Taranaki By-Products Ltd Monitoring Programme Annual Report 2015-2016

Technical Report 2016-80

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Executive summary

Taranaki By-Products Ltd (TBP) operates an animal rendering operation located on Kohiti Road at Okaiawa, in the Inaha catchment. Two rendering plants operate on the site: an inedibles plant owned by TBP, and a food grade plant owned by Taranaki Bio-Extracts Ltd (TBE). A trucking firm, Jackson Transport Ltd operates from the site also. This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess TBP's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of TBP's activities.

Taranaki By-Products Ltd holds 13 resource consents, which include a total of 166 conditions setting out the requirements that they must satisfy. TBP holds two resource consents to allow it to take and use water, one consent for placing structures in a watercourse, one consent to realign a watercourse, four consents to discharge to the Inaha Stream and a tributary, three consents to discharge to land, and two consents to discharge emissions into the air at the site. Two of the consents were granted during the previous review period: one in February 2014 to take groundwater, the other in January 2015 to discharge emissions to air from burning of wood waste.

During the monitoring period, Taranaki By-Products Ltd demonstrated generally a good level of environmental performance.

Monitoring was carried out by both the Council and TBP. TBP monitors water abstraction rates, wastewater volumes and composition, effluent loadings on irrigation areas, bio-filter performance and weather conditions. The Council undertakes inspections of the plant site, irrigation and burial areas; water quality and biological monitoring in the Inaha Stream and its tributaries; riparian management, and groundwater surveys, and facilitates community and Iwi engagement meetings.

The Council's monitoring programme for the year under review included 14 inspections, 192 water samples collected for physicochemical analysis and two biomonitoring surveys of receiving waters. In addition, it undertakes continuous monitoring of the temperature of the cooling water discharge and of the Inaha Stream, and a staff gauge rating was maintained for measurement of flow in the stream.

The monitoring indicated compliance was achieved in terms of abstraction rates and volumes with respect to water takes from both the Inaha Stream and the associated groundwater abstraction bore. However, some data was missing from the surface water abstraction data provided to the Council, which was attributed to data storage issues.

The discharge of cooling water to the Inaha Stream was found to have complied with the relevant consent; in particular the tolerable temperature differential was not exceeded through out the monitoring year. The discharge of wastewater to the Inaha, whereby the discharge must meet a dilution rate of 300:1, was complied with, though a calculation error had resulted in a slightly lower dilution rate of 295 on a couple of occasions.

The analysis of wastewater entering the Inaha Stream, where the dissolved oxygen concentration must meet a standard of 1.0 g/m^3 was complied with on two occasions of five. For the remaining key parameters of concern, pH, ammonia and BOD, compliance was

achieved. The analysis of the cooling water revealed no exceedance when compared to the consent conditions.

During the 2015-2016 monitoring period, compliance with the annual nitrogen loading limits for effluent discharge to land was achieved. The average nitrogen loadings for the designated 300 kg N/ha areas were 31%, and 37% for the 200 kg N/ha. For individual paddocks, compliance was recorded for 97% of the irrigated areas where the limit to the loading rate is 300 kg N/ ha, and for 97 % for the paddocks in the Shearer block where the limit is 200 kg N/ha.

In terms of application of wastewater to individual paddocks, there were two exceedances in nitrogen loading. Paddock 34 received an additional 135 kg N over the year, which resulted in an exceedance by 18 kg N/ha of the consented loading rate, with an overall loading rate of 318 kg N/ha. Paddock S-26, which is limited to 200 kg, received an additional 8 kg N, which resulted in an exceedance by 11 kg N/ha of the consented loading rate, with an overall loading rate of 211 kg N/ha.

In terms of the application of fertiliser, the reported application of fertilisers decreased slightly from the previous period (a reduction of 9%), from 44,000 kg N to 40,000 kg N. In comparison to the discharge of wastewater to land, which is limited to 300 and 200 kg N/ha, the application of fertiliser has no limit.

In this period, six of 44 paddocks received applications of fertiliser greater than 300 kg N/ha, with the highest receiving 404 kg N/ha (paddock 6).

The combined budget of both fertiliser and wastewater in terms of kg nitrogen to land meant that eleven paddocks received an application greater than 300 kg N/ha, with six over 400 kg N/ha and five over 500 kg N/ha. The largest combined application in this period was 587 kg N/ha, on paddock 40.

Groundwater nitrate concentrations in some of the wastewater specific groundwater monitoring wells remained high in this monitoring period, namely wells GND1346, 1347, 1348 and 2226. These wells held concentrations close to or above 60 g/m^3 N. This indicated that these locations are not capable of managing this level of application of wastewater in the future. Crop assimilation of fertiliser should be managed as to not adversely affect the groundwater.

An area which had been subject to high nitrate concentrations in the groundwater had responded swiftly to the reduction in wastewater application in that specific area in this period. Well GND1056 is an example of this, whereby the surrounding paddock/s had been put to crop for the majority of the monitoring year. This would imply that areas which are put to crop or not irrigated will respond with consequent decreasing concentrations over time.

The spring at Shearers property (used to supply local residents with drinkable water), continued to show an increasing trend this term, with its largest fluctuation increase to date, an increase from 5.1 g/m^3 N to 7.8 g/m^3 N in a one month period, prior to dropping back to 4.2 g/m^3 N by July 2016. Paddock loadings in this period ranged from 205 kg N/ha to 513 kg N/ha across the five paddocks in the immediate locality.

Surface water analysis of the Northern and Western tributaries indicated elevated nitrate in these water courses, although no issues were noted for the in-stream biology as assessed by

the Council's biologists. The elevated nitrate in the surface waters was inferred to be a result of the irrigation of wastewater to land.

Two bio-monitoring surveys were undertaken of the Inaha Stream and its associated tributaries in this period. The conclusion of the late summer survey was that overall, there was no evidence that discharges from TBP had impacted on the freshwater macroinvertebrate communities present in the Inaha Stream. However, changes in habitat and habitat variation between sites make drawing strong conclusions from the data difficult.

In the upcoming monitoring period TBP will seek to mitigate elevated nitrate concentrations in the groundwater. This will occur by two means:

- the first will be the gradual removal of stickwater; while for technical reasons this cannot be removed immediately, TBP has began to reprocess this fluid, and to limit the amount discharged to the environment. The Company is now aware that its utilisation as a soil fertiliser is not sustainable in combination with the wastewater application to land. If this is not mitigated then the Council will require TBP to limit total combined nitrogen application rate to below 300 kg N/ha across all paddocks, not including the Shearer block which is already limited to 200 kg N/ha.

- the second will be the development of an updated wastewater land application plan. As previously discussed TBP has engaged a suitably qualified environmental professional to undertake this task. This will aid TBP in balancing their requirement to discharge to land with the sustainable management of the discharge areas so as to lessen the potential for elevated nitrate in this resource.

These two facets display a proactive approach by TBP to managing emerging environmental trends arising as a result of exercising their consents. It is noteworthy to mention that while there are elevated nitrate related effects due the applications of wastewater and fertiliser over time, the bio-monitoring has not indicated anything of an adverse nature in this monitoring period in surface waters.

This proactive approach will bring in to line the TBP wastewater programme with the internal audits of their air quality system, which is audited by Golder Associates, a consulting company.

Air quality continues to be the primary source of complaints received by the Council against TBP. In comparison to the previous monitoring period when seven complaints were received with regard to odour related complaints, thirteen were received this term. 50% of complaints were substantiated by Council Officers in terms of actual noticeable odour. 43% were unnoticeable. As a result, the Council undertook additional odour surveys, all of which were inconclusive.

Developments have been undertaken by the Company, and it is the continued progress which the Council is most interested in. TBP undertook improvements that were identified after undertaking the biannual air quality audit in May 2015, albeit with minor modifications. In the up coming monitoring period this audit will occur again, as it is a consented obligation.

The recommendations will be implemented as TBP seek to continually mitigate the odour generation potential associated with this facility.

The Company's contribution to the Taranaki Tree Trust has been made each year since 1999. These contribution have been used to subsidise riparian planting along the main stream and its tributaries. The effect of these measures will be to increase shading, with consequent decrease in water temperature and in nuisance algal growth; to reduce stock access and bank erosion; to reduce nutrient and sediment input to watercourses; to enhance the stream's macroinvertebrate communities, and to enhance the appearance of the riparian margins.

At the end of 2015-2016, a total of $34,260.86 of TBP funding had been spent on or was committed to riparian management covering planting of stream margins. The works were carried out throughout the catchment, mainly along reaches above the Okaiawa plant. Funding was granted to landholders at a rate of 50% on plants as a rebate.

During the year, generally TBP demonstrated a 'Good' level of environmental and a 'Good' level of administrative performance with the resource consents as defined in Section 1.1.4.

However, specifically two environmental compliance aspects in respect of significant issues will require improvement moving forward. These aspects are as follows:

- Commitment to mitigating odour (consent 4058-4). The implementation/ recommendations from the upcoming site specific audit, to be undertaken by Golder Associates, will aim to progress with this area. The second audit was undertaken in May 2015 and the third audit will be undertaken in 2017 as it is a consented obligation.

- Commitment to mitigating significant nitrate trends in the groundwater (consent 3941-2). The engagement of a suitably qualified consultant (Pattle Delamore and Partners) is with the intent that they will seek to determine appropriate solutions and measures in this area.

Administrative Compliance requires improvement in the following area:

- Commitment to the improving control of burning pallets, paper and cardboard on site with respect to 10054-1.

Of the ten consents for which environmental compliance is rated, two were rated 'improvement required', four were rated 'good' and four were rated 'high'.

For the abstraction of water from the Inaha Stream and groundwater, the environmental performance and administrative performance were rated at a good level.

For the abstraction of groundwater for industrial water supply, the environmental performance was rated as high, as was their administrative performance.

The wastewater discharge from the facility to the Inaha Stream was found to be of a good level of environmental compliance and was coupled with a good administrative performance.

In terms of the discharge of cooling water to the Inaha, this was found to have a high level of environmental compliance and administrative performance.

In terms of the discharges of stormwater to the Inaha tributary, this was rated as high for environmental and high for administrative compliance.

For the discharge of emissions to air, environmentally this was rated as 'improvement required'. This rating was due to the additional complaints received from the public this monitoring period. Conversely though, in terms of administration performance for this consent, TBP were rated good.

In respect of the Company's discharge of treated wastewater to land, TBP were rated as 'improvement required' with regard to their environmental performance. This was due to the continued elevation of nitrate in groundwater which is not sustainable. They were rated a 'good' for administrative performance as they provided accurate loading rates and amounts to the Council.

