-2018 12:30 pm	GND1301 30-May-2018 11:00 am		
Lab Number:		1992298.1	1992298.2	1992298.3		
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Diethylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dimethylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Di-n-butylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Di-n-octylphthalate	g/m ³	< 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	-	-
Di(2-ethylhexyl)adipate	g/m ³	< 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	-	-
1,3-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
1,4-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Hexachloroethane	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
1,2,4-Trichlorobenzene	g/m ³	< 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	-	-
Carbazole	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Dibenzofuran	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Isophorone	g/m ³	< 0.0005	< 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
Free Ammonia*	Calculation from NH ₄ N, pH, Temperature (Calculations based on data for distilled water). APHA Table 8010:VI 22 nd ed. 2012.	0.010 g/m ³ at Client Temperature	1-3
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	1-3
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
pH	pH meter. APHA 4500-H ⁺ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1-3
Sample Temperature*	Supplied by customer, otherwise 20°C.	0.1 °C	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-3
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.003 g/m ³	1-3
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.005 g/m ³	1-3
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00005 g/m ³	1-3
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0002 g/m ³	1-3

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-3
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22 nd ed. 2012.	0.5 g/m ³	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 22 nd ed. 2012.	0.010 g/m ³	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22 nd ed. 2012.	0.5 g/m ³	1-3
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22 nd ed. 2012.	6 g O ₂ /m ³	1-3

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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Martin Cowell - BSc
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 4

Client:	Taranaki Regional Council	Lab No:	1993179	SPv1
Contact:	L Smith	Date Received:	01-Jun-2018	
	C/- Taranaki Regional Council	Date Reported:	18-Jun-2018	
	Private Bag 713	Quote No:	91996	
	Stratford 4352	Order No:		
		Client Reference:	Template 298	
		Add. Client Ref:	Colson Road groundwater	
		Submitted By:	R McDonnell	

Sample Type: Aqueous

Sample Name:	GND0251 31-May-2018 1:30 pm	GND0573 31-May-2018 3:30 pm	GND1300 31-May-2018 10:45 am		
Lab Number:	1993179.1	1993179.2	1993179.3		

Individual Tests

Free Ammonia*	g/m ³ at Client Temperature	< 0.010	< 0.010	< 0.010	-	-
pH	pH Units	6.3	6.0	6.4	-	-
Total Alkalinity	g/m ³ as CaCO ₃	47	27	30	-	-
Electrical Conductivity (EC)	mS/m	16.7	36.1	18.0	-	-
Sample Temperature*	°C	13.1	14.8	13.3	-	-
Dissolved Aluminium	g/m ³	0.008	< 0.003	0.013	-	-
Dissolved Arsenic	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dissolved Beryllium	g/m ³	< 0.00010	< 0.00010	< 0.00010	-	-
Dissolved Boron	g/m ³	0.016	0.025	0.021	-	-
Dissolved Cadmium	g/m ³	< 0.00005	< 0.00005	< 0.00005	-	-
Dissolved Chromium	g/m ³	0.0008	< 0.0005	< 0.0005	-	-
Dissolved Cobalt	g/m ³	< 0.0002	< 0.0002	0.0002	-	-
Dissolved Copper	g/m ³	0.0007	< 0.0005	0.0009	-	-
Dissolved Iron	g/m ³	< 0.02	< 0.02	< 0.02	-	-
Dissolved Lead	g/m ³	< 0.00010	< 0.00010	< 0.00010	-	-
Dissolved Manganese	g/m ³	0.0049	0.0047	0.0078	-	-
Dissolved Selenium	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dissolved Vanadium	g/m ³	0.0013	< 0.0010	0.0011	-	-
Dissolved Zinc	g/m ³	0.0179	0.0019	0.020	-	-
Chloride	g/m ³	21	84	27	-	-
Total Ammoniacal-N	g/m ³	< 0.010	< 0.010	< 0.010	-	-
Nitrite-N	g/m ³	< 0.002	< 0.002	< 0.002	-	-
Nitrate-N + Nitrite-N	g/m ³	0.174	0.71	1.83	-	-
Sulphate	g/m ³	4.1	7.1	6.9	-	-
Chemical Oxygen Demand (COD)	g O ₂ /m ³	< 6	< 6	< 6	-	-

