Stratford District Council Landfills Monitoring Programme Annual Report 2014-2015

Technical Report 2015-59

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## **Executive summary**

The Stratford District Council (SDC) maintains a closed landfill located on Victoria Road at Stratford, in the Patea catchment. The landfill was closed to the public on 11 March 2002 and to commercial disposers on 23 March 2002. The site has more recently been used to dewater and dispose of oxidation pond sludge from the adjacent municipal waste water treatment plant but this activity ceased in early 2006, and the landfill was recapped and reinstated. The only external material now accepted at the landfill is soil from a local sawmill site remediation project. This activity is covered by separate consent<sup>1</sup> held by a third party.

The SDC also maintains closed landfills at Douglas Rd, Huiroa, and Wingrove Rd, Pukengahu, in the Patea catchment. Both the Huiroa and Pukengahu landfills have been closed since 1991, but are still monitored with regards to maintenance and leachate discharge on a triennial basis. Monitoring of these sites was undertaken during the 2014-2015 year.

This report for the period July 2014 to June 2015 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess SDC's environmental performance of these three sites during the period under review, and the results and environmental effects of their activities.

SDC holds three resource consents, which include a total of 14 special conditions setting out the requirements that SDC must satisfy.

# During the monitoring period, SDC demonstrated and overall high level of environmental performance and compliance with resource consent conditions.

The Council's monitoring programme for the closed landfill at Stratford included two inspections, three ground water samples collected for physicochemical analysis, and one biomonitoring survey of receiving waters. The scheduled monitoring for the closed Huiroa and Pukengahu landfills each included one inspection and two water samples collected for physicochemical analysis.

The monitoring showed that there were only minor effects on the environment due to the discharges at SDC's landfill sites.

During the period under review, SDC demonstrated a high level of environmental performance and compliance with all the resource consents. The Council received no complaints about any of the sites and no incidents were recorded.

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

There were no incidents recorded by the Council in regards to SDC's landfill sites during the period under review.

This report includes recommendations for the 2015-2016 year.

<sup>&</sup>lt;sup>1</sup> Consent 7645-1 Alby M Limited

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## 1. Introduction

## 1.1 Compliance monitoring programme reports and the Resource Management Act 1991

### 1.1.1 Introduction

This report is the Annual Report for the period July 2014-June 2015 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Stratford District Council (SDC). SDC maintains closed landfills on Victoria Road, Stratford, on Douglas Road, Huiroa, and on Wingrove Road, Pukengahu.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by SDC that relate to discharges of leachate and stormwater to water from the three closed landfills within the Patea catchment, in the Stratford district.

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 SDC's use of water, land, and air, and is the 22<sup>nd</sup> report by the Council for the landfills managed by the consent holder.

### 1.1.2 Structure of this report

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

Each of the closed landfills is then discussed in a separate section (Sections 2 to 4).

In each subsection 1 (e.g. Section 2.1) there is a general description of the landfilled site and its discharges, an aerial photograph or map showing the location of the former landfill, and an outline of the matters covered by the water discharge permit.

Subsection 2 presents the results of monitoring of the SDC's activities at each of the sites during the period under review, including scientific and technical data.

Subsection 3 discusses the results, their interpretation, and their significance for the environment in the immediate vicinity of the site under discussion.

Subsection 4 presents recommendations to be implemented in the 2015-2016 monitoring year.

Section 5 is a summary of recommendations for the 2015-2016 period.

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);
- (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 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 the consent holder. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual courses of non-compliance or failure to maintain good practices. A pro-active approach that, in the first instance, avoids issues occurring is favoured.

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

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

Any investigations, interventions, and incidents for each site are discussed in subsection 3.

### 1.1.5 Evaluation of environmental performance

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

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

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

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

#### **Environmental Performance**

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.
- **Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor noncompliant 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 failures to do this had trivial consequences and were addressed promptly and co-operatively.
- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from 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 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

## **1.2 Resource consents**

### 1.2.1 Water discharge permits

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

SDC holds water discharge permits **3889-3**, **3890-2** and **3891-2** issued by the Council. The purposes and approximate locations of the consents are provided in Table 1 and

**Error! Reference source not found.**, and they are each discussed further in the sections of this report covering the individual landfills.

Consent number	Location	Purpose	Next review date	Expiry date
3889-3	Stratford	To discharge leachate into land and into groundwater adjacent to the Patea River	June 2016	1 June 2028
3890-2	Huiroa	To discharge up to 230 cubic metres/day [20 litres/second] of stormwater and leachate from a former landfill site onto and into land in the vicinity of an unnamed tributary of the Makuri Stream in the Patea Catchment	-	1 June 2016
3891-2	Pukenga hu	To discharge up to 910 cubic metres/day [84 litres/second] of stormwater and leachate from the former Pukengahu Landfill into an unnamed tributary of the Waihapa Stream in the Patea Catchment	-	1 June 2016

 Table 1
 Stratford District Council landfill consents



Figure 1 Regional map showing SDC landfill sites

## 1.3 Monitoring programme

### 1.3.1 Introduction

Section 35 of the RMA sets out obligations upon the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report upon these.

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 Stratford landfill closed in 2006 and monitoring is conducted annually.

Both the Huiroa and Pukengahu landfills have been closed since 1991 but are still monitored with regards to leachate discharge and site maintenance on a three yearly basis. Monitoring was undertaken in the 2011-2012 period, and was undertaken as scheduled during the year under review, as per the triennial programme.

The monitoring programmes for the SDC landfills consist of four primary components as outlined below.

### 1.3.2 Programme liaison and management

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

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

### 1.3.3 Site inspections

The Stratford municipal landfill site and Huiroa landfill site were each visited on two occasions during the monitoring period. The Pukengahu landfill site was visited on one occasion.

The landfill inspections focused on the stability, integrity, and drainage of the caps, any potential or actual discharges to receiving watercourses, including potential for leachate discharges, and visual assessment of the receiving water quality.

## 1.3.4 Chemical sampling

The Patea River in the vicinity of the Stratford landfill was sampled on one occasion, and the sample analysed for black disc transparency, biochemical oxygen demand, cadmium, chloride, conductivity, chromium, dissolved oxygen, dissolved reactive

phosphorus, faecal coliforms, ammoniacal nitrogen, nitrate/nitrite nitrogen, dissolved oxygen saturation, pH, suspended solids, temperature, turbidity, and zinc.

The Council also undertook sampling of the groundwater at the Stratford landfill. Groundwater was sampled on two occasions, and the sample analysed for alkalinity, bicarbonate, chloride, conductivity, dissolved reactive phosphorus, faecal coliforms, ammoniacal nitrogen, nitrate, pH, temperature, water level and zinc.

The receiving waters waters (after reasonable mixing) were each sampled upstream and downstream of the Huiroa and Pukengahu sites. The samples were analysed for conductivity, acid soluble iron, pH and ammoniacal nitrogen.

#### 1.3.5 Biomonitoring surveys

A biological survey was performed on one occasion in the Patea River to determine whether or not the Stratford landfill has had a detrimental effect upon the macroinvertebrate communities of the river.

## 2. Stratford landfill at Victoria Road

## 2.1 Process description

The Stratford District Council operated a landfill located on Victoria Road at Stratford, in the Patea catchment. The landfill was closed to the public on 11 March 2002 and to commercial disposers on 23 March 2002. All contaminated surface water from the landfill is pumped to the adjacent oxidation ponds for treatment.

In March 2004 SDC cleared a site on top of the landfill and created a bunded area for the purpose of oxidation pond sludge dewatering. This dewatering process continued through to early 2006 and the sludge was then covered and capped and the site reinstated. There has been no discharge of refuse to the landfill since 2006.

A third party currently holds a consent to discharge chromated copper arsenate (CCA) contaminated soil as base fill (under the supervision of SDC) to the landfill for recontouring purposes<sup>2</sup>. This consent has been exercised. However, due to an excess of clean overburden, further re-contouring is required.