The waste burial area was rated as good environmentally and administratively, though an elevation in ammonia in groundwater nearby has been observed.

Finally, the consent to burn pallets and associated cardboard, was rated as good environmentally, however, rated as improvement required administratively, as defined in the inspection section. This rating was due to the observation that more control was required while undertaking this potentially polluting task.

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

In terms of overall environmental and compliance performance by TBP over the last several years, this report shows that the consent holder's performance is improving, but still has some way to go to be considered satisfactory in all aspects.

This report includes recommendations for the 2016-2017 year.

Table of contents

			Page
1	Introduction		1
	1.1	Compliance monitoring programme reports and the Resource Management Act 1991	1
		1.1.1 Introduction	1
		1.1.2 Structure of this report	1
		1.1.3 The Resource Management Act 1991 and monitoring	2
		1.1.4 Evaluation of environmental and administrative performance	2
	1.2	Process description	4
		1.2.1 Wastewater treatment system	5
		1.2.2 Bio-extracts plant	6
		1.2.3 Odour management	6
	1.3	Resource consents	8
		1.3.1 Water abstraction consent	8
		1.3.2 Water discharge consent	9
		1.3.3 Air discharge consent	12
		1.3.4 Discharge of waste to land	13
		1.3.5 Waste burial	15
		1.3.6 Land use consent	17
	1.4	Monitoring programme: water	18
		1.4.1 Introduction	18
		1.4.2 Programme liaison and management	19
		1.4.3 Site inspections	19
		1.4.4 Water take	19
		1.4.5 Chemical sampling	19
		1.4.6 Bio-monitoring surveys	20
		1.4.7 Monitoring by Taranaki By-Products	20
	1.5	Monitoring programme: air	21
		1.5.1 Introduction	21
		1.5.2 Programme liaison and management	21
		1.5.3 Site inspections	21
		1.5.4 Monitoring by Taranaki By-Products	21
2	Results		22
	2.1	Water	22
		2.1.1 Inspections	22
		2.1.2 Water abstraction	25
		2.1.3 Discharges of wastewater to land	27
		2.1.4 Results of receiving environmental monitoring	34
		2.1.5 Irrigation and groundwater monitoring	47
		2.1.6 Solid waste burial	65
	2.2	Air	68
		2.2.1 Inspections	68
	2.3	Investigations, interventions, and incidents	77

2.4 Community consultation 80
2.5 Riparian management 82
2.6 Provision of reports, management plans and certification 85
2.6.1 Reports and plans 85
2.6.2 Air discharge engineering practice certification 86

3 Discussion 88
3.1 Discussion of plant performance 88
3.2 Environmental effects of exercise of consents 91
3.3 Evaluation of performance 94
3.4 Recommendations from the 2013-2015 Biennial Report 107
3.5 Alterations to monitoring programmes for 2016-2017 107
3.6 Exercise of optional review of consent 108

4 Recommendations 109

Glossary of common terms and abbreviations 110

Bibliography and references 112

Appendix I Resource consents held by Taranaki By-Products Limited (For a copy of the signed resource consent please contact the TRC Consents department) 1

Appendix II Biomonitoring reports 1

Appendix III Golder Air Report 1

List of tables

Table 1	Summary of resource consents held by Taranaki By-Products	8
Table 2	Point source sampling key	24
Table 3	Sampling points for receiving waters Inaha Stream and tributary	25
Table 4	Chemical monitoring data of the effluent discharge post treatment system Pond 6 IND004004	30
Table 5	Chemical monitoring of the cooling water discharged at location IND002004	31
Table 6	Chemical monitoring of stormwater from TBP in the 2015-2016 monitoring year	32
Table 7	Chemical monitoring results for the combined tributary, cooling, storm and fire water discharges from the site IND001015 in the 2015-2016 monitoring period with summary since July 1997-2015	33
Table 8	Surface water sample collection locations	37
Table 9	Inaha Stream water quality analysis	37
Table 10	Northern tributary 2015-2016 monitoring year results, with historical data since January 1999	41
Table 11	Water quality in the western tributary of the Inaha Stream 2015-2016 monitoring year	42
Table 12	Specific testing of INH000440 final sample location on western tributary for NNN testing	43
Table 13	Summary of discharge consents held by Taranaki By-Products Ltd	44
Table 14	Biomonitoring sites in the Inaha Stream and in an unnamed tributary relating to the Taranaki By-Products plant	45
Table 15	Groundwater monitoring well information	51
Table 16	Borehole 1 GND1054 TBP groundwater monitoring well 2015-2016	55
Table 17	Borehole 3 GND1056 TBP groundwater monitoring well 2015-2016	56
Table 18	Borehole 4 GND1057 TBP groundwater monitoring well 2015-2016	57
Table 19	Shearer bore GND1058 2015-2016	58
Table 20	Borehole 5B GND1346 TBP monitoring well 2015-2016	59
Table 21	Borehole 6B GND1347 TBP monitoring well 2015-2016	60
Table 22	Borehole 7 GND1348 TBP monitoring well 2015-2016	61
Table 23	Borehole 8 GND1349 TBP monitoring well 2015-2016	62
Table 24	BH 9 GND2225 TBP monitoring well 2015-2016	63
Table 25	Borehole 10 GND2226 TBP monitoring well 2015-2016	64
Table 26	Burial specific groundwater monitoring wells 2015-2016	67
Table 27	Unauthorised incidents reported from 1 July 2015 to 30 June 2016	78
Table 28	Summary of registered incidents relating to TBP 2000-2016	80
Table 29	Requirements for reports and plans imposed by special conditions	85
Table 30	Summary of performance for consent 2051-4	94
Table 31	Summary of performance for consent 2049-4	94
Table 32	Summary of performance for consent 2050-4	95
Table 33	Summary of performance for Consent 5426-1	96
Table 34	Summary of performance for Consent 4058-4	96
Table 35	Summary of performance for Consent 3941-2	97
Table 36	Summary of performance for Consent 5495-1	99
Table 37	Summary of performance for Consent 5560-1	100
Table 38	Summary of performance for Consent 6431-1	102
Table 39	Summary of performance for Consent 7234-1	103

Table 40 Summary of performance for Consent 7329-1 103
Table 41 Summary of performance for Consent 9756-1 104
Table 42 Summary of performance for Consent 10054-1 105
Table 43 Summary of performance for TBP 2016-2016 monitoring year 106

List of figures

Figure 1 Surface water sample collection locations in relation to TBP 23
Figure 2 Point source sample location and labelling 24
Figure 3 Surface water abstraction from the Inaha Stream 2015-2016 monitoring period 26
Figure 4 Daily groundwater abstraction volumes by Taranaki By-Products July 2015-June2016 27
Figure 5 Hydrograph for the Inaha Stream at Kohiti Road, July 2015- June 2016 from daily staff readings with the TBP discharge rate from pond 6 35
Figure 6 Cooling water temperature 1 July 2015- 30 June 2016 36
Figure 7 Inaha Stream temperature increase post discharge 1 July 2015- 30 June 2016 36
Figure 8 Aerial photo detailing the biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. 47
Figure 9 Wastewater and fertiliser application areas with groundwater monitoring well locations 53
Figure 10 Nitrate/ Nitrite concentration at GND1058 Shearer 2011-2016 long term record 54
Figure 11 Groundwater level, Nitrate/Nitrite concentrations and conductivity in BH1 GND1054 2012-2016 54
Figure 12 Nitrite/Nitrate concentration and conductivity at BH 1 GND1054 September 2014-September 2016 55
Figure 13 Nitrite/Nitrate concentration and conductivity at BH3 GND1056 July 2014-September 2016 56
Figure 14 Nitrite/Nitrate concentration and conductivity at BH4 GND1057 September 2014-September 2016 57
Figure 15 Nitrite/Nitrate concentration and conductivity at GND1058 Shearer September 2014-September 2016 58
Figure 16 Nitrite/Nitrate (black squares) concentration and conductivity (line) at GND1346 September 2014-September 2016 59
Figure 17 Nitrite/Nitrate (black squares) concentration and conductivity (line) at BH6B GND1347 September 2014-September 2016 60
Figure 18 Nitrite/Nitrate concentration and conductivity at BH7 GND1348 September 2014-September 2016 61
Figure 19 Nitrite/Nitrate concentration and conductivity at BH8 GND1349 September 2014-September 2016 62
Figure 20 Nitrite/Nitrate concentration and conductivity at BH9 GND2225 September 2014-September 2016 63
Figure 21 Nitrite/Nitrate concentration and conductivity at BH10 GND2226 September 2014-September 2016 64
Figure 22 Nitrate/Nitrite Nitrogen concentrations long term record GND1346 65

Figure 23 Location of the burial pit monitoring wells 66
Figure 24 Nitrite/Nitrate concentrations in the active burial pit monitoring 67
Figure 25 Riparian management plan for the TBP site 83

List of photos

Photo 1 Taranaki By-Products aerial view 5

1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2015 to June 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Taranaki By-Products Limited (TBP). TBP operates a rendering operation situated on Kohiti Road at Okaiawa, in the Inaha catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by TBP that relate to abstractions and discharges of water within the Inaha catchment, and the air discharge permit held by TBP to cover emissions to air from the site.

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 TBP's use of water, land and air, and is the 23rd annual report by the Council for TBP.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about:

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

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

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

Section 4 presents recommendations to be implemented in the 2016-2017 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

(a) the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
(b) physical effects on the locality, including landscape, amenity and visual effects;
(c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
(d) natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
(e) risks to the neighbourhood or environment.

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

1.1.4 Evaluation of environmental and administrative performance

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

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

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

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

Environmental Performance

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

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

  For example:

  - High suspended solid values recorded in discharge samples; however the discharge was to land or to receiving waters that were in high flow at the time;
  - Strong odour beyond boundary but no residential properties or other recipient nearby.

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

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

Administrative performance

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

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

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

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

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents

1.2 Process description

The TBP plant on Kohiti Road, Okaiawa is the major animal rendering plant in Taranaki. It was established in 1936. About 60 persons are employed. Raw material comes largely from meat and poultry processing plants in the central and southern North Island. TBP also runs a dead stock collection service in Taranaki and adjacent regions. Transport of raw materials to and products from the site is undertaken by a trucking firm that operates from the site, Jackson Transport Ltd.

The site is located beside Inaha Stream in mid-catchment, about 13 km from sea, and less than 1 km from Okaiawa, a village of about 50 dwellings. Intensive pastoral farming, mainly dairy, occurs around the site (Photo 1).