Haloethers Trace in SVOC Water Samples by GC-MS

Bis(2-chloroethoxy) methane	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Bis(2-chloroethyl)ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Bis(2-chloroisopropyl)ether	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
4-Bromophenyl phenyl ether	g/m ³	< 0.0003	< 0.0003	< 0.0003	-	-
4-Chlorophenyl phenyl ether	g/m ³	< 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	-	-
2,6-Dinitrotoluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Nitrobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
N-Nitrosodi-n-propylamine	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-



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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Aqueous						
Sample Name:		GND0251 31-May-2018 1:30 pm	GND0573 31-May-2018 3:30 pm	GND1300 31-May-2018 10:45 am		
Lab Number:		1993179.1	1993179.2	1993179.3		
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
N-Nitrosodiphenylamine + Diphenylamine	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
alpha-BHC	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
beta-BHC	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
delta-BHC	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
gamma-BHC (Lindane)	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
4,4'-DDD	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
4,4'-DDE	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
4,4'-DDT	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Dieldrin	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
Endosulfan I	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan II	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan sulfate	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Endrin	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
Endrin ketone	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Heptachlor	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
Heptachlor epoxide	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
Hexachlorobenzene	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Acenaphthylene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Anthracene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[a]anthracene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[a]pyrene (BAP)	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[g,h,i]perylene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Benzo[k]fluoranthene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
1&2-Chloronaphthalene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Chrysene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Dibenzo[a,h]anthracene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Fluoranthene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Fluorene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Indeno(1,2,3-c,d)pyrene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
2-Methylnaphthalene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Naphthalene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Phenanthrene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Pyrene	g/m3	< 0.0003	< 0.0003	< 0.0003	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
2,4-Dichlorophenol	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
2,4,6-Trichlorophenol	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
2,4-Dimethylphenol	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
2-Methylphenol (o-Cresol)	g/m3	< 0.0005	< 0.0005	< 0.0005	-	-
2-Nitrophenol	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
Pentachlorophenol (PCP)	g/m3	< 0.010	< 0.010	< 0.010	-	-
Phenol	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-
2,4,5-Trichlorophenol	g/m3	< 0.0010	< 0.0010	< 0.0010	-	-

Sample Type: Aqueous						
Sample Name:		GND0251 31-May-2018 1:30 pm	GND0573 31-May-2018 3:30 pm	GND1300 31-May-2018 10:45 am		
Lab Number:		1993179.1	1993179.2	1993179.3		
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Diethylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Dimethylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Di-n-butylphthalate	g/m ³	< 0.0010	< 0.0010	< 0.0010	-	-
Di-n-octylphthalate	g/m ³	< 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	-	-
Di(2-ethylhexyl)adipate	g/m ³	< 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	-	-
1,3-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
1,4-Dichlorobenzene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Hexachloroethane	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
1,2,4-Trichlorobenzene	g/m ³	< 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	-	-
Carbazole	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Dibenzofuran	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Isophorone	g/m ³	< 0.0005	< 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
Free Ammonia*	Calculation from NH ₄ N, pH, Temperature (Calculations based on data for distilled water). APHA Table 8010:VI 22 nd ed. 2012.	0.010 g/m ³ at Client Temperature	1-3
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	1-3
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
pH	pH meter. APHA 4500-H ⁺ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22 nd ed. 2012.	1.0 g/m ³ as CaCO ₃	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 nd ed. 2012.	0.1 mS/m	1-3
Sample Temperature*	Supplied by customer, otherwise 20°C.	0.1 °C	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	1-3
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.003 g/m ³	1-3
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.005 g/m ³	1-3
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00005 g/m ³	1-3
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0002 g/m ³	1-3