Figure 2 Stratford landfill (shaded in yellow) and sampling locations

<sup>&</sup>lt;sup>2</sup> This consent was granted to provide for the remediation of a local sawmill site. The consent (7645-1) is held by Alby M Limited, and compliance monitoring of consent 7645-1 is not included in this report

## 2.2 Resource consent

#### 2.2.1 Water discharge permit

SDC held consent 3889-2 to cover discharge of stormwater and leachate from Stratford Municipal Landfill into the Patea River. This permit was issued by the Council on 27 February 1998 under Section 87(e) of the RMA. This consent expired on 1 June 2010. As discharges were still occurring from the landfill, an abatement notice was issued and the consent holder subsequently re-applied for a consent. Consent **3889-3** was issued by the Council on 6 December 2010. It is due to expire on 1 June 2028, with provision for review the conditions of the consent in June 2016 and/or June 2022.

Condition 1 requires that the consent holder adopt best practical option to minimise effects.

Condition 2 requires the preparation and maintenance of a Contingency and Landfill Maintenance Plan.

Condition 3 requires SDC to maintain certain structures at the site.

Condition 4 states that the discharge shall not reduce in-stream water quality after a specified mixing zone.

Condition 5 is a review provision.

The permit is attached to this report in Appendix I.

## 2.3 Results

#### 2.3.1 Inspections

#### 9 September 2014

The site was inspected in fine weather with light wind conditions. The inspecting officers were met on site by a SDC staff member. The cap was inspected and staff walked across this. It was found that the cap over the soil containing copper chrome arsenate (CCA) from the remediation of the Fazackerly timber treatment site had about 99 % establishment of vegetative cover. There was no evidence of ponding in the open stormwater drains constructed through this area. The proposed work to recontour this area of the cap was discussed. It was outlined that the area was to be surveyed so that the work required to achieve proper contouring could be ascertained. Work was expected to start as soon as the weather was settled. The inspecting officer advised that the Regional Council would not want any of the existing material present to be scraped back, unless it could not be avoided, as this may re-expose material containing CCA. If scraping back needed to happen, then the Council would need to be notified so that soil sampling could be undertaken. The consent holder indicated that the programme of works may need to be undertaken over a period of time due to budget constraints. The inspecting officer asked that the Council be provided with a plan outlining the programme of works to be carried out, including the timeframes. The SDC staff member undertook to provide the plan within a month of this inspection date.

It was found that permanent seven wire fencing had been installed along the top of the batter along the eastern half of the northern boarder of the cap. This had been installed to prevent stock access, therefore avoiding the potential for stock damage to expose refuse. The area had sufficient vegetative cover, and looked good. The inspecting officer was informed that this area was to be planted out, and that the details of the timing of this would be included in the report to be provided. The eastern half of the cap boarder had a temporary two wire fence along the top, however this area had been deliberately grazed, as evidenced by the hay residues found in this area. It was noted that there was some stock damage in this area, but that at the time of inspection, there was no exposed refuse observed. The consent holder undertook to remind the farmer not to allow stock access to this area. The inspecting officer was also informed that the permanent seven wire fence that currently ran along the eastern half was to be extended right along to the western boundary, ensuring that stock would be excluded in future. The timeframe for this work to be undertaken was not identified at the time of inspection.

The cap on the area not affected by the Fazackerly CCA soil disposal looked good. Although the grass was quite short, there was little, if any, pugging noted, and there were no leaking troughs found.

#### The following action was to be taken:

Ensure that stock are kept off the area along the northern boundary, from the top of the cap to the toe, to prevent stock damage from exposing refuse.

#### 17 June 2015

The site was inspected in fine weather conditions. The inspecting officer walked across the cap. The area capping the Fazackerly CCA soil appeared to have been regrassed and seed-drilled. This area was fenced off to prevent stock access, and the pasture cover was establishing. The rest of the cap had good vegetative cover, and there was a low number of calves (<12) grazing on site at the time of inspection. There were no overflowing troughs and the batter to the walkway had good grass cover. There was a two-wire fence in place at the top of the western half of the northern batter. Some minor stock damage to the batter was observed at this location, and the SDC was advised that this was to be monitored. There was no exposed refuse, and no evidence of recent grazing in this area at the time of inspection. A very small amount of ponding was evident on the south eastern area of the cap. The stormwater drain through the CCA area appeared to have been truncated by changes in contouring.

The following action was to be taken:

- Works needed to be undertaken to ensure the stormwater drain on the cap is free-flowing and unobstructed.
- Continue to manage the northern batter to prevent stock damage.

#### 2.3.2 Groundwater

Groundwater samples were taken from monitoring bores upslope (GND1015 and GND1016) and down slope (GND1014) of the landfill on two occasions, with the bores sampled over two days on each occasion. Sampling was carried out on 8 & 15 August 2014 and 6 &11 May 2015. The results from these samples are shown in Tables 1 and 2.

As with the results from previous samples taken from these monitoring bores, the groundwater down gradient of the landfill (as represented by bore GND1014), shows some evidence of contamination from the landfill. The graphs of historical data given in Figures 3, 4 and 5 show how bore GND1014 is affected by landfill indicator species; ammoniacal nitrogen, chloride, and zinc. The graphs also show how the levels of chloride and ammonia are apt to fluctuate against the more stable background levels found in the two bores mid and up gradient from the filled area (more so in the case of chloride and ammoniacal nitrogen). Zinc is found to be higher in the down gradient bore but is also seen to fluctuate in the up gradient bores as well, which may indicate other local effects in the groundwater.

The affected area consists of the narrow riparian strip between the landfill and the Patea River and the contaminated groundwater eventually permeates through to the Patea River. The results of the monitoring of the Patea River, as discussed below, show that there is at most only negligible impact on Patea River water quality. This suggests that either the level of groundwater migration is not of sufficient volume to make any significant changes to the water quality of the Patea River, or that the groundwater contamination is being attenuated by its passage through the soil.

Parameter	Unit	GND1014 down-gradient 8-Aug-2014	GND1015 up-gradient 15Aug-2014	GND1016 up-gradient 15Aug-2014
Alkalinity	g/m³	583	31	26
Dissolved arsenic	g/m <sup>3</sup>	<0.001	<0.001	<0.001
Chloride	g/m <sup>3</sup>	40.2	8.4	7.3
Chemical oxygen demand	g/m <sup>3</sup>	33	<5	<5
Conductivity	mS/m	102	10.3	7.29
Dissolved chromium	g/m <sup>3</sup>	<0.03	<0.03	<0.03
Dissolved copper	g/m <sup>3</sup>	<0.01	<0.01	<0.01
Dissolved reactive phosphorus	g/m <sup>3</sup>	0.005	0.004	< 0.003
Ammoniacal nitrogen	g/m <sup>3</sup> -N	47.6	0.004	< 0.003
Nitrate/nitrite nitrogen	g/m³-N	0.02	2.72	0.78
рН	рН	6.8	6	5.9
Temperature	Deg. C	12.0	13.2	12.6
Dissolved zinc	g/m <sup>3</sup>	0.008	0.012	0.009

 Table 2
 Results of the Stratford landfill groundwater quality survey 8 & 15 August 2014

\*= not measured

 Table 3
 Results of the Stratford landfill groundwater quality survey, 8 & 11 May 2015

Parameter	Unit	GND1014 down-gradient 6-May-2015	GND1015 up-gradient 11-May-2015	GND1016 up-gradient 6-May-2015
Alkalinity	g/m³	482	10	41
Dissolved arsenic	g/m <sup>3</sup>	0.003	<0.001	<0.001
Chloride	g/m³	29.5	9.2	8.3
Chemical oxygen demand	g/m <sup>3</sup>	40	<5	<5
Conductivity	mS/m	104	12.6	10.5
Dissolved chromium	g/m <sup>3</sup>	<0.03	<0.03	<0.03
Dissolved copper	g/m <sup>3</sup>	<0.001	<0.001	0.002
Dissolved reactive phosphorus	g/m <sup>3</sup>	0170	4.11	0.690

Parameter	Unit	GND1014 down-gradient 6-May-2015	GND1015 up-gradient 11-May-2015	GND1016 up-gradient 6-May-2015
Unionised ammonia	g/m³-N	0.005	0.005	0.003
Ammoniacal nitrogen	g/m³-N	47.7	0.022	0.003
Nitrate/nitrite nitrogen	g/m³-N	0.01	2.48	0.52
рН	pН	6.3	5.8	5.5
Temperature	Deg. C	15.2	15.6	15.3
Dissolved zinc	g/m <sup>3</sup>	0.095	<0.005	<0.005



Figure 3 Graph showing chloride levels in groundwater at the Stratford landfill



Figure 4 Graph showing ammoniacal nitrogen levels in groundwater at the Stratford landfill



Figure 5 Graph showing zinc levels in groundwater at the Stratford landfill

#### 13

#### 2.3.3 Surface waters

Samples were collected from the Patea River on 16 February 2015 and the results are set out in Table 4. This sampling was undertaken in conjunction with the monitoring of the Stratford waste water treatment plant (WWTP), which is discussed in a separate report.