Inedible products are manufactured, including meat and bone, poultry, feather, and blood meals, as well as tallow and chicken oil. There are three separate processing lines – a mixed abattoir material line [processing beef and mutton, hard and soft offal, and fallen stock], a poultry line [processing soft poultry offal and feathers], and a blood line. The plant is able to process up to 26 t/h of raw material (18 t/h through the mixed abattoir material line and 6-8 t/h through the poultry feather and offal line). Up to 100,000 L/day of blood can be processed.

The plant operates 24 hours/day, seven days/week throughout the year, with weekly maintenance shutdowns on Sunday/Monday. There is some seasonal variation in beef offal processing, the peak occurring between January and May, being earlier in dry seasons, when the availability of stock feed is reduced. Processing of fallen stock peaks in July and August, during the calving season. Poultry processing is relatively steady throughout the year, with a slight increase before Christmas and over the summer months. However, poultry is to be phased out at the TBP facility, with the facility to primarily focus on fallen stock.

Photo 1 Taranaki By-Products aerial view

Animal rendering is essentially a two-stage process, involving separation of fat and drying of the residual solids. The TBP process is largely continuous low temperature (below 100˚ C) dry rendering with mechanical de-watering by screw press, and some thermal de-watering. Indirect (Rotadisc) steam-heated driers are employed. The dried product is milled, sieved and stored in bulk.

The mechanical de-watering of the raw material creates large quantities of stickwater, essentially the pressed-out meat juices. Waste heat exchangers dry the stickwater under vacuum to a stage where it can be incorporated back into the meal product. Washings and waste products from the stickwater system have been registered as a fertiliser (Zeal Grow) and are applied to an adjacent dairy farm owned by TBP. Solid wastes are buried in a designated area on the farm.

1.2.1 Wastewater treatment system

Wastewater from TBP's plant comprises equipment and floor washings, condensates from treatment of gas emissions, and blood decanter liquids. There is potential for stickwater and blood losses to be put through the treatment system.

The wastewater treatment system comprises a contra-shear screen, a dissolved air flotation (DAF) unit, three anaerobic ponds (ponds 1-3), an aeration pond (pond 4), a settling pond (pond 5), and a large aerobic pond (pond 6).

All wastewater from the plant (except condensate wastewater from the waste heat exchanger) is pumped through the rotary screen, then a 100 m^3/h DAF unit to which flocculent is added to assist in recovery of solids. The wastewater then moves sequentially through ponds 1-3, with a total volume of about 15,000 m^3, where anaerobic activity breaks it down. The condensate wastewater from the plant is

pumped directly to pond 1. Ponds 1 and 2, on the northern side of the plant, may be operated in parallel, depending on loadings. The wastewater from pond 2 enters wet well pump station 1, from where it is pumped to pond 3, at a higher level on the southern side of the plant.

From pond 3, the wastewater discharges to an aerated lagoon (pond 4) with a volume of 8,000 m^3. Aerators of about 315 kW total capacity assist in the reduction of biochemical oxygen demand (BOD) and of ammonia concentration. The wastewater finally passes, via a small settling pond (5), into a large aerobic pond (6), with an area of 1.04 ha and a nominal volume of 30,000 m^3, with four brush aerators each of 17.5 kW capacity. The purpose of the aerobic pond is to allow further treatment of the effluent, and to provide for storage of treated wastewater. Pond 6 is also used as a source of scrubbing water in the odour control system.

The treated wastewater is discharged either to Inaha Stream directly or to adjacent land by spray irrigation. This 'dual' wastewater disposal system addresses the limited capacity of Inaha Stream to assimilate the treated wastewater, while promoting grass growth for dairy production on land that is well suited to irrigation. The total area utilised for irrigation increased from 269 ha in 2011-2012 to 291 ha in 2012-2013.

1.2.2 Bio-extracts plant

In April 2003, an edible (food grade) tallow and gelatine bone chip recovery plant was commissioned adjacent to the existing rendering plant at Okaiawa. A new company, Taranaki Bio Extracts Ltd (TBE), was established for the venture that is owned by TBP and Riverlands Eltham Ltd in equal partnership.

The TBE operation involves the processing of boning-room waste that has been separated from other raw offal at meat processing plants. The rendering and drying is carried out at lower temperatures than at the inedibles plant, resulting in less odour generation and heat emission. Certain utilities are shared between the two plants, including the steam generators, the wastewater treatment plant, and bio-filters for treatment of air emissions.

1.2.3 Odour management

The rendering operations have potential to generate offensive odour. Sources include the raw materials, rendering processes, wastewater treatment and disposal systems, odour control system, and solid waste burial areas. The generation of odour is controlled through the quality and preservation of raw materials, design and operation of the rendering processes, maintenance of the buildings, treatment of odorous emissions, and management of the wastewater treatment and disposal systems and burial areas.

Odour extraction, cooling and bio-filters are the main components of the odour control systems that are operated at the TBP and TBE plants. There are four extraction systems, one each for concentrated odour sources in the two plants, and two independent factory building air systems (FA1 and FA2) at the TBP plant to capture fugitive emissions that are not collected by the concentrated sources (CS) bio-filter.

Concentrated odorous gases from the TBP bovine, poultry and feather rendering (but not blood) lines are collected at source, then cooled and scrubbed in two water spray condenser towers before being discharged to the bio-filter. Hot exhaust gases, from pre-cookers and driers, are passed through three waste heat evaporators to concentrate stick liquor, then a vertical condenser, before going to the spray towers with the other concentrated emissions.

The FA1 ventilation system extracts air from above the mixed abattoir and poultry rendering lines in the northern part of the TBP building. The FA2 system collects air from the dead stock pre-breaker, blood drying processes within the blood room, meal mill exhausts and the poultry dryer room, in the southern part of the building, and passes the air through a wet scrubber.

At the TBE plant, humid odorous air streams from the concentrated sources are extracted, and cooled and scrubbed, before being ducted to the CS bio-filter. TBE building air is ventilated directly to atmosphere as it contains no significant odour.

There are three bio-filter systems, comprising two factory air bio-filters, and a concentrated sources bio-filter. FA1 bio-filter is of coarse bark set in the ground, with three parallel zones that are each 30 m x 40 m x 1.5 m (total volume of 5,400 m^3). FA2 bio-filter is also formed of coarse bark, set above ground over pea gravel with two zones 25 m x 30 m x 1 m (1,500 m^3). The CS bio-filter has two parallel beds 25 m x 20 m x 0.7 m (700 m^3) of coarse bark overlaid with fine bark compost. The locations of the bio-filters are given in Figure 2, labelled BF1 and BF2.

The CS bio-filter was repaired in November 2010, when two sides of both beds were replaced. Bed 3 of FA1 bio-filter was reconstructed between July and December 2011, improving the pipework for air distribution and for drainage of liquids. The remainder of FA1 bio-filter was reconstructed between October 2012 and April 2013, the corrosion-prone corrugated iron manifolds being replaced with concrete pipes, and bark replacement being delayed by problems with supply.

Upon upgrade of FA1 bio-filter, the concentrated sources air flow from the TBP plant was redirected to it temporarily, reducing heat load on the designated CS bio-filter, now dedicated to the TBE plant. At the end of the 2012-2013 review period, construction had begun of a fourth zone for FA1 bio-filter, intended to receive the TBP plant concentrated sources streams.

The CS bio-filter was completed and operational prior to Christmas in 2013, as now both TBE and TBP have independent bio-filters.

1.3 Resource consents

A summary of the consents held by TBP in relation to activities at its Okaiawa plant is given in Table 1 below, and the consents are discussed in Sections 1.3.1 to 1.3.7. A copy of each of the consents can be found in Appendix I.

Table 1 Summary of resource consents held by Taranaki By-Products

Consent number	Purpose	Volume	Next review date	Expiry date
2049-4	Discharge treated wastewater to Inaha Stream	940 m^3/day	2017	2019
2050-4	Discharge cooling/backwash water to Inaha Stream	2,160 m^3/day	2017	2019
2051-4	Take from Inaha Stream	2,160 m^3/day(50L/s)	2017	2019
3941-2	Discharge treated wastewater to land and air	1,400 m^3/day	2014	2019
4058-4	Discharge emissions to air from rendering operations		2015	2024
5426-1	Discharge stormwater to Inaha tributary	1,025 L/s	2017	2019
5495-1	Discharge meat wastes by burial into land	200 tonne/day	2017	2019
5560-1	Discharge waste cheese by burial	100 tonne	-	2017
6431-1	Place culverts in Inaha Stream		2017	2023
7234-1	Disturb to realign Inaha Stream		2017	2023
7329-1	Discharge sediment during Inaha Stream realignment		2017	2023
9756-1	Take groundwater	22.8 L/s(1,970 m^3/day)	2017	2029
10054-1	Discharge emissions to air from burning		2017	2029

In addition, TBP holds consents **2446** and **3117** to discharge untreated farm dairy effluent by irrigation to land. Consent **2446** was exercised until the 2004-2005 dairy season, when dairy operations were consolidated at a new shed on Kohiti Road from which wastewater is transferred to the treatment system for the nearby rendering operations. Consent **3117** now applies to a small shed used for sick cows on Katotauru Road.

1.3.1 Water abstraction consent

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14.

TBP holds two water permits that provide for abstraction of water, one from Inaha Stream and one from groundwater.

1.3.1.1 Surface water extraction consent Inaha Stream

TBP holds water permit **2051-4** to cover the abstraction of up to 50 L/s of water from the Inaha Stream for a rendering operation. This permit was issued by the Council on 31 May 1999 under Section 87(d) of the RMA. It is due to expire on 1 June 2019.

There are six conditions imposed on consent **2051-4**.

Condition 1 requires the means of taking water to be satisfactory to Council.

Condition 2 imposes a minimum flow of 25 L/s be maintained in the stream and condition 3 requires installation of a measuring device and records to be kept of daily abstraction and condition 4 requires the flow of Inaha Stream to be measured and recorded.

Condition 5 required the consent holder to investigate and report on the use of wastewater for cooling water.

Condition 6 sets out provision for review of the consent.

Condition 4 was changed on 21 January 2015 to remove the requirement to install a flow recorder, but preserve the requirement to visually record the stream height daily, and keep records of the flows within Inaha Stream.

1.3.1.2 Groundwater extraction consent

TBP holds water permit **9756-1** to cover the take and use of groundwater for industrial water supply. This permit was issued by the Council on 3 February 2014 under section 87(d) of the RMA. It is due to expire on 1 June 2029.

There are 12 conditions imposed on consent **9756-1**.

Condition 1 imposes a limit on maximum abstraction rate.