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.02 g/m ³	1-3
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.00010 g/m ³	1-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0005 g/m ³	1-3
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 nd ed. 2012.	0.0010 g/m ³	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22 nd ed. 2012.	0.5 g/m ³	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 22 nd ed. 2012.	0.010 g/m ³	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I 22 nd ed. 2012 (modified).	0.002 g/m ³	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22 nd ed. 2012.	0.5 g/m ³	1-3
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22 nd ed. 2012.	6 g O ₂ /m ³	1-3

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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Martin Cowell - BSc
Client Services Manager - Environmental

Appendix IV

Report on gas flare feedstock and temperature verification

Author(s): Daniel Howie

CRL Ref: 18-82460

Title: Gas Flare Feedstock and Temperature
Verification

Client Name: New Plymouth District Council

Client Address: Liardet Street
New Plymouth 4342

Distribution: None
(Other than client)

Date of Issue: 13th April 2018

Prepared by: _____
Name & Designation: Daniel Howie (BSc) - Environmental Officer

Approved by: _____
Name & Designation: Nathan Frost (BSc) - Environmental Officer

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1 Introduction

CRL Energy Ltd was commissioned by New Plymouth District Council to provide third party verification of the operating temperatures and typical feedstock gas constituents burned within an enclosed gas flare at Colson Road Landfill, New Plymouth.

Daniel Howie and Thomas Robertson from the CRL Hamilton branch undertook gas sampling and temperature verification on March 28th, 2018. Temperatures within the enclosed gas flare were recorded. Three gas samples were collected in Tedlar bags on site and delivered to the CRL Lower Hutt laboratory for analysis. On site analysis of the gas feedstock using the Testo 350 portable emission analyser was conducted.

2 Methodology

Three feedstock gas samples were collected within Tedlar bags via teflon tubing which was attached to a small sampling port on the feedline prior to the gas flare. As these gas samples were collected temperature within the gas flare was recorded. Temperature was measured via a permanently installed thermocouple and was displayed on an HDMI screen at the flares control panel. Other parameters including sampling time, flow of the gas feedstock in to the flare, inlet pressure, %CH₄, % CO₂, and % O₂ displayed on the gas flare's control panel display were also recorded.

The Tedlar bag gas samples were analysed by CRL Energy's Lower Hutt laboratory using an Agilent 3000A TCD micro gas chromatograph (GC-TCD), CRL Energy Ltd's in-house procedures, and BOC Alpha and Beta calibration gasses. The Hydrogen Sulphide content of each Tedlar bag gas sample was determined using drager gas detection tubes.

Analysis of O₂, NO_x, NO and NO₂ concentrations within the feedstock gas was conducted using the Testo 350 portable emission analyser. A 30-minute sample of the flare feedstock gas was delivered to the Testo 350 via the same teflon tubing and sampling port through which Tedlar Bag gas samples were collected. Additionally, the feedstock gas sample was passed through a chilled Greenburg-Smith impinger to ensure removal of moisture from the gas before analysis by the Testo 350.

These test methods are not accredited under CRL's scope of IANZ accreditation.

3 Results

The tables below present the results of sampling undertaken by CRL at the Colson Road Landfill gas flare on March 28th, 2018. Table 1 presents the data recorded from the gas flare control panel display at the time of feedstock gas sampling. Table 2 presents the results of GC-TCD and Drager Tube analysis on the Tedlar bags containing feedstock gas samples. Table 3 presents the average concentrations of feedstock gas constituents across the 30-minute sampling period as analysed by the Testo 350.

Table 1. Colson Road Landfill gas flare display data.