As with the results from previous monitoring periods, the results from this period indicate that the Stratford landfill had only a very minor, if not negligible, effect on the water quality of the Patea River.

In relation to the parameters tested for, there was no significant difference in water quality between the upstream and downstream sites. There was a slight rise in ammoniacal nitrogen, however, the level of unionised ammonia downstream of the landfill was well below the  $0.025 \text{ g/m}^3$  guideline for the long term protection of aquatic ecosystems.

		16 February 2015		
Parameter	Units	Above landfill PAT000315	Below landfill PAT000345	
Black disc transparency	m	2.61	2.49	
Biochemical oxygen demand	g/m³	0.6	0.6	
Filtered biochemical oxygen demand	g/m³	а	а	
Cadmium (dissolved)	g/m³	<0.005	<0.005	
Chloride	g/m³	8.3	8.5	
Conductivity	mS/m	10.0	10.1	
Chromium (dissolved)	g/m³	<0.03	< 0.03	
Dissolved oxygen	g/m³	10.2	10.0	
Dissolved reactive phosphorus	g/m³-P	0.057	0.051	
Faecal coliforms	/100ml	250	220	
Unionised ammonia	g/m³-N	0.00014	0.00056	
Ammoniacal nitrogen	g/m³-N	0.010	0.048	
Nitrate/nitrite nitrogen	g/m³-N	0.42	0.40	
Dissolved oxygen saturation	%	99	98	
рН	pН	7.7	7.6	
Suspended solids	g/m³	2	2	
Temperature	Deg.C	13.2	13.5	
Turbidity	NTU	0.94	0.95	
Dissolved zinc	g/m <sup>3</sup>	<0.005	<0.005	

 Table 4
 Results of the Stratford landfill water quality survey

a Laboratory error

Figure 6 shows the ammoniacal nitrogen data gathered over the past 25 years. It is noted that, as the Stratford WWTP had an upgrade in 2009, the discharge point of the WWTP was moved and the sites used to monitor the downstream effects of the landfill also changed. Monitoring at site PAT000330 ceased in March 2009, with monitoring continuing at site PAT000345, further downstream.



Figure 6 Graph showing ammoniacal nitrogen levels in the Patea Stream up and downstream of the landfill (where comparative data is available).

\*Downstream site prior to WWTP upgrade \*\*Downstream site after WWTP upgrade

Whilst there is some separation between the sites locations, the graph indicates that a similar, stable, and modest rise in ammoniacal nitrogen has occurred in the Patea River as result of the landfill's presence. The highest level of ammoniacal nitrogen found downstream of the landfill since monitoring began was  $0.87 \text{ g/m}^3$ , on 16 March 2005. Under the pH and temperature conditions prevailing at the time of sampling, this ammoniacal nitrogen concentration would have resulted in an unionised ammonia concentration of  $0.014 \text{ g/m}^3$ , well below the  $0.025 \text{ g/m}^3$  unionised ammonia guideline used for the long term protection of aquatic ecosystems.

#### 2.3.4 Biomonitoring

The Council's standard 'kick-sampling' technique was used at four established sites to collect streambed macroinvertebrates from the Patea River on 10 February 2015. Samples were sorted and identified and the number of taxa (richness), MCI score, and SQMCI<sub>s</sub> score were calculated for each site. It is noted that although this monitoring is predominantly carried out for monitoring of the WWTP, it also provides information in relation to effects, if any, on the Patea River as a result of discharges from the former landfill.

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<sub>S</sub> 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<sub>S</sub> between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This scheduled summer, 2015 macroinvertebrate survey (which has complemented previous additional assessments of the upgraded system performance) indicated that the discharge of treated oxidation ponds wastes from the upgraded Stratford WWTP system had had localised effects on the macroinvertebrate communities of the Patea River under summer low river flow conditions with minimal further deterioration at the site 2.4 km downstream of the discharge. Some significant changes in macroinvertebrate communities' compositions were recorded between the upstream 'control' site and sites downstream of the relocated outfall from the WWTP. However, the similarity in the community compositions at the two sites upstream of the WWTP outfall indicated that there were no significant effects associated with seepages from the closed landfill site.

A copy of the full biomonitoring report is provided in Appendix II.

## 2.3.5 Investigations, interventions, and incidents

In the 2014-2015 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with conditions in the SDC' Stratford landfill resource consent or provisions in Regional Plans.

## 2.4 Discussion

## 2.4.1 Discussion of site performance

In terms of the management of the landfill, only a few minor issues were noted during the monitoring period. The site had good vegetative cover and the newly capped areas had stabilised. Extra capping soil was required to cover the additional area that had been affected by cross contamination during the discharge of the CCA soils at the start of the monitoring period. As a result, the cap still required surface drains in and around the crown of the east batter to ensure effective stormwater drainage. Although work was undertaken during the 2014-2015 year to recontour some areas of the cap to rectify drainage issues and re-establish vegetative cover on the site, there was still one very small area where ponding was again found, due to a truncated stormwater drain. At the time of the preparation of this report SDC was in the process of having the site re-surveyed with a view to reinstating the cap profile and effective stormwater drainage in this area. Alby M, the third party consent holder that was consented to discharge the CCA soils at the site, is cooperating with SDC in this matter.

## 2.4.2 Environmental effects of exercise of consents

Groundwater bore GND1014 continues to exhibit some signs of contamination, however there is no evidence from surface water sampling or biomonitoring that the discharge of groundwater is having a significant effect on the Patea River. There was no evidence of odour or dust problems at the site during any inspection.

### 2.4.3 Evaluation of performance

A tabular summary of the SDC's compliance record for the year under review in regard to the Stratford landfill is set out in Table 5.

Table 5Summary of performance for Consent 3889-3 (Stratford landfill)

Purpose: To discharge leachate into land and into groundwater adjacent to the Patea River						
Condition requirement	Compliance achieved?					
1. Adopt best practical option	Site specific monitoring programme – programme supervision	Yes				
2. Prepare a Contingency and Maintenance Plan	Site specific monitoring programme – programme supervision	Yes				
3. Maintain landfill site	Site specific monitoring programme – inspection	Yes				
4. Effects beyond mixing zone	Water quality monitoring of the Patea River upstream and downstream of the landfill	Yes				
5. Optional review	N/A					
Overall assessment of consent compliance Overall assessment of administrative perfor	High High					

N/A = not applicable

During the year, SDC demonstrated a high level of environmental performance and high level of administrative performance with the Stratford landfill resource consent as defined in Section 1.1.5.

### 2.4.4 Recommendation from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

THAT monitoring of the Stratford landfill in the 2013-2014 year continues at the same level as in 2012-2013 period.

The monitoring programme was implemented as recommended.

### 2.4.5 Alterations to monitoring programmes for 2015-2016

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

It is proposed that for 2015-2016, the monitoring programme remains unchanged.

A recommendation to this effect is presented in Section 2.5 of this report, and summary of recommendations is given in Section 5.

#### 2.4.6 Optional review

Resource consent 3889-3 provides for an optional review of the consent in June 2016. Condition 5 allows the Council to review the consent, 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.

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

## 2.5 Recommendations

- 1. THAT monitoring of the consented activities at the Stratford landfill in the 2015-2016 year continues at the same level as in 2014-2015 period.
- 2. THAT the option for a review of resource consent 3889-3 in June 2016, as set out in condition 5 of the consent, not be exercised, on the grounds that the current level of monitoring is adequate to deal with any potential adverse effects.

## 3. Huiroa landfill

## 3.1 Process description

The Huiroa landfill is sited within an elbow of Douglas Road. The dump was an uncontrolled roadside landfill used by local residents to dispose of domestic waste. The site was closed in 1991 and reinstated by SDC.

This closed landfill is monitored on a triennial basis, with inspections and sampling undertaken during the period under review. The location of the landfill and monitoring sites are shown in Figure 7.