Condition 2 requires the bore to be permanently labelled for identification.

Conditions 3 and 6 address water level monitoring.

Conditions 4 and 5 address metering and logging of water use, and certification.

Condition 7 deals with the telemetry of monitoring data to Council.

Conditions 8 and 9 relate to access to and failure of monitoring equipment.

Condition 10 requires adoption of the best practicable option.

Conditions 11 and 12 relate to lapse and review of consent.

1.3.2 Water discharge consent

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.

TBP holds four discharge permits that provide for discharge to surface water, one of wastewater, one of cooling water, and two of stormwater.

1.3.2.1 Wastewater discharge consent

TBP holds water discharge permit **2049-4** to cover discharge of up to 940 m^3/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha

Stream. This permit was issued by the Council on 31 May 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

The consent was changed on 4 October 2006, following a review of conditions invoked by Council to deal with adverse effects resulting from exercise of the consent, and an application by TBP to include provision for farm dairy wastewater.

There are 19 special conditions imposed on consent **2049-4**.

Conditions 1 and 2 relate to the location and area of the mixing zone and Condition 3 relates to the point of discharge into the Inaha Stream.

Condition 4 requires the consent holder to give notice of changes in process which may affect the nature of the discharge.

Condition 5 requires the consent holder to monitor consent conditions as deemed reasonably necessary by Council.

Condition 6 sets a minimum dilution rate on the discharge.

Condition 7 prohibits the discharge of stickwater, and deals with increase in dairy herd size.

Condition 8 requires cessation of discharge into the stream at the specified minimum flow rate.

Condition 9 prohibits the discharge from giving rise to specific adverse effects in the receiving waters.

Condition 10 sets a limit on the level of ammonia in the receiving waters.

Condition 11 requires controls on discharge and records of discharge rate.

Condition 12 requires the consent holder to maintain a stream flow gauge.

Conditions 13 and 14 relate to the requirement for a wastewater disposal management plan.

Conditions 15 and 16 require notice of changes to the management plan, provide for review of the plan, and require a designated manager of the wastewater system.

Condition 17 requires the wastewater management plan be adhered to, and that site staff are trained in implementation and advised of any changes to the plan.

Condition 18 relates to a consent holder donation to Taranaki Tree Trust and commitment to riparian planting.

Condition 19 is a provision for review of consent conditions.

The changes of conditions from the review were a requirement to operate the dual wastewater disposal system so as to minimise discharge to Inaha Stream, increasing the

minimum dilution of treated wastewater in the stream, prohibition of discharge of stickwater, and annual review of the wastewater management plan.

The changes of conditions in relation to the inclusion of farm dairy wastewater were an increase in discharge volume, a limit on the number of cows provided for, and an additional review date.

1.3.2.2 Cooling water discharge consent

TBP holds water discharge permit **2050-4** to cover discharge of up to 2,160 m^3 /day of cooling water and backwash water into the Inaha Stream. This permit was issued by the Council on 31 May 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

There are 7 special conditions imposed on consent **2050-4**.

Condition 1 requires the consent holder to monitor consent conditions as deemed reasonable and necessary by Council.

Condition 2 prohibits the increase in concentration of pollutants in the discharge.

Conditions 3 and 4 place a temperature and suspended solids limit on the cooling water discharge.

Condition 5 prohibits specific adverse effects in the receiving waters of the Inaha Stream.

Condition 6 requires the consent holder to measure and keep record of discharge temperature, to make available on request.

Condition 7 sets out provision for review of the consent.

1.3.2.3 Stormwater discharge consent

TBP Plant Site
TBP holds water discharge permit **5426-1 to** cover discharge of up to 1,095 L/s of stormwater into an unnamed tributary of the Inaha Stream. This permit was issued by the Council on 31 May 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

There are five special conditions imposed on consent **5426-1**.

Condition 1 requires the consent holder to give notice of changes in process which may alter the nature of the discharge.

Condition 2 sets chemical limits on the discharge.

Condition 3 prohibits specific adverse effects in the receiving waters of the Inaha Stream.

Condition 4 requires the consent holder to provide Council with a contingency plan.

Condition 5 sets out provision for review of the consent.

Land re-contouring
TBP holds water discharge permit **7329-1** to cover the discharge of stormwater and sediment into the Inaha Stream from earthworks associated with the re-contouring of land and the re-alignment of a section of the Inaha Stream. This permit was issued by the Council on 30 June 2008 under Section 87(e) of the RMA. It is due to expire on 1 June 2023.

There are 10 conditions imposed under consent **7329-1**.

Condition 1 requires the consent to be exercised in accordance with documentation submitted.

Conditions 2 and 3 limit the area and volume of soil disturbed.

Conditions 4 and 5 address sediment control measures and mitigation of effects in the stream.

Condition 6 requires notification and a programme of works.

Condition 7 deals with stabilisation of completed earthwork areas.

Condition 8 lays down procedure in case an archaeological site is encountered.

Conditions 9 and 10 relate to lapse and review of consent.

1.3.3 Air discharge consent

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

TBP holds two discharge permits that provide for emissions to air, one from rendering operations and one from burning waste wooden material.

1.3.3.1 Rendering operations

TBP holds discharge permit **4058-4** to cover the discharge to air of emissions from rendering operations and associated processes including wastewater treatment and burial of material. This permit was issued by the Council under Section 87(e) if the RMA on 11 October 2011. It expires on 1 June 2024,

There are 12 special conditions imposed on consent **4058-4**.

Condition 1 requires the consent holder to adopt best options to minimise adverse effects of discharge on the environment.

Condition 2 prohibit offensive or objectionable odour beyond the property boundaries at any time, and Condition 3 defines such odour.

Condition 4 requires the employment of a suitable person to ensure compliance with consent conditions.

Condition 5 prohibits fish processing.

Condition 6 requires certification of the works, processes and equipment by a suitable independent engineer biennially.

Conditions 7 to 9 relate to an Air Discharge Management Plan.

Condition 10 deals with dust.

Condition 11 deals with community consultation.

Condition 12 is a review condition, applicable in June 2013 and biennially thereafter.

1.3.3.2 Burning

TBP holds discharge permit **10054-1** to cover the discharge to air of emissions from the burning of pallets, paper and cardboard. This permit was issued by the Council under Section 87(e) of the RMA on 21 January 2015. It expires on 1 June 2029.

There are nine special conditions imposed on consent **10054-1**.

Condition 1 requires the consent holder to adopt best practicable options to minimise adverse effects of discharge on the environment.

Condition 2 restricts the type of material combusted.

Condition 3 prohibits objectionable or offensive odour beyond the property boundaries.

Condition 4 requires burning to be supervised at all times.

Conditions 5 to 7 deal with dust and other contaminants.

Conditions 8 and 9 relate to lapse and review of consent.

1.3.4 Discharge of waste to land

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

TBP holds two discharge permits that provide for disposal of untreated farm dairy effluent on land.

Discharge permit **2446-2** to cover the discharge of untreated farm dairy effluent by honey wagon onto and into land was issued by the Council on 18 November 2004 under Section 87(e) of the RMA. It is due to expire on 1 December 2023.

Discharge permit **3117-2** to cover the discharge of untreated farm dairy effluent by spray irrigation onto and into land was issued by the Council on 13 July 2004 under Section 87(e) of the RMA. It is due to expire on 1 December 2023.

The two consents have essentially the same nine conditions, relating to volume, location, control of effects, system maintenance, and review of conditions. Consents 2446-2 and 3117-2 provide for up to 1,000 and 250 cows, respectively.

Consent 2446-2 is no longer exercised, but has been retained by TBP in case it is needed in future. Consent 3117-2 applies to a small shed used for sick cows on Katotauru Road.

1.3.4.1 Spray irrigation

TBP holds discharge permit **3941-2** to cover the discharge of up to 1400 m^3/day of treated wastewater by irrigation onto and into land. This permit was issued by the Council on 15 December 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

The consent was changed on 21 December 2005, following a review of conditions invoked by Council to deal with adverse effects resulting from exercise of the consent, and an application by TBP to extend the irrigation area and include the discharge of farm dairy effluent. The consent was changed again on 9 November 2009 to allow a further extension of the irrigation area.

Condition 1outlines the authorised area for the discharge.

Condition 2 outlines the requirement to provide a spray irrigation management plan and specific matters it must address.

Condition 3 requires adherence to the plan and states that consent conditions prevail over any contradictory aspects.

Condition 4 provides for review of the management plan and

Condition 5 requires a designated manager to implement the management plan.

Condition 6 requires adoption of the best practicable option to deal with adverse effects, with particular reference to minimisation of nitrogen in the effluent.

Condition 7 requires notification to Council when irrigation is not possible and discharge to the stream will cause dilution limits to be exceeded.

Condition 8 places a minimum limit on the level of dissolved oxygen in the discharge.

Conditions 9 and 10 stipulate there shall be no objectionable odour or spray drift as a result of irrigation.

Condition 11 limits the sodium adsorption ratio in the wastewater.

Condition 12 prohibits ponding of wastewater or direct discharge.

Conditions 13 and 14 specify the area of the irrigation spray zone and limit the rate of nitrogen loading.

Condition 15 requires the consent holder to investigate and report on options for reducing ammonia concentrations in wastewater prior to discharge.

Conditions 16 and 17 restrict the average application rate and specify the return period between effluent applications.

Conditions 18 and 19 require the consent holder to monitor groundwater bores and to monitor consent activities deemed necessary by Council.

Condition 20 relates to liaison meetings with interested submitters to the consent, and condition 21 addresses notification of Ngai Manuhiakai hapu of discharge to Inaha Stream.

Condition 22 relates to mitigating effects in the case of contamination of groundwater.

Condition 23 allows for the consent holder to apply for change of conditions.

Conditions 24, 25 and 26 all set out provisions for review of specific conditions and the consent in general.

The changes of conditions from the review were a requirement to operate the dual wastewater disposal system so as to minimise discharge to Inaha Stream, adoption of the best practicable technology to minimise wastewater nitrogen concentration, and an annual review of the spray irrigation management plan.

The changes of conditions in relation to first extension of the irrigation area were increased wastewater volume, increased safety buffer zones, and greater liaison with neighbours and interested parties. The second change of consent simply increased the irrigation area with no other change of condition.

1.3.5 Waste burial

TBP holds two discharge permits that provide for burial of wastes into land.

TBP holds water discharge permit **5495-1** to cover discharge of up to 200 tonnes/day of wastes from meat rendering operations by burial into land in the vicinity of the Inaha Stream.

This permit was issued by the Council on 30 March 2000 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

There are 18 conditions imposed on consent 5495-1.