Time	Flare Temp °C	Flow NM ³ /hr	Inlet Pressure mbar	CH ₄ %	CO ₂ %	O ₂ %	Gas Sample Reference
11:19	783	65	-14	48.4	29.6	3.96	18-82460-1
11:21	800	70	-15	48.8	29.7	3.89	18-82460-2
11:23	769	72	-15	48.9	29.8	3.83	18-82460-3

Table 2. Colson Road Landfill gas flare feedstock analysis by GC-TCD and Drager Tube.

Time	CH ₄ %	CO ₂ %	H %	O ₂ %	CO %	H ₂ S ppm	Gas Sample Reference
11:19	49.2	29.4	<0.01	4.6	<0.04	<0.2	18-82460-1
11:21	49.3	27.8	<0.01	5	<0.04	<0.2	18-82460-2
11:23	49.2	27.2	<0.01	5.1	<0.04	<0.2	18-82460-3

Table 3. Colson Road Landfill gas flare feedstock analysis by Testo 350.

Sample Period Start	Sample Period Stop	Average O ₂ %	Average NO _x mg/m ³ *	Average NO mg/m ³	Average NO ₂ mg/m ³
11:41	12:11	5.6	1.1	0.7	0

* Expressed as NO₂

4 Appendix 1 – Testo 350 Data

Date / time	% O ₂	mg/m ³ NOx	mg/m ³ NO	mg/m ³ NO ₂
28/03/2018 11:41:10 AM	4.93	0.0	0.0	0.0
28/03/2018 11:42:10 AM	4.91	0.0	0.0	0.0
28/03/2018 11:43:10 AM	5.02	0.0	0.0	0.0
28/03/2018 11:44:10 AM	5.08	0.0	0.0	0.0
28/03/2018 11:45:10 AM	5.09	0.0	0.0	0.0
28/03/2018 11:46:10 AM	5.29	0.0	0.0	0.0
28/03/2018 11:47:10 AM	5.45	0.0	0.0	0.0
28/03/2018 11:48:10 AM	5.58	0.0	0.0	0.0
28/03/2018 11:49:10 AM	5.52	0.0	0.0	0.0
28/03/2018 11:50:10 AM	5.67	0.0	0.0	0.0
28/03/2018 11:51:10 AM	5.63	0.0	0.0	0.0
28/03/2018 11:52:10 AM	5.71	1.9	1.2	0.0
28/03/2018 11:53:10 AM	5.76	1.9	1.2	0.0
28/03/2018 11:54:10 AM	5.71	0.0	0.0	0.0
28/03/2018 11:55:10 AM	5.72	1.9	1.2	0.0
28/03/2018 11:56:10 AM	5.77	1.9	1.2	0.0
28/03/2018 11:57:10 AM	5.75	1.9	1.2	0.0
28/03/2018 11:58:10 AM	5.71	1.9	1.2	0.0
28/03/2018 11:59:10 AM	5.75	1.9	1.2	0.0
28/03/2018 12:00:10 AM	5.77	1.9	1.2	0.0
28/03/2018 12:01:10 AM	5.72	1.9	1.2	0.0
28/03/2018 12:02:10 AM	5.69	1.9	1.2	0.0
28/03/2018 12:03:10 AM	5.72	1.9	1.2	0.0
28/03/2018 12:04:10 AM	5.71	1.9	1.2	0.0
28/03/2018 12:05:10 AM	5.77	1.9	1.2	0.0
28/03/2018 12:06:10 AM	5.78	1.9	1.2	0.0
28/03/2018 12:07:10 AM	5.76	1.9	1.2	0.0
28/03/2018 12:08:10 AM	5.82	1.9	1.2	0.0
28/03/2018 12:09:10 AM	5.85	1.9	1.2	0.0
28/03/2018 12:10:10 AM	5.84	1.9	1.2	0.0
28/03/2018 12:11:10 AM	5.79	1.9	1.2	0.0
Average	5.6	1.1	0.7	0.0