Figure 7 Huiroa landfill and approximate sampling locations

## 3.2 Resource consent

### 3.2.1 Water discharge permit

SDC holds water discharge permit **3890-2** to cover discharge of stormwater and leachate from the former Huiroa landfill into an unnamed tributary of the Makuri Stream. This permit was issued by the Council on 17 October 1996 under Section 87(e) of the RMA. It is due to expire on 1 June 2016.

Condition 1 requires SDC to install and maintain stormwater drains on the site.

Condition 2 requires SDC to maintain vegetative cover on the site.

Condition 3 requires that SDC adopts the best practicable option at the site.

Condition 4 states that the discharge from the site shall not cause detrimental effect on water quality or aquatic life of the Makuri Stream.

Conditions 5 and 6 are review conditions.

The permit is attached to this report in Appendix I.

## 3.3 Results

### 3.3.1 Inspections

#### 9 September 2014

The site was inspected in fine weather with calm wind conditions. The entire cap and stormwater diversion drains were inspected. The cap appeared to be sound over the majority of the fill area. The grass cover showed evidence of reasonably heavy grazing by cattle not too long prior to the inspection, with some pugging noted in the drain at the base of the western border of the fill area. There was no sign of ponding, slumping or cracking of the cap. However, it appeared that erosion from the stormwater flow and stock access had resulted in some exposed refuse in the open stormwater drain along the south western side of the cap. Photos were taken. Samples were collected from the base of the sump below the filled area, and from the drain on the northern side of the railway (Council site code RTP001002).

SDC was instructed to address the exposed refuse, and ensure that this area of the cap and drain were protected from stock damage.

#### 25 June 2015

A follow-up inspection of the site was carried out in fine weather with calm wind conditions, following heavy rain five days prior to the inspection. The inspecting officer walked across the cap. It was noted that the cap was moist, but intact, with no ponding observed. The stormwater diversion drain through the centre of the cap showed evidence of overland flow, but no damage to the cap was noted. The grass cover showed evidence of stock grazing, but this was not recent.

The south western batter had been remediated and no exposed refuse was observed. There was a minor amount of rilling in the top corner of the drain, attributed to the extremely high rainfall of the previous few days. This area, including the stormwater drainage system, was fenced off with a single-wire fence and had re-grassed well. The stormwater drain along the south western side of the cap had been filled in with rocks to create a rip rap. The material was well-consolidated and permeable (stormwater was heard draining through at the time of inspection). The pipe at the bottom of the drain was clear of debris. A small hole in the ground surface was observed at the edge of the concrete sump. No odour or dust issues were noted. Photographs were taken.



Photo 1 Remediated stormwater drain at Huiroa closed landfill

### 3.3.2 Results of discharge monitoring

During the monitoring period a sample was taken of the discharge from a culvert manhole immediately below the toe of the Huiroa landfill. The results of the analyses are given Table 6.

		Ammoniacal nitrogen	Un-ionised ammonia	Conductivity @ 20'C	Iron Acid Soluble	рН	Temperature		
		g/m³ N	g/m³	mS/m@20C	g/m³	рН	Deg.C		
	09 Sep 2014	1.70	0.00381	19.5	35.9	6.9	12.9		

Table 6 Results of Huiroa leachate discharge sampling

The discharge from the Huiroa landfill continues to exhibit a low level of contamination from the historical activities here. This is evidenced by the slightly elevated levels of ammoniacal nitrogen in the discharges. Also of note are the elevated levels of iron found. While it is likely that the landfill contributes to the iron content in the discharge, the naturally high iron levels found in Taranaki groundwater will also be a factor.

### 3.3.3 Results of receiving environment monitoring

The small unnamed tributary of the Makuri Stream that flows approximately 70 m to the north west of the Huiroa closed landfill was sampled on one occasion during the period under review (9 September 2014). The results, together with a summary of historical results, are presented in Table 7.

	Ammoniacal nitrogen	Un-ionised ammonia	Conductivity @ 20'C	Iron Acid Soluble	рН	Temperature
	g/m³ N	g/m³	mS/m@20C	g/m³	рН	Deg.C
Minimum	0.13	0.00411	19.6	2.36	7.1	10.8
Maximum	2.01	0.01161	21.6	17.5	7.5	15.3
Median	1.26	0.00522	20.6	8.47	7.2	12.5
Number	10	3	4	9	6.0	9.0
09 Sep 2014	1.24	0.00411	20.2	9.02	7.1	12.0

 Table 7
 Unnamed tributary of the Makuri Stream downstream of the Huiroa closed landfill

Based on the results of the sampling and the low discharge rates, it is considered that the effect of the closed landfill is having on the receiving environment is minor, at most.

#### 3.3.4 Investigations, interventions, and incidents

In the 2014-2015 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with conditions in SDC's Huiroa landfill resource consent or provisions in Regional Plans.

### 3.4 Discussion

#### 3.4.1 Site performance

The Huiroa landfill has been closed since 1991 after which SDC reinstated the site. There were no issues in regard to ponding, excessive leachate seepage or refuse migration observed at this site, however, erosion in a stormwater channel from high flows and stock access had resulted in some refuse becoming exposed. This was remediated. A rock rip rap was installed in the drain to prevent a reoccurrence, and temporary fencing was installed to prevent stock access.

#### 3.4.2 Environmental effects of exercise of consents

There is no evidence that the exercise of the consent 3890 was having any significant effect on the environment. The site was generally well maintained and well vegetated with the exposed refuse in the stormwater drain remediated promptly. There was no refuse observed to be migrating through the cap. The samples gathered during the period under review indicated no significant effects on the environment.

#### 3.4.3 Evaluation of performance

A tabular summary of SDC's compliance record for the Huiroa landfill during the period under review is set out in Table 11.

Table 8	Summarv of	performance for Consent 3890-2 (	Huiroa)
	•••••••••••••••••••••••••••••••••••••••		

Purpose: To discharge up to 230 cubic metres/day [20 litres/second] of stormwater and leachate from a former landfill site onto and into land in the vicinity of an unnamed tributary of the Makuri Stream in the Patea Catchment					
Condition requirement	Means of monitoring during period under review	Compliance achieved?			
1. Maintenance of site	Site specific monitoring programme – inspection	Remediation undertaken on request			
2. Water quality after mixing	Site specific monitoring programme – inspection and sampling	Yes			
3. Optional review	N/A				
Overall assessment of consent compliance and environmental performance in respect of this consentGoodOverall assessment of administrative performance in respect of this consentHigh					

N/A = not applicable

During the year, SDC demonstrated a good level of environmental performance and high level of administrative performance with the Huiroa landfill resource consent as defined in Section 1.1.5.

#### 3.4.4 Recommendation from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

That the triennial monitoring programme for the Huiroa and Pukengahu landfills remain unchanged with monitoring to be next implemented in the 2014-2015 period.

The monitoring programme was implemented as recommended.

#### 3.4.5 Alterations to monitoring programmes for 2015-2016

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

It is proposed that for 2015-2016, the monitoring programme remains unchanged.

A recommendation to this effect is presented in Section 3.5 of this report, and summary of recommendations is given in Section 5.

## 3.5 Recommendation

1. THAT, in the 2015-2016 year, the triennial monitoring for the Huiroa landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

## 4. Pukengahu landfill

## 4.1 Process description

The site is situated in a small gully off Wingrove Road (Figure 8). At the base of the gully is a small wetland area, which is fed by a spring that is culverted beneath the road and feeds into a small unnamed stream. The dump was unmanaged but was mostly used for the discharge of domestic waste by local residents. The landfill closed in 1991 and the site was reinstated by SDC. It is monitored on a triennial basis, with inspections and sampling undertaken during the period under review.



Figure 8 Pukengahu landfill and approximate sampling locations

## 4.2 Resource consent

## 4.2.1 Water discharge permit

SDC holds water discharge permit **3891-2** to cover discharge of stormwater and leachate from the former Pukengahu landfill into an unnamed tributary of the

Waihapa Stream. This permit was issued by the Council on 12 February 1998 under Section 87(e) of the RMA. It is due to expire on 1 June 2016.

Condition 1 requires SDC to manage ground contours, final cover and illegal dumping at the site.

Condition 2 states that the discharge from the site shall not cause detrimental effect on water quality or aquatic life of the Waihapa Stream.

Condition 3 is a review provision.

The permit is attached to this report in Appendix I.