Condition 1 requires the Consent holder to provide a waste burial management plan addressing specific matters.

Conditions 2, 3 and 4 relate to the implementation and exercise of the management plan and provide for a review with notice from either party.

Condition 5 prohibits disposal pits from intercepting shallow groundwater.

Conditions 6 and 7 relate to the construction of the disposal pits and Condition 8 requires inspection by Council prior to disposal.

Condition 9 relates to the timing of conditions 1-4.

Condition 10 imposes a time limit on the covering of discharged material.

Conditions 11 and 12 impose a certain quality of cover material and suitable stormwater contouring.

Condition 13 requires the disposal site be reinstated satisfactorily.

Conditions 14 and 15 prohibit irrigation of effluent onto disposal area or direct discharge of contaminants to surface water.

Condition 16 requires a minimum of eight monitoring bores to monitor groundwater quality.

Condition 17 allows the consent holder to apply for change to consent conditions.

Condition 18 sets out provision for review of the consent.

TBP holds water discharge permit **5560-1** to discharge waste cheese and associated packaging by burial into land and discharge emissions into air in the vicinity of the Inaha Stream. This permit was issued by the Council on 15 October 1999 under Section 87(e) of the RMA. It expired on 1 February 2000 for the air discharge and is due to expire on 1 June 2017 for the land discharge.

There are 23 conditions imposed on consent **5560-1**.

Condition 1 requires notification by the consent holder prior to operations.

Condition 2 requires the consent holder to house affected parties for the period of removal and disposal.

Condition 3 places a limit on tonnage.

Condition 4 ensures access to Council employees for inspection and monitoring.

Condition 5 requires the consent holder to maintain a photographic record of disposal operation.

Conditions 6, 7 and 8 impose a time period on disposal operations and provide for an interim measure if the time frame is exceeded.

Conditions 9 and 10 prescribe the nature of cover at completion and prohibit the disposal of other wastes.

Condition 11 requires the consent holder to minimise odour and other effects arising from discharge.

Conditions 12, 13 and 14 relate to air discharge and require that transported waste is covered and only transported in southerly wind conditions.

Condition 15 prohibits odours after February 2000.

Condition 16 relates to the construction of the disposal pit and Condition 17 prohibits the pit from intercepting groundwater.

Conditions 18 and 19 require the cover material be contoured away from disposal area and that the site be rehabilitated.

Condition 20 prohibits irrigation of effluent over the disposal area.

Condition 21 requires that the cover material remain intact and Condition 22 prohibits direct discharge of contaminants to a water body.

Condition 23 sets out provision for review of the consent.

1.3.6 Land use consent

1.3.6.1 Stream culverts

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

TBP Ltd holds land use permit **6431-1** to erect and maintain two culverts in the Inaha Stream for farm access. This permit was issued by the Council on 4 October 2004 under Section 87(e) of the RMA. It is due to expire on 1 June 2023.

There are 12 conditions imposed on consent **6431-1**.

Conditions 1 and 2 require the consent holder to adopt best practicable option to minimise adverse environmental effects and establishes that consent conditions prevail over conflicting information.

Condition 3 requires notice of initial construction and subsequent maintenance of the culverts.

Condition 4 stipulates dates within which maintenance must occur.

Conditions 5 and 6 require the consent holder to minimise adverse effects on the water quality and riverbed disturbance.

Condition 7 requires removal and reinstatement of area when structures are no longer needed.

Condition 8 prohibits the structure from preventing fish passage.

Conditions 9 and 10 set out requirements for the establishment and maintenance of fenced riparian margins.

Condition 11 specifies the placement of culverts and structures to prevent erosion.

Condition 12 relates to lapse of consent and Condition 13 provides for review of consent conditions.

1.3.6.2 Stream diversion

Section 13(2)(b) of the RMA stipulates that no person may disturb, remove, damage, or destroy any plant or part of any plant or habitats of any such plants or of animals in, or under, or over the bed of any lake or river, unless the activity is expressly allowed for by a resource consent, or rule in a regional plan and in any relevant proposed regional plan.

TBP holds land use permit **7234-1** to realign a section of approximately 350 m of the Inaha Stream for land improvement purposes. This permit was issued by the Council on 12 March 2008 under Section 87(a) of the RMA. It is due to expire on 1 June 2023.

There are 11 conditions imposed on consent **7234-1**.

Condition 1 requires the consent to be exercised in accordance with documentation submitted.

Conditions 2 and 4 relate to notification and timing of works.

Condition 3 specifies the construction of a rock wall for bank protection.

Conditions 5 and 6 address the control and mitigation of riverbed disturbance and sediment effects.

Conditions 7 and 8 address the removal of fish from the old channel and future fish passage.

Condition 9 prohibits the burial of the removed vegetation near the stream.

Conditions 10 and 11 relate to lapse and review of consent.

1.4 Monitoring programme: water

1.4.1 Introduction

Section 35 of the RMA sets out an obligation 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 on these.

The Council may therefore make and record measurements of physical chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations, and seek information from consent holders.
The monitoring programme for the TBP site consisted of six primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application:

- in discussion over monitoring requirements,
- preparation for any reviews
- renewals
- new consents
- advice on the Council's environmental management strategies and the content of regional plans, and
- consultation on associated matters.

1.4.3 Site inspections

The TBP site was visited on 14 occasions (Section 2.2.1) during the 2015-2016 monitoring period. With regard to consents for the abstraction of water and for the discharge of wastes to water and land, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Water take

The water take is checked during site inspections. A rating curve for the stage board at Kohiti Road has been developed and maintained by the Council and updates provided to TBP since April 2001.

1.4.5 Chemical sampling

The Council undertook sampling of the discharges from the site, of surface waters upstream and downstream of the discharge points and irrigation areas, and of groundwaters around the irrigation and waste burial areas.

The final discharge from the wastewater treatment system (the discharge from the aerobic pond, pond 6) was sampled on five occasions in 2016-2016 monitoring period (Table 4). The samples were analysed for both mineral and organic components, and general water quality parameters, to enable determination of compliance with consent conditions, and to calculate loadings on both Inaha Stream and land irrigation areas. The cooling water discharge and the receiving Inaha tributary were sampled concurrently with the wastewater. The stormwater discharge point was sampled when it was found to be discharging.

Monitoring of up to 10 sites in the Inaha Stream and its tributaries were carried out to determine compliance with consent conditions, and to assess the impact of discharges to water and land.

In addition, three temperature recorders (one installed in the cooling water tributary and one each upstream and downstream of the confluence of the tributary with Inaha Stream) were run continuously and downloaded as required. TBP took responsibility for this monitoring in July 2010, and forwarded the data to Council monthly. (Council took back responsibility in September 2013, at the request of TBP).

Groundwater sampling was undertaken as part of monitoring of the irrigation of wastewater under consent 3941, and of the burial of unprocessable material under consent 5495. Nine monitoring bores and a spring were sampled every two months in connection with the irrigation areas. Up to five monitoring bores around the waste burial area were sampled, including a new bore that was established in April 2015 to replace two damaged bores.

1.4.6 Bio-monitoring surveys

Two surveys of biological communities at up to eight sites in Inaha Stream and a major tributary were scheduled each year. These surveys assessed the effects of TBP's discharges (point source discharges and any diffuse source discharges as a result of spray irrigation) on benthic invertebrate communities of the stream. These surveys are further discussed in Section 2.1.4.4.

1.4.7 Monitoring by Taranaki By-Products

TBP measures and records rate of abstraction from Inaha Stream and, since March 2015, from groundwater.

- TBP monitors the Inaha Stream, and wastewater discharged to the stream and to land, as an integral part of the management of its wastewater disposal system.
- The flow rate of Inaha Stream (at Kohiti Road staff gauge) and of the wastewater discharge to the stream are measured daily in order to control dilution of the wastewater.
- The stream is sampled and analysed weekly to determine compliance with the consent limit on ammonia concentration.
- The wastewater is analysed weekly for nitrogen species to enable calculation of allowable ammonia discharge rate to the stream, and of the nitrogen loading on irrigation areas.
- The results of this stream and effluent monitoring were forwarded to the Council monthly.

1.5 Monitoring programme: air

1.5.1 Introduction

The air quality monitoring programme for the TBP site consisted of three primary components.

1.5.2 Programme liaison and management

This part of the monitoring programme was combined with that for the water monitoring programme, and involved discussion and liaison with TBP staff, both on site during regular inspections and at the Regional Council's and TBP's offices.

1.5.3 Site inspections

The TBP site was inspected on 14 regulated occasions during the 2015-2016 monitoring period as part of the annual monitoring programme. An additional number of inspections were undertaken in response to complaints received – this is addressed further in Section 2.2.1 and 2.3.

The main points of interest were plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, and noxious or offensive emissions.

As far as was practicable, inspections in relation to air emissions were integrated with inspections undertaken for other purposes for example water monitoring or in response to complaints. A list of incidents which led to complaints is summarised in Section 2.3 of this report.

1.5.4 Monitoring by Taranaki By-Products

From 2 February 2012, TBP was required, under the new air discharge permit 4058-4 to operate in accordance with an Air Discharge Management Plan. In respect of monitoring, the Plan included the production of a daily activities log, the requirement to conduct ambient odour surveys, and maintenance of a register of complaints. The monitoring components of the Plan had been in place for several years.

The daily activities log presents a checklist of operational monitoring items that must be recorded on a routine daily basis, such as climatic data, condition of the wastewater and odour treatment systems, cleaning and maintenance of plant, and various process records such as temperature in the driers and blood coagulator.

The results of bio-filter and weather monitoring, and comment from the daily activities log on events affecting environment quality, were forwarded to the Council monthly. Odour survey reports and the complaints register are made available during site inspections.

2 Results

2.1 Water

2.1.1 Inspections

Compliance monitoring inspections were undertaken at approximately monthly intervals throughout the monitoring period. Inspections pertaining to water-related matters were undertaken in conjunction with air quality inspections (Section 2.2.1). In addition, physico-chemical sampling was stipulated as part of the Tailored Compliance Monitoring Programme for 2015-2016 monitoring year.

Water samples were collected according to the Tailored Compliance Monitoring Programme. All components of the programme were carried out, with samples taken of the following on five scheduled occasions in 2015-2016 monitoring period:

1. Samples of the aerobic pond discharge to Inaha Stream were taken and analysed for the following constituents: temperature, dissolved oxygen, total and filtered carbonaceous BOD_5, COD (chemical oxygen demand), total sulphide, conductivity, pH, alkalinity, turbidity, suspended solids, total grease, ammonia, nitrite, nitrate and total nitrogen, total and dissolved reactive phosphorus, sodium, potassium, calcium, magnesium, chloride, sulphate and faecal coliforms (Table 2 and 4).