## 4.3 Results

### 4.3.1 Inspections

#### 9 September 2014

The site was inspected in fine weather with calm wind conditions. The entire cap and stormwater diversion drains were inspected. It was found that the cap looked good, with no evidence of ponding or slumping. There was good grass cover, with no evidence of over grazing. It was noted that there was evidence of some pugging having occurred, however there were no indications that this had affected the integrity of the cap. The stormwater diversion drain appeared to be effective and was unobstructed.

Samples and photographs were taken. A sample was collected from the drain below the landfill, and from the tributary into which this drain flowed. The sample was collected approximately five metres downstream of the confluence.

## 4.3.2 Results of discharge monitoring

During the monitoring period a sample was taken of the discharge from the Pukengahu closed landfill. The results of the analyses, together with a summary of historical results, are given in Table 9.

	Ammoniacal nitrogen	Un-ionised ammonia	Conductivity @ 20'C	Iron Acid Soluble	рН	Temperature
	g/m³ N	g/m³	mS/m@20C	g/m³	рН	Deg.C
Minimum	1.11	0.00213	23.9	5.35	6.4	12.5
Maximum	5.54	0.00365	48.0	104	7.1	15.6
Median	3.09	0.00279	32.9	44.1	6.6	13.6
Number	11	3	5	10	7	10
09 Sep 2014	1.58	0.00279	26.5	26.9	6.8	12.8

 Table 9
 Results of Pukengahu closed landfill leachate sampling

The discharges from both landfills continue to exhibit a low level of contamination from the old landfills. This is evidenced by the slightly elevated levels of ammoniacal nitrogen in the discharges. Also of note are the elevated levels of iron found (especially in the Pukengahu landfill discharge). While it is likely that the landfill contributes to the iron content in the discharge, the naturally high iron levels found in Taranaki groundwater is also likely to be a factor.

Based on the results of the sampling and the fact that the rates of discharge at both sites are quite low, it is unlikely that either of the closed landfills are having a significant effect of the receiving environment.

## 4.3.3 Results of receiving environment monitoring

The unnamed tributary of the Waihapa Stream that flows approximately 120 m to the south of the Pukengahu closed landfill was sampled on one occasion during the period under review. The sampling site was approximately five meters downstream of where the groundwater/leachate flow enters the tributary.

 Table 10
 Unnamed tributary of the Waihapa Stream downstream of the Pukengahu closed landfill

	Ammoniacal nitrogen	Un-ionised ammonia	Conductivity @ 20'C	Iron Acid Soluble	рН	Temperature
	g/m³ N	g/m³	mS/m@20C	g/m³	рН	Deg.C
09 Sep 2014	0.073	0.00016	15.1	1.2	7.0	9.4

These results show that the leachate from the closed Pukengahu landfill was having little, if any, effect on the water quality of the unnamed tributary of the Waihapa Stream.

## 4.3.4 Investigations, interventions, and incidents

In the 2014-2015 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with conditions in SDC's Pukengahu landfill resource consent or provisions in Regional Plans.

## 4.4 Discussion

## 4.4.1 Site performance

The Pukengahu landfill has been closed since 1991 after which SDC reinstated the site. There were no issues in regard to ponding, excessive leachate seepage or refuse migration observed at this site.

## 4.4.2 Environmental effects of exercise of consents

There is no evidence that the exercise of the consent 3891 was having any significant effect on the environment. The site was well maintained and well vegetated with no evidence of refuse migrating through the cap. None of the samples gathered during the period under review indicated significant effects on the environment.

## 4.4.3 Evaluation of performance

A tabular summary of SDC's compliance record for the Pukengahu landfill during the period under review is set out in Table 11.

Purpose: To discharge up to 910 cubic metres/day [84 litres/second] of stormwater and leachate from the former Pukengahu Landfill into an unnamed tributary of the Waihapa Stream in the Patea Catchment						
Condition requirement	Means of monitoring during period under review	Compliance achieved?				
1. Maintenance of site	Site specific monitoring programme – inspection	Yes				
2. Maintenance of vegetative cover	Site specific monitoring programme – inspection	Yes				
3. Adoption of best practicable option	Site specific monitoring programme – inspection	Yes				
4. Water quality after mixing	Site specific monitoring programme – inspection and sampling	Yes				
5. Optional review	N/A					
Overall assessment of consent compliance and environmental performance in respect of this consentHighOverall assessment of administrative performance in respect of this consentHigh						

 Table 11
 Summary of performance for Consent 3891-2 (Pukengahu)

N/A = not applicable

During the year, SDC demonstrated a high level of environmental performance and high level of administrative performance with the Pukengahu landfill resource consent as defined in Section 1.1.5.

#### 4.4.4 Recommendation from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

That the triennial monitoring programme for the Huiroa and Pukengahu landfills remain unchanged with monitoring to be next implemented in the 2014-2015 period.

The monitoring programme was implemented as recommended.

#### 4.4.5 Alterations to monitoring programmes for 2015-2016

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

It is proposed that for 2015-2016, the monitoring programme remains unchanged.

A recommendation to this effect is presented in Section 4.5 of this report, and summary of recommendations is given in Section 5.

## 4.5 Recommendation

1. THAT, in the 2015-2016 year, the triennial monitoring for the Pukengahu landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

## 5. Summary of recommendations

- 1. THAT monitoring of the consented activities at the Stratford landfill in the 2015-2016 year continues at the same level as in 2014-2015 period.
- 2. THAT the option for a review of resource consent 3889-3 in June 2016, as set out in condition 5 of the consent, not be exercised, on the grounds that the current level of monitoring is adequate to deal with any potential adverse effects.
- 3. THAT, in the 2015-2016 year, the triennial monitoring for the Huiroa landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.
- 4. THAT, in the 2015-2016 year, the triennial monitoring for the Pukengahu landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

# Glossary of common terms and abbreviations

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

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.
E.coli	Escherichia coli, 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 <sup>3</sup>	Grammes per cubic metre, and equivalent to milligrammes per litre
	(mg/L). In water, this is also equivalent to parts per million (ppm), but
	the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have
	actual or potential environmental consequences or may involve non-
	compliance with a consent or rule in a regional plan. Registration of an
	incident by the Council does not automatically mean such an outcome
	had actually occurred.
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
IR	Incident Register - contains a list of events recorded by the Council on
	the basis that they may have the potential or actual environmental
	consequences that may represent a breach of a consent or provision in a
	Regional Plan.

L/s	Litres per second.					
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.					
NH <sub>4</sub>	Ammonium, normally expressed in terms of the mass of nitrogen (N).					
NH <sub>3</sub>	Unionised ammonia, normally expressed in terms of the mass of nitrogen					
	(N).					
NO <sub>3</sub>	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 (for example hexane). May include both animal material					
	(fats) and mineral matter (hydrocarbons).					
Pb*	Lead.					
pН	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).					
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents					
	(refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and					
	15), water permits (Section 14) and discharge permits (Section 15).					
RMA	Resource Management Act 1991 and subsequent amendments.					
SQMCI	Semi quantitative macroinvertebrate community index.					
SS	Suspended solids.					
Temp	Temperature, measured in °C (degrees Celsius).					
Turb	Turbidity, expressed in NTU.					
UI	Unauthorised Incident.					
Zn*	Zinc.					

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

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

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Appendix I

Resource consents held by Stratford District Council

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

Name of	Stratford District Council
Consent Holder:	P O Box 320
	STRATFORD 4352

- Decision Date: 6 December 2010
- Commencement 6 December 2010 Date:

## **Conditions of Consent**

Consent Granted:	To discharge leachate into land and into groundwater adjacent to the Patea River at or about (NZTM) 1712119E-5644346N
Expiry Date:	1 June 2028
Review Date(s):	June 2016, June 2022
Site Location:	Swansea Road, Stratford
Legal Description:	Lots 5-6 DP Pt Lot 4 DP 1942 Lot 2 DP 11213 Blk II Ngaere SD [Discharge source & site]
Catchment:	Patea

#### **General condition**

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

#### **Special conditions**

- 1. The consent holder shall at all time adopt the best practical option as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.
- 2. Before 31 March 2011 the consent holder shall submit a Landfill Maintenance and Contingency Plan to the satisfaction to the Chief Executive of the Taranaki Regional Council that;
  - a) sets out the requirements and scheduling for the maintenance of the landfill cap;
  - b) identifies all other structures on the site [drains, stock watering troughs, and groundwater bores etc] that require ongoing maintenance and sets out requirements and scheduling for their maintenance;
  - c) outlines the proposed responses to inadvertent exposure of refuse, significant cap disturbance, and leachate breakouts; and
  - d) provides a list of contact details for all appropriate staff and agencies to be contacted during an emergency at the site.
- 3. In addition to adhering to the Landfill Maintenance and Contingency Plan as required by condition 2, the consent holder shall at all times take all reasonable steps to ensure;
  - a) that the cap is contoured is maintained in a manner that prevents ponding, stormwater infiltration and minimises leachate production;
  - b) that the cap retains a reasonable cover of appropriate vegetation;
  - c) that any stock water troughs on the site are maintained to ensure that they do not leak or overflow;
  - d) that any existing drains or other diversion structures are kept clear and functional; and
  - e) that the cap depth is maintained to the original specifications as set out in the Swansea Street Sanitary Landfill Management Plan of 1992.

- 4. That downstream of the discharge zone in the Patea River , beyond grid reference 1712256E-5644543N, the discharge shall not give rise to any of the following effects in the receiving waters of the Patea River:
  - a) the production of any conspicuous oil or grease films, scums or foams or floatable or suspended materials;
  - 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 effects of aquatic life.
- 5. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2016 and/or June 2022, 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 6 December 2010

For and on behalf of Taranaki Regional Council

**Director-Resource Management** 

#### **DISCHARGE PERMIT**

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

Name of Consent Holder:

STRATFORD DISTRICT COUNCIL PO BOX 320 STRATFORD

Renewal Granted Date:

17 October 1996

#### **CONDITIONS OF CONSENT**

Consent Granted: TO DISCHARGE UP TO 230 CUBIC METRES/DAY [20 LITRES/SECOND] OF STORMWATER AND LEACHATE FROM A FORMER LANDFILL SITE ONTO AND INTO LAND IN THE VICINITY OF AN UNNAMED TRIBUTARY OF THE MAKURI STREAM IN THE PATEA CATCHMENT AT OR ABOUT GR: Q20:370-150

Expiry Date: 1 June 2016

Review Date[s]: June 2004 and June 2010

Site Location: HUIROA LANDFILL, DOUGLAS ROAD, DOUGLAS

Legal Description: ROAD RESERVE BLK IX NGATIMARU SD

Catchment:PATEA343.000Tributary:MAKURI343.250

**UNNAMED TRIBUTARY** 

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



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



#### **GENERAL CONDITIONS**

- (a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- (b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- (c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - (i) the administration, monitoring and supervision of this consent;
  - (ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
  - (iii) charges authorised by regulations.

#### SPECIAL CONDITIONS

1. THAT the consent holder shall install and maintain stormwater drains and ground contours at the site, to the satisfaction of the General Manager, Taranaki Regional Council, in order to minimise stormwater movement across, or ponding on the site, and the maintenance of soil cover on the site.

2. THAT the consent holder shall maintain an adequate vegetative cover on the site, to the satisfaction of the General Manager, Taranaki Regional Council, to prevent dust emission or stormwater erosion of the site.

- 3. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any adverse effect or any likely adverse effect on the environment associated with the discharges of leachate from the site. Without restriction or limitation, the best practicable option shall include the measures specified in conditions 1 and 2 above.
- 4. THAT the discharge shall not give rise to any of the following effects in the receiving waters of the unnamed tributary of the Makuri Stream:
  - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
  - 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.
- 5. THAT the Taranaki Regional Council may review any or all of the conditions of this consent should further chemical sampling of the unnamed tributary of the Makuri Stream reveal levels of contamination resulting in or likely to result in significant adverse environmental effects.

)

6. THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2004 and/or June 2010, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at the time.

#### Signed at Stratford on 17 October 1996

For and on behalf of TARANAKI REGIONAL COUNCIL

**OPERATIONS MANAGER** 



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



47 CLOTON ROAD

PHONE 0-6-765 7127 FAX 0-6-765 5097

STRATFORD NEW ZEALAND

#### **DISCHARGE PERMIT**

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

Name of Consent Holder: STRATFORD DISTRICT COUNCIL PO BOX 320 STRATFORD

Renewal Granted Date:

12 February 1998

#### CONDITIONS OF CONSENT

Consent Granted:

TO DISCHARGE UP TO 910 CUBIC METRES/DAY [84 LITRES/SECOND] OF STORMWATER AND LEACHATE FROM THE FORMER PUKENGAHU LANDFILL INTO AN UNNAMED TRIBUTARY OF THE WAIHAPA STREAM IN THE PATEA CATCHMENT AT OR ABOUT GR: Q20:292-016

Expiry Date: 1 June 2016

Review Date[s]: June 2004 and June 2010

Site Location: FORMER LANDFILL, WINGROVE ROAD, STRATFORD

Legal Description: ROAD RESERVE WINGROVE ROAD PUKENGAHU BLK VII NGAERE SD

Catchment: PATEA 343.000

Tributary: WAIHAPA 343.280 UNNAMED TRIBUTARY

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 consent holder shall ensure, to the satisfaction of the General Manager, Taranaki Regional Council, that:
  - a) the site contours are maintained so that no ponding, damming or retention of water occurs on the site;
  - b) the integrity of the cover is maintained so as to minimise infiltration of stormwater; and
  - c) access to the site is restricted so that illegal dumping of wastes is discouraged.
- 2. THAT allowing for a mixing zone of 50 metres downstream of the discharge, the discharge shall not give rise to any of the following effects in the unnamed tributary of the Waihapa Stream:
  - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
  - 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 effects on aquatic life.
- 3. THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004 and/or June 2010, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at that time.

Signed at Stratford on 12 February 1998

For and on behalf of TARANAKI REGIONAL COUNCIL

RESOURCE MANAGEMENT

Appendix II

**Biomonitoring report** 

ToSciences Manager - Hydrology/Biology - R PhippsFromScientific Officer, C R FowlesDoc No1489527Report NoCF638DateMarch 2015

## Summer biomonitoring of the Patea River in relation to the Stratford District Council's upgraded Wastewater Treatment Plant, February 2015

## Introduction

The upgrading of the wastewater treatment plant (WWTP) completed in 2009, required by conditions attached to the renewed consent 0196 (TRC, 2013), has been the subject of an additional investigative assessment of the upgrade's effectiveness in terms of system performance and its impacts on the receiving waters of the Patea River. A component of the assessment included two spring biomonitoring surveys of the river specifically in association with the upgraded treatment system and relocated, improved outfall structure (some 600 m downstream of the sealed-off original outfall). The summer survey (CF486) performed soon after completion of the WWTP upgrade, and the subsequent spring, 2009 (CF491), scheduled summer, 2010 (CF501), spring, 2010 (CF517), and summer, 2011 (CF526) surveys completed the requisite assessments. Subsequently, summer surveys (including the current survey) have been requirements of scheduled monitoring programmes for compliance monitoring purposes.

## **Methods**

The standard '400 ml kick sampling' technique was used to collect streambed (benthic) macroinvertebrates from three established sites and one more recently established site in the Patea River (illustrated in Figures 1 and 2), on 10 February 2015.

Site No	Site code	GPS reference	Location
1	PAT 000315	E1711801 N5644382	Swansea Road bridge (upstream of landfill and oxidation ponds' discharge)
2	PAT 000330	E1712403 N5644580	Upstream of WWTP discharge (and downstream of landfall)
3a	PAT 000350	E1712956 N5644292	Approximately 130 m downstream of the WWTP new outfall
4	PAT 000356	E1714497 N5645112	Approximately 1 km upstream of the Kahouri Stream confluence

These sites were:

The upgrade to the WWTP system had included a new outfall (via rock rip-rap) to the river located a further 600m downstream of the original discharge point. The original site 3 was not required for the purpose of the current survey as no discharge from the sealed 'old' outfall was occurring at the time nor had any recent leakages occurred.

This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semiquantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of

NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al, 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)=less than 5 individuals;C (common)=5-19 individuals;A (abundant)=20-99 individuals;VA (very abundant)=100-499 individuals;XA (extremely abundant)=500 or more individuals



Figure 1 Biomonitoring sites in the Patea River in relation to Stratford landfill and oxidation ponds discharge



 Figure 2
 Aerial photo of site and location of sampling sites

Macroinvertebrate Community Index (MCI) values were calculated for taxa present at each site (Stark 1985) with certain taxa scores modified in accordance with Taranaki experience.