2. Cooling water from the discharge point to the fire-water reservoir was sampled and analysed for temperature, turbidity, conductivity, pH, total BOD_5 and ammonia (Table 5).

3. Samples were taken from the stormwater discharge point, when it was discharging, and analysed for temperature, turbidity, conductivity, pH, suspended solids, total BOD_5, ammonia, oil and grease, and faecal coliforms (Table 6).

4. Samples from the tributary which receives the stormwater, cooling water and fire-water reservoir discharges were taken at the confluence of the tributary with Inaha Stream, and analysed for temperature, turbidity, dissolved oxygen, total BOD_5, pH, alkalinity, chloride, ammonia, nitrate/nitrite, dissolved reactive phosphorus, suspended solids, oil and grease, and faecal coliforms (Table 7).

5. Water quality in the Inaha Stream and its tributaries was sampled at up to 10 sites and analysed for temperature, turbidity, conductivity, pH, dissolved oxygen, total and filtered carbonaceous BOD_5, ammonia, nitrate, nitrite, dissolved reactive phosphorus, chloride and faecal coliforms (Table 9).

For groundwater, up to nine monitoring bores and a spring were sampled on six occasions and analysed for temperature, conductivity, pH, ammonia, nitrite/nitrate and chloride. The water level in each of the bores was also measured. Specific groundwater analysis of the wastewater irrigation area is provided in Section 2.1.5.8.

In-stream temperature sensors (in Inaha Stream and the tributary that receives the cooling water discharge) were employed and the data downloaded and reset as required (Figure 6 and Figure 7).

The stream physico-chemical water quality sampling sites are illustrated in Figure 1 and described in Table 3.

The point-source sampling sites for the rendering operations area are illustrated in Figure 2 and described in Table 2.

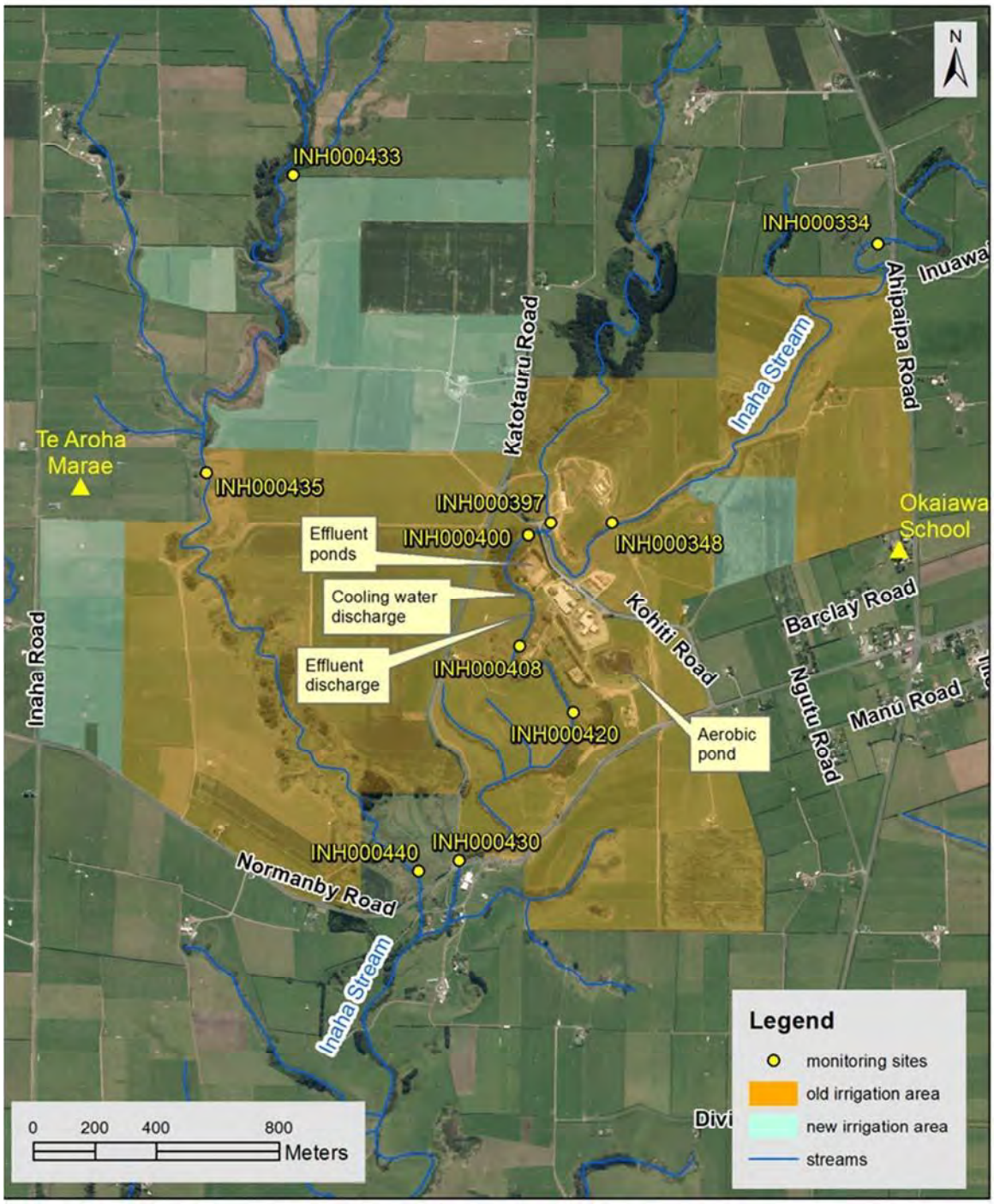

Figure 1 Surface water sample collection locations in relation to TBP

Figure 2 Point source sample location and labelling

Table 2 Point source sampling key

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
A	Aerobic pond effluent	1703086	5623907	IND004004
B	Cooling water discharge	1702015	5623991	IND002004
C	Stormwater, firewater, coolant and groundwater seepage from reservoir	1701968	5624052	IND001014
D	Stormwater, firewater, coolant and groundwater seepage to Inaha	1701894	5624084	IND001015
E	No 1 stormwater: main reception, garage and yard to firewater reservoir	1702022	5623983	STW001075

Table 3 Sampling points for receiving waters Inaha Stream and tributary

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
1	Ahipaipa Road	1703013	5625271	INH000334
3	Bridge, 420 m u/s Kohiti Road	1702138	5624345	INH000348
4	Unnamed northern tributary at Inaha confluence	1701947	5624362	INH000397
5	Kohiti Road	1701874	5624322	INH000400
6	110 m d/s cooling water discharge and 30 m d/s pond 6 discharge	1701861	5623980	INH000408
7	500 m d/s pond waste discharge	1702021	5623745	INH000420
8	Normanby Road bridge, 1,450 m d/s discharges	1701650	5623262	INH000430
9a	Unnamed western tributary, 3,500 m u/s Inaha confluence	1701109	5625496	INH000433
9	Unnamed western tributary 2,550 m u/s Inaha confluence	1700816	5624558	INH000435
9b	Unnamed western tributary ~2,000 m u/s Inaha confluence	1700818	5624175	
9c	Unnamed western tributary ~1,450 m u/s Inaha confluence	1701183	5623577	
9d	Unnamed western tributary ~900 m u/s Inaha confluence	1701013	5623963	
10	Unnamed western tributary 250 m u/s Inaha confluence	1701518	5623227	INH000440
11	State Highway 45	1700393	5620330	INH000470

A total of 14 routine inspections[1] were undertaken during the 2015-2016 year. Council holds a record of detailed inspection notes which are available by request. They are also referenced under the air section, 2.1.1. Additional inspections were carried out in response to public complaints as they arose. Inspections were also carried out at the times of effluent and receiving water chemistry monitoring. During or immediately after each inspection by an officer of the Council made contact with a TBP representative to discuss the findings.

Particular attention is given to the following items:

- rendering processes
- air emission control systems
- load-in and load-out areas
- workshops
- truck depot
- chemical and oil/fuel storage areas
- stormwater system
- wastewater treatment system
- land irrigation system
- waste burial areas

2.1.2 Water abstraction

In the previous monitoring period all water for processing at TBP's inedibles rendering plant was drawn from Inaha Stream at a point beside the plant under consent 2051-4. Water for the adjacent edibles plant, and potable water for both plants, came from Waimate West rural water supply. In February 2014, following surface water quality problems experienced with new high pressure boilers and with other processes, TBP started to use groundwater taken under consent 9756-1 from a 151.2 m bore that had

[1] Additional inspections were also carried out when required.

been sunk beside the old cowshed on Katotauru Road, about 800 m north-west of the inedibles plant.

2.1.2.1 Surface water

The water take from the Inaha Stream resulted in no compliance issues with regard to the maintenance of the minimum flow (25 L/s downstream of the abstraction point) required under special condition 2 of consent 2051-4.

In terms of the abstraction rate and specifically the limit of the abstraction rate, whereby consent 2051-4 allows for maximum daily abstraction rate of 2,160 m^3 /day or 25 L/s on average, and an instantaneous maximum of 50 L/s. TBP continuously operate one of two pumps rated at 33 and 25 L/s, with the larger pump as the primary supply.

Under the Resource Management Regulations 2010 (Measurement and Reporting of Water Takes), TBP has been required since 10 November 2012 to take continuous measurements and keep daily records of volume taken, and thereafter supply by 31 July each year the record of the preceding 1 July to 30 June period. TBP installed a flow measurement and recording system as required. Verification of the accuracy of the system was carried out by an approved certifier.

Abstraction data for the 2015-2016 period recorded at 10 second intervals were supplied. There was one month of data missing from the data supplied; this was attributed to data storage problems.