A semi-quantitative MCI value, SQMCIs (Stark 1999) 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 scores, and dividing by the sum of the loading factors. 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).

Where necessary sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned 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 or river.

## **Results and discussion**

This survey was performed on 10 February, 2015 during a very low recession flow, 40 days after a fresh in excess of 3x median flow and 41 days after a fresh in excess of 7x median flow during a dry late summer period. River flow at Skinner Road was 0.90 m<sup>3</sup>/sec representing a flow well below the average monthly mean February flow (2.73 m<sup>3</sup>/sec) but above the minimum mean monthly flow for February (0.64 m<sup>3</sup>/sec) recorded for the period 1978-2014. This flow was slightly lower (by about 0.04 m<sup>3</sup>/sec) than the flow at the time of the previous biomonitoring survey in late summer, 2014.

Periphyton mats were patchy at thin at sites 1 and 2 and patchy at sites 3a and 4, while filamentous algal growth was patchy at sites1, 3a, and 4 with none recorded at site 2. Patchy moss was recorded on the stony substrate at all sites. The algal component of the oxidation ponds discharge appeared moderate with rapid dispersion in the river downstream of the outfall and no algae were trapped or deposited amongst the river substrates at either of the downstream sites. Only site 3a did not have partial shading. Water temperatures ranged from 15.0°C to 16.3°C over the four sites at the time of this early to mid morning survey. The low discharge rate via the rock rip-rap at the re-located outfall was slightly turbid and pale green in appearance and caused a minimal increase in turbidity in the river at sites 3a and 4 downstream of the outfall.

## Macroinvertebrate communities

surveys performed between February 1985 and March 2014											
	Site	No of surveys	Taxa r	numbers	MCI Values						
			Range	Median	Range	Median					
	1	44	20-33	27	98-130	110					
	2	32	11-36	24	96-119	105					
	3a	8	21-29	25	95-110	101					
	4	39	17-31	24	82-116	98					

A summary of the results of previous surveys is presented in Table 1.

 Table 1
 Summary of macroinvertebrate taxa numbers and MCI values for previous

Survey results since February 1986 are illustrated in Figure 2, while the results of the current survey are presented in Table 2 and discussed beneath.

	Site Number		1	2	3a	4
Taxa List	Site Code	MCI	PAT000315	PAT000330	PAT000350	PAT000356
	Sample Number	score	FWB15062	FWB15063	FWB15064	FWB15065
PLATYHELMINTHES (FLATWORMS)	Cura	3	-	-	R	-
NEMERTEA	Nemertea	3	-	-	-	R
NEMATODA	Nematoda	3	-	-	-	R
ANNELIDA (WORMS)	Oligochaeta	1	R	С	VA	А
MOLLUSCA	Potamopyrgus	4	С	-	-	R
EPHEMEROPTERA (MAYFLIES)	Austroclima	7	С	-	-	-
	Coloburiscus	7	XA	ХА	А	С
	Deleatidium	8	XA	ХА	А	С
	Nesameletus	9	А	А	-	R
	Zephlebia group	7	С	R	R	-
PLECOPTERA (STONEFLIES)	Megaleptoperla	9	R	-	-	-
	Zelandoperla	8	С	С	-	-
COLEOPTERA (BEETLES)	Elmidae	6	VA	А	А	А
	Hydraenidae	8	А	С	R	R
MEGALOPTERA (DOBSONFLIES)	Archichauliodes	7	VA	VA	А	А
TRICHOPTERA (CADDISFLIES)	Hydropsyche (Aoteapsyche)	4	XA	XA	VA	XA
	Costachorema	7	С	А	А	С
	Hydrobiosis	5	С	С	А	А
	Neurochorema	6	С	R	С	С
	Beraeoptera	8	R	С	-	-
	Oeconesidae	5	R	-	-	-
	Olinga	9	-	R	R	-
	Oxyethira	2	-	R	С	R
	Pycnocentrodes	5	С	-	-	R
DIPTERA (TRUE FLIES)	Aphrophila	5	VA	VA	А	VA
	Eriopterini	5	R	-	-	-
	Harrisius	6	R	-	-	-
	Maoridiamesa	3	С	С	А	VA
	Orthocladiinae	2	A	С	VA	А
	Polypedilum	3	-	-	R	-
	Tanypodinae	5	С	R	С	R
	Tanytarsini	3	С	С	VA	А
	Empididae	3	R	-	С	R
	Muscidae	3	-	-	А	С
	Austrosimulium	3	С	R	С	С
	Tanyderidae	4	R	R	R	-
	No of taxa	29	23	24	24	
	110	110	95	93		
	6.2	6.3	3.5	4.1		
	EPT (taxa)	14	11	8	8	
	%	EPT (taxa)	48	48	33	33
'Tolerant' taxa         'Moderately sensitive' taxa         'Highly sensitive' taxa					taxa	
R = Rare C = Com	mon A = Abundant V	A = Very A	bundant	XA = Extren	nely Abundan	it

 Table 2
 Macroinvertebrate fauna of the Patea River in relation to Stratford District Council WWTP discharge and closed landfill leachate discharges sampled on 10 February, 2015

The results from the current survey (Table 2) indicated faunal richnesses ranging from one taxon below (site 2) to two taxa above (site 1) median richnesses (ranging from 23 to 29 taxa) present at the four river sites. These taxa numbers were well within ranges previously recorded (Table 1) at the three longer established sites (1, 2 and 4).

The range of taxa richnesses was generally typical of richnesses recorded by previous surveys which have been recorded under summer, more widespread periphyton cover and tending toward low flow conditions.



Figure 3 Taxa richness and MCI scores recorded to date at the Patea River sites

#### Sites upstream of the WWTP discharge (sites 1 and 2)

The macroinvertebrate communities of this reach of the river upstream of the WWTP discharge (and adjacent to the landfill) were of moderate richnesses (23 to 29 taxa) and characterised by up to three 'highly sensitive' taxa [mayflies (extremely abundant Deleatidium; and Nesameletus) and hydraenid beetles]; up to five 'moderately sensitive' taxa [mayfly (Coloburiscus), elmid beetles, dobsonfly (Archichauliodes), free-living caddisfly (Costachorema), and cranefly (*Aphrophila*)]; and up to two 'tolerant' taxa [net-building caddisfly (*Aoteapsyche*) and orthoclad midges]. These dominant taxa were similar to those dominant at the time of the previous summer survey (CF604) but two fewer in number of 'tolerant' taxa. In comparison with spring surveys, a lower ratio of 'sensitive' to 'tolerant' taxa generally has characterised these summer communities associated with more extensive periphyton assemblages typical of the mid and lower reaches of Taranaki rivers and streams during periods of warmer, low recession flows. The presence of up to seven 'highly sensitive' taxa at these two sites within this surveyed reach of the river was indicative of relatively good preceding physicochemical water quality upstream and adjacent to the Stratford landfill and WWTP under summer, low recession flow conditions. MCI scores (both 110 units) reflected the significant proportions of 'sensitive taxa (69% and 65%) comprising the fauna at these sites, with these scores equivalent with to five units higher than medians of previously recorded scores (Table 1). These scores were both 5 units lower than scores predicted for sites at these altitudes (280 to 300 m asl) but 7 to 8 units higher than predicted for sites this distance from the National Park (12.9 to 13.6 km) in ringplain rivers (Stark & Fowles, 2009). These scores categorised these sites as having 'good' generic river health (TRC, 2015a) at the time of this summer survey, and not different to that expected under summer low flow conditions at these two sites (Figure 3). Minimal significant differences in individual taxon abundance between sites (very similar SQMCIs scores), together with no downstream decrease in MCI score, were indicative of no recent impacts of the adjacent closed landfill on the macroinvertebrate communities of this reach of the river.