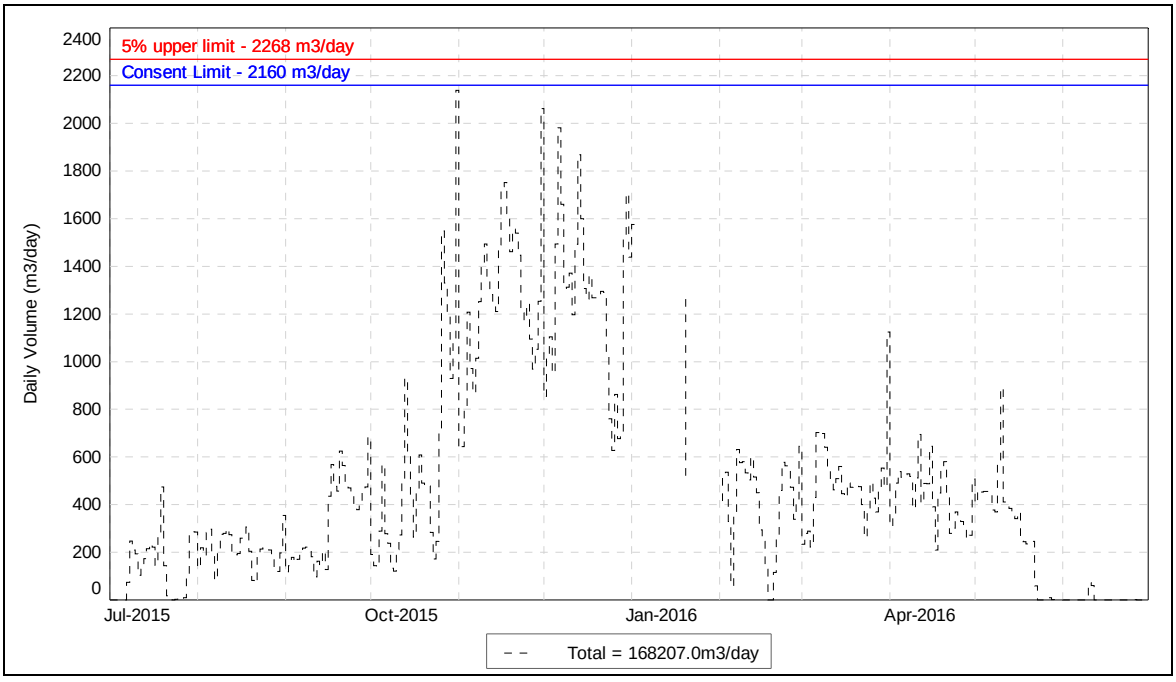

Figure 3 Surface water abstraction from the Inaha Stream 2015-2016 monitoring period

The records show that the limit of 2,160 m^3/day of maximum daily abstraction volume was complied with throughout the period monitored; the highest reading was 2,138.64 m^3 on the 31 October 2015. The total volume abstracted from the Inaha was 168,207m^3.

2.1.2.2 Groundwater

Consent 9756-1 allows abstraction at a rate not exceeding 22.8 L/s (1,970 m^3/day). The consent was first exercised in February 2014, before the required installation of a flow measurement, recording and telemetry system, for which abatement and infringement notices were issued at the time. Telemetry to Council's computer system was established on 27 March 2014. Verification of the accuracy of the measurement system was undertaken by an approved certifier. The telemetered record for the period ending 30 June 2015 is presented in Figure 4.

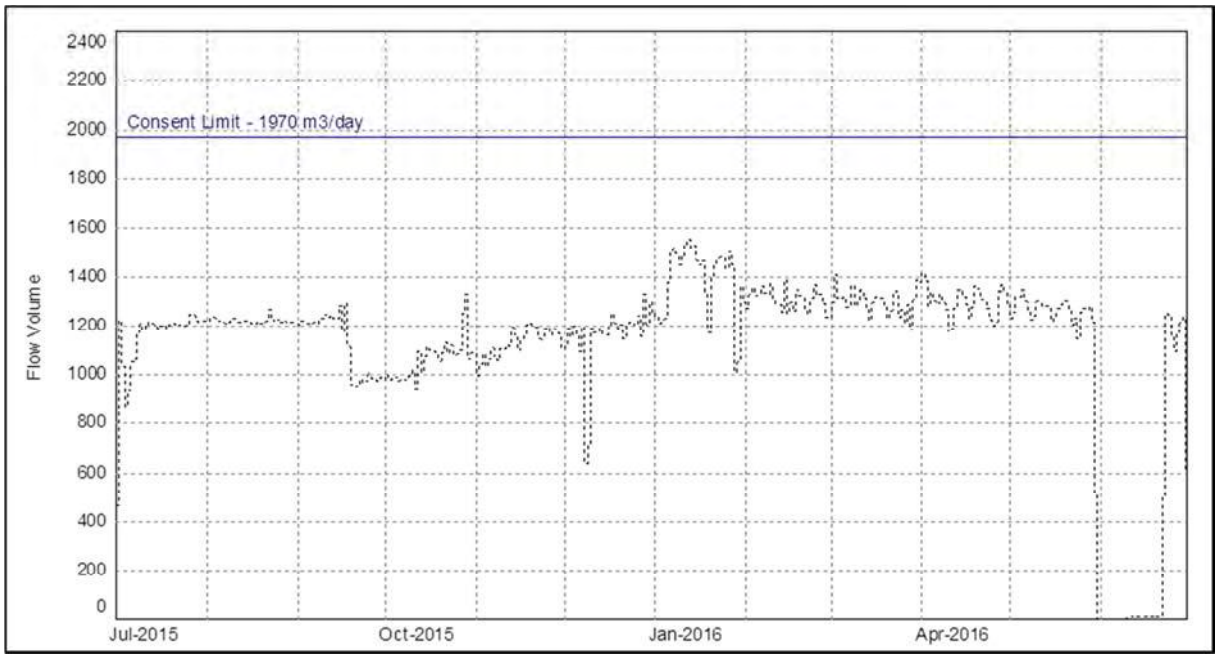

Figure 4 Daily groundwater abstraction volumes by Taranaki By-Products July 2015-June2016

The total groundwater abstraction volume over this monitoring year (2015-2016) was 417,137 m^3, and this equated to a daily average of 1,142 m^3/ day. The consent limit as shown in the above Figure 4 is for a maximum daily abstraction rate of 1,970 m^3 /day. Compliance was achieved.

2.1.3 Discharges of wastewater to land

2.1.3.1 Wastewater

The results of the analysis of the wastewater discharge, sampled by the Council are outlined in Table 4. Samples were for the most part, collected between 9 am and 10 am om sampling days and were extracted from pond 6 (Figure 2). This table also contains the maximum and median of samples collected from between 1997 and 2015.

TBP hold consent 3941-2; to discharge up to 1,400 m^3/ day of treated wastewater from a rendering operation and from a farm dairy onto and into land, in the vicinity of the Inaha Stream and its tributaries. It contains a specific condition with regard to the concentration of dissolved oxygen within this wastewater. This condition states that the level of dissolved oxygen within the wastewater should be above 1.0 gm^3 at all times.

- Dissolved oxygen concentration, measured by a probe, recorded levels below 1.0 g/m^3 on three occasions out of five in this monitoring period, with all the exceedances occurring during and after December 2015. While on the three occasions the DO was not as required (1.0 g/m^3), these three concentration values were all above the long term median value of 0.28 g/m^3.

- Percentage oxygen saturation followed similar theme to the DO readings in as much as they ranged from 20.2% to 5.2%.

- The recorded temperature range was 19.8 to 30.9 °C, with the highest temperature recorded in January 2016 at 30.9 °C; note this was 1.9 °C short of the highest recorded temperature which occurred in the previous monitoring year, in January 2015.

- Total nitrogen continued to decrease in the wastewater, decreasing from 257 g/m^3 in July 2015 to 148 g/m^3 by May 2016.

- Sodium adsorption ratio (SAR) in the discharge water is consented to not be discharged above a SAR of 15, in this monitoring period the SAR reached a maximum of 10 which was slightly over the long term median value, but below the consented guideline value.

- pH values ranged from 7.4 to 6.9 over the course of the monitoring period, all below the long term median value.

- Nitrite and ammoniacal nitrogen are the two dominant species in the wastewater, opposed to nitrate and unionized ammonia. Nitrate was the dominant species at the beginning of the monitoring year.

- Sodium ranged from 173 to 222 g/m^3, which were close to or below the median value and in similarity the chloride concentrations were close to or below the median value.

- Alkalinity values were below the median value for the whole period, where as the values for fecal coliform counts ranged from 43 to 2,600/100ml.

- Chemical oxygen demand ranged from 180 to 430 g/m^3.

- Potassium ranged from 75 to 148 g/m^3.

- Total sulphide concentrations were all below the limit of detection for this parameter.

- Total phosphorous concentrations ranged from 22 to 42 g/m^3, marginally exceeding the median value of 39.8 g/m^3.

- BOD readings ranged from 150-110 g/m^3 which were all above the long term median value of 93 g/m^3.

- Suspended solid analysis recorded its highest value to date, 840 g/m^3, while similarly the turbidity was also elevated in the same sample with 310 g/m^3.

Table 4 Chemical monitoring data of the effluent discharge post treatment system Pond 6 IND004004

	Parameter	ALK	BOD5	BODCF	Ca	Cl	COD	Cond	DO	DRP	FC	FLOW	HCO3	K	KAR	Mg	Na
Date	Time/Unit	g/m³ $CaCO_3$	g/m³	g/m³	g/m³	g/m³	g/m³	mS/m@20°C	g/m³	g/m³ P	/100ml	m³/s	g/m3 HCO3	g/m³	None	g/m³	g/m³
24-Jul-15	09:45	210	150	21	25.4	182	320	224	1.5	20.5	300	0.00217	256.2	76.3	1.690	17	173
16-Sep-15	10:02	66	120	34	29.2	194	250	220	1.85	22.3	250	0.0031	80.5	104	2.174	18.7	189
16-Dec-15	10:25	131	110	4.3	25.3	239	430	250	0.97	26.9	2,600	0	159.8	138	3.084	16.5	214
20-Jan-16	09:57	107	130	8	17.5	241	390	208	0.38	35.6	1,100	0	130.5	134	3.399	14.1	222
04-May-16	10:15	126	150	2.3	11.2	207	180	170	0.61	24.8	43	0	153.7	75.4	2.385	9.1	188
1997-2015	Max	2,260	>480	79	67.5	339	7200	561	12.6	53.6	20,000	0.0019	1720.2	188	7.761	20.2	366
1997-2015	Median	546	93	5.8	17.4	240	370	281	0.28	34.6	390	0	396.5	118	5.139	11.7	219
	Parameter	NH3	NH4	NNN	NO2	NO3	TN	pH	SAR	SO4	SS	TS	Temp	TG	Persat	TP	Turbidity
Date	Time/Unit	g/m³	g/m³ N	g/m³ N	g/m³ N	g/m³ N	g/m³ N	pH	None	g/m³	g/m³	g/m³	°.C	g/m³	%	g/m³ P	NTU
24-Jul-15	09:45	1.43219	122	121	22.6	98.4	253	7.4	6.518	73.7	130	-	19.8	11	20.2	22.1	120
16-Sep-15	10:02	0.51378	100	140	36	104	257	7	6.717	108	120	-	21	5	20	25	67
16-Dec-15	10:25	0.59771	108	-	126	8	252	6.9	8.133	148	110	<0.05	25.1	-	12.1	33.8	52
20-Jan-16	09:57	1.38588	82.3	75	74.3	0.7	157	7.2	9.577	171	840	<0.05	30.9	-	5.2	42.4	310
04-May-16	10:15	0.89178	66.5	73.3	69.6	3.7	148	7.2	10.114	75.7	59	<0.05	27.8	-	8.1	26.1	34
1997-2015	Max	54.00858	570	189	150	111.8	814	8.5	14.040	257	580	2.4	32.8	49	110	88.6	390
1997-2015	Median	2.90903	206	88.7	32.15	11.85	324	8	9.808	122	130	0.02	20.8	2	3	39.8	100