#### Sites downstream of the WWTP new discharge outfall (sites 3a and 4)

These sites' macroinvertebrate communities had identical taxa richnesses, very similar to medians of previous surveys (Table 1), and were within the range of richnesses recorded at the two sites upstream of the outfall. The communities were characterised by up to one 'highly sensitive' taxon [mayfly (Deleatidium)]; up to six 'moderately sensitive' taxa [mayfly (Coloburiscus), elmid beetles, dobsonfly (Archichauliodes), free-living caddisflies (Costachorema and Hydrobiosis), and cranefly (Aphrophila)]; and up to six 'tolerant' taxa [oligochaete worms, net-building caddisfly (Aoteapsyche), muscid flies, and midges (orthoclads, tanytarsids, and Maoridiamesa)]. There were no significant differences between sites in characteristic taxa. However, there were several significant differences in individual taxon abundances between the two sites (2 and 3a) immediately upstream and downstream of the WWTP discharge. These included increased abundances within five 'tolerant' taxa (oligochaete worms, midges (tanytarsids and orthoclads), and muscid and empidid flies; most of which were associated with the increased periphyton streambed cover; and decreased abundances within four 'highly sensitive' and one 'moderately sensitive' taxa. Decreases in the proportion of 'sensitive' taxa (50% and 50% of richnesses) at sites 3a and 4, resulted in significant decreases (of 15 and 17 units) in the MCI scores between site 2 (upstream of the WWTP discharge) and sites 3a and 4 (95 and 93 units). At site 3a this score was significantly lower (Stark, 1998) than the score obtained in the river reach immediately upstream of the discharge from the WWTP but not to the same degree at site 4 taking into account the distance of this site further downstream. These differences in scores were indicative of some recent impacts of the upgraded WWTP

wastes discharge on the macroinvertebrate fauna in the surveyed reach of the Patea River, with downstream sites' scores from 5 to 6 units lower than the relevant medians of past scores. The score at site 3a was equal with the lowest score recorded previously (by eight surveys) at this site and one unit lower than the historical minimum recorded at the site (2) upstream of the discharge. There was a minimal difference in MCI scores (a decrease of 2 units) between the two adjacent downstream sites (3a and 4) and the overall fall in MCI scores (17 units) over a distance of 4.3 km between the 'control' site (1) and furthest downstream site (4) was significant for this reach of the river despite the distance between these two sites. The several changes in community compositions (referenced above) resulted in a significant decrease in SQMCI<sub>s</sub> score of 2.8 units immediately downstream of the new outfall (site 3a), but a small recovery in SQMCI<sub>s</sub> score (increase of 0.6 unit) at site 4 predominantly was due to decreased abundances within four of the dominant 'tolerant' taxa at site 4.

The MCI scores categorised sites 3a and 4 as having 'fair' generic river health (TRC, 2015a) at the time of this summer survey, which was consistent with river health often recorded by previous surveys. These scores (95 and 93 units) were a significant 17 units lower than predicted for both sites at these altitudes (265 and 250 m asl) in ringplain rivers but insignificantly 6 to 7 units below predicted scores for these sites 14.8 km and 17.2 km downstream of the National Park boundary (Stark and Fowles, 2009).

The 17 unit difference in MCI scores between sites 1 ('control') and site 4 over a river distance of 4.3km represented a significant 14 unit larger difference than predicted for this reach of the Patea River some 13 to 17 km below the National Park boundary (Stark and Fowles, 2009), and the 15 units difference between sites (2 and 3a) adjacent to the discharge was indicative of some recent impacts of the WWTP point source discharge under summer, very low flow conditions.

## **Riverbed heterotrophic growth assessment**

Microscopic assessment of material from the riverbed at the four sampling sites indicated that there were no unusual heterotrophic growths present in the river at the two upstream and two downstream sites during a period of summer low recession flow conditions. This was consistent with the visual absence of such growths noted at all sites at the time of the survey. Also, there was no increase in planktonic pond algal deposition at the site downstream of the relocated outfall but benthic algal substrate cover tended to increase through the reach surveyed downstream of the outfall.

## Conclusions

Typical macroinvertebrate communities' richnesses were found by surveys at the four Patea River sites during a very low flow recession period in the latter part of summer and under conditions of thin to widespread mats of periphyton river substrate cover and none to patchy filamentous algae. This summer survey was performed as a component of the scheduled monitoring programme in relation to the assessment of compliance of the relatively recently upgraded WWTP with consent conditions. Very minor discolouration of the river's reach below the WWTP's re-located discharge was apparent and there was no planktonic pond algal deposition on the river bed, as a result of reduced algal concentration in the upgraded partitioned second oxidation pond cells. Faunal communities upstream of the WWTP discharge had higher percentages of 'sensitive' taxa whereas communities at downstream sites had increased percentages of 'tolerant' taxa. There were some differences in dominant (characteristic) taxa between these four sites' communities with a tendency toward proportionately fewer 'sensitive' and more 'tolerant' dominant taxa in a downstream direction.

MCI scores were relatively similar to scores generally typical of mid-catchment ringplain rivers in Taranaki, particularly those found during summer low flow conditions and showed a moderately wide range (17 units) along the four sites through the 4.5 km reach of the Patea River. No impacts of seepage from the Stratford landfill (situated between sites 1 and 2) were indicated by the faunal composition at these sites. An increase in number of 'tolerant' taxa, together with fewer 'sensitive' taxa downstream of the WWTP's relocated discharge, resulted in lower MCI scores at these sites, which were significant in the immediate vicinity of the discharge with minimal further deterioration downstream. There were several significant changes in individual taxon abundances including amongst some dominant taxa as reflected in a reduction in SQMCI<sub>s</sub> value between sites 2 and 3a of 2.8 units and sites 2 and 4 of 1.8 units. These lower SQMCI<sub>s</sub> scores at sites 3a and 4 ( up to 2.4 km downstream of the wastewater discharge) reflected lower abundances in certain 'highly sensitive' taxa and increased numbers within 'tolerant' oligochaete worms and midges in particular.

No 'undesirable heterotrophic growths were found on the substrate of the river at the sites surveyed downstream of the discharge under these summer very low recession flow conditions and there was no apparent deposition of oxidation ponds' planktonic algae on the river bed.

Effects of discharges on the macroinvertebrate communities of the Patea River vary in relation to the treatment provided by the WWTP, dilution available in the receiving waters, preceding climatic conditions and the microfloral component of the wastewaters. Such variations in effects have been documented by previous summer biomonitoring surveys with this summer survey illustrating some effects (significant at the boundary of the mixing zone), during a very low recession flow period, below the discharge from the relocated rock riprap outfall following the WWTP upgrade.

## Summary

The Council's standard 'kick-sampling' technique was used at four established sites to collect streambed macroinvertebrates from the Patea River. Samples were sorted and identified and the number of taxa (richness), MCI score, and SQMCI<sub>S</sub> score were calculated 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<sub>S</sub> 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<sub>S</sub> between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This scheduled summer, 2015 macroinvertebrate survey (which has complemented previous additional assessments of the upgraded system performance) indicated that the discharge of treated oxidation ponds wastes from the upgraded Stratford WWTP system had had localised effects on the macroinvertebrate communities of the Patea River under summer low river flow conditions with minimal further deterioration at the site 2.4 km downstream of the discharge. Some significant changes in macroinvertebrate communities' compositions were recorded between the upstream 'control' site and sites downstream of the relocated outfall from the

WWTP. However, the similarity in the community compositions at the two sites upstream of the WWTP outfall indicated that there were no significant effects associated with seepages from the closed landfill site.

The macroinvertebrate communities of the Patea River contained higher proportions of 'sensitive' taxa at the two upstream sites while 'tolerant' taxa were more predominant proportionately at the two sites downstream of the relocated WWTP discharge. Dominant taxa composition had some similarities at all four sites although proportionately tending toward more 'moderately sensitive' and 'tolerant' taxa in a downstream direction, through the surveyed reach of the river, however. Taxonomic richnesses (numbers of taxa) varied by only six taxa at the four sites in this summer survey and were slightly higher at two these sites than those found by the previous summer (2014) survey. However, higher proportions of 'tolerant' taxa were present at sites downstream of the WWTP discharge compared to the previous summer survey under slightly lower flow conditions and more widespread periphyton cover of the river bed at the time of this latest survey.

MCI and SQMCI<sub>S</sub> scores indicated that the upstream stream communities were of 'good' health (TRC, 2015a) and typical of conditions recorded in summer in the mid reaches of similar Taranaki ringplain rivers. Stream communities downstream of the WWTP discharge were of 'fair' generic health and were similar to those documented in this reach by most previous surveys during summer recession low flow conditions.

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