ALKT = alkalinity to pH 4.5 as $CaCO_2$
BOD_5 = total 5-day biochemical oxygen demand, g/m³
Ca = calcium, g/m³
C1 = chloride, g/m³
COD = chemical oxygen demand g/m³
Cond = conductivity, mS/m at 20˚610C
DO = dissolved oxygen, g/m³
DRP = dissolved reactive phosphorus, g/m³P
FC = faecal coliforms, cfu/100 ml
Flow = flow rate, L/s
K = potassium, g/m³
Mg = magnesium, g/m³
Na = sodium, g/m³
NH = ammonia, g/m³N
NNN = nitrite/nitrate nitrogen, g/m³N
O&G = oil & grease, g/m³
pH
SAR = sodium adsorption ratio
SO_4 = sulphate, g/m³
SS = suspended solids, g/m³
Temp = temperature, ˚C
TG = total grease, g/m³
TN = total nitrogen, g/m³
TS = total sulphide, g/m³

2.1.3.2 Cooling water

During each sampling run, the cooling water discharge (to the firewater pond) is monitored to assess its quality. The results of this sampling are shown in Table 5 together with a summary of results since cooling water was diverted to the head of the firewater pond in February 1998.

Table 5 Chemical monitoring of the cooling water discharged at location IND002004

Parameter	TEMP	COND	pH	TURB	BOD	NH_4
Date	°C	mS/m@20°C	pH	NTU	g/m^3	g/m^3 N
24-Jul-15	13.3	29.1	7.3	3.6	1.3	1.64
16-Sep-15	14.7	30	7.2	14	1.1	1.78
16-Dec-15	18	26.5	7.9	3.4	1.5	0.07
20-Jan-16	19.1	28.6	7.4	3.7	2	0.446
04-May-16	39	21.2	7.9	1.3	1.1	0.074
Number	75	77	76	12	77	76
Max	65.1	29.6	8.2	6.7	2.7	1.91
Median	27.4	21.7	7.7	4.4	1	0.096

BOD_5 = total 5-day biochemical oxygen demand, g/m^3
Cond = conductivity, mS/m at 20°C
NH_4 = ammonia, g/m^3 N
pH
Temp = temperature, ˚C
Turb – turbidity, NTU

Temperature ranges in the cooling water were all below the median value when compared to the historical data for this sample point on four of the five sample occasions. The highest temperature recorded in this period was 39 °C. Conductivity maximum concentration values were exceeded for the first time in this data set, by 0.4 mS/m at 20°C in September 2015.

pH values were between 7 to 8 pH, though with the higher pH values TBP should be wary of an increase in ammonia as it would lead to an increase in un-ionised ammonia. Turbidity values were all below the median value and BOD values were close to the median value.

2.1.3.3 Stormwater

In the 2015-2016 monitoring year there was one point source discharge location for stormwater from the facility. Historically there were three locations.

- Stormwater from the main yard, garage and raw material reception area flow via a drain from Kohiti Road into the firewater pond (STW01075), through which the tributary flows.

The sampling results from the 2015-2016 monitoring period are presented below in Table 6.

Table 6 Chemical monitoring of stormwater from TBP in the 2015-2016 monitoring year

STW01075	Parameter	BOD_5	COND	FC	NH4	O&G	pH	SS	TEMP	TURB
Date	Time/unit	g/m3	mS/m@20C	/100ml	g/m3 N	g/m3	pH	g/m3	°C	NTU
24-Jul-15	09:55	3.5	60.8	2400	0.285	No result	7	<2	13.5	2.1
16-Sep-15	10:35	0.5	54.8	560	0.173	<0.5	7	2	12.9	1.3
16-Dec-15	10:35	1.3	49.1	3100	1.31	<0.5	7.3	12	24.4	24
20-Jan-16	11:30	2.4	67.2	18000	0.594	0	7.2	7	18.8	3.8
04-May-16	10:32	>24	67.3	37000	3.99	0	7.6	20	19.3	7.8
1997-2015	Max	1600	895	12,000,000	337	180	11.2	6000	21	1400
1997-2015	Median	39	53	68,500	3.51	2.4	7.2	100	14.5	26

BOD_5 = total 5-day biochemical oxygen demand, g/m^3
Cond = conductivity, mS/m at 20°C
NH_4 = ammonia, g/m^3 N
FC = faecal coliforms, cfu/100 ml
SS = suspended solids, g/m3
pH
Temp = temperature, ˚C
Turb – turbidity, NTU
O&G = oil & grease g/m^3

Consent 5426-1 places a limit on the range of pH (6 to 9) allowable in the stormwater, as well as a maximum concentration for suspended solids (100 g/m^3) and oil and grease (15 g/m^3). In total the stormwater discharge was sampled five times during this monitoring period and there were no exceedance in any of the samples when compared to the consent conditions.

The most prevalent increase observed in this monitoring period was the high concentration of faecal coliforms (37,000 cfu). This concentration was half the median value when compared to historical records, median value 68,500 cfu.

In comparison to the previous monitoring period, where there were exceedances in the level of suspended solids and oil and grease, this monitoring period has seen no exceedance within the monitored stormwater.

The sample collected during May contained a high BOD (>24 g/m^3), which also corresponded with the highest coliform count and ammonia result. Because of the lack of certainty as to the actual concentration of BOD on this occasion, it is not clear whether the BOD was below the median value for this location.

The temperature range was exceeded when compared to the long term record with a value of 24.4 °C, compared to the previous highest which was 21 °C.

2.1.3.4 Inaha tributary at plant site

In addition to the sampling of the final pond 6 discharge, prior to irrigation on to land, or the stormwater and cooling water discharges, the Council also collects a sample from a tributary which flows through the fire-water reservoir on a regular basis. This sampling will monitor the combined discharges of the stormwater and the cooling water, as well as any seepage from the ring drain around the final pond 6. The analyses of the combined discharge sample location IND001015 are presented in Table 7.

Table 7 Chemical monitoring results for the combined tributary, cooling, storm and fire water discharges from the site IND001015 in the 2015-2016 monitoring period with summary since July 1997-2015

IND001015	Parameters	ALKT	BOD	CL	COND	DO	DRP	FC	NH3	NH4	NNN	O&G	PERSAT	PH	SS	ST	TEMP	TURB
Date	Time/ unit	g/m³ $CaCO_3$	g/m³	g/m³	mS/m@20°C	g/m³	g/m³ P	/100ml	g/m³	g/m³ N	g/m³ N	g/m³	%	pH	g/m³	g/m³	°C	NTU
24 Jul 2015	10:10	110	2.8	40.4	35.7	2.18	0.05	370	0.0116	3.01	3.06	-	19.7	7.2	8	-	10.9	11
16 Sep 2015	10:43	110	1.7	42.9	37.4	6.1	0.055	340	0.018	2.34	3.88	<0.5	59.5	7.4	5	-	14.1	11
16 Dec 2015	-	93	2.2	90.8	49	6.21	0.109	2100	0.0274	0.923	4.25	<0.5	69.7	7.8	8	<0.05	20.1	10
20 Jan 2016	11:44	108	3.2	71.3	43.3	2.92	0.146	2400	0.0198	1.53	1.97	0	32.6	7.4	21	-	21.1	6.6
04 May 2016	10:38	101	3.1	33.9	28.5	5.15	0.178	1300	0.0152	1.17	1.4	0	58.3	7.4	6	-	21.2	11
1997-2015	Max	118	120	59.5	46.4	9.2	0.736	45000	0.2169	6.84	10.8	3.6	95	8	140	<0.06	33.6	44
1997-2015	Median	61	3	35.8	25.8	6.95	0.042	1100	0.0176	0.814	3.88	0.2	82.4	7.4	7	0.02	22.7	4.2

ALKT = alkalinity to pH 4.5
BOD_5 = total 5-day biochemical oxygen demand, g/m³
Cond = conductivity, mS/m at 20°C
FC = faecal coliforms, cfu/100 ml
TS = total sulphide, g/m³
Turb = turbidity, NTU
NH4 = ammonia, g/m³N
pH
O&G = oil & grease, g/m³
Temp = temperature, °C
DRP = dissolved reactive phosphorus, g/m³
DO = dissolved oxygen, g/m³

The analysis in this period has been compared to previous monitoring data; this allows the reader to assess how this compares with historical data. This data set has been on going since July 1997.

- Alkalinity readings were within 8 g/m^3 of the highest recorded reading, with four of five results over 100 g/m^3.
- Biochemical oxygen demand readings were close to the median value of 3.0 g/m^3 across the samples collected in this period.
- Chloride recorded its highest ever concentration at this location, eclipsing the original maximum of 59.5 g/m^3 on two occasions in the year.
- Conductivity maximum was extended by an additional 3.6 mS/@20 °C in December, which also corresponded with the highest chloride reading.
- Dissolved oxygen readings were all below the median value of 7 g/m^3.
- Fecal coliform counts were above the median values on three occasions, with the highest counts in the summer.
- Un-ionised ammonia concentrations (NH_3) were below the median value in two of the five samples collected, with the highest value at 0.027 g/m^3 which was a result of the slight increase in pH at 7.8. Note that on three occasions the recorded concentration was above the long term median value of 0.017 g/m^3.
- Ammonia concentrations were all above the median value during this monitoring period.
- pH levels were below 7.5 on four of the five occasions. TBP should be mindful to keep this pH low if they are likely to have ammonia in this discharge as it will contribute to an increase in un-ionised ammonia, which was observed in the December sample.
- Temperature readings were below median values.
- Turbidity was above the median value in all samples collected.

2.1.4 Results of receiving environmental monitoring

2.1.4.1 Inaha Stream flows

The flow rate of Inaha Stream is measured for the purpose of managing the dilution of TBP's treated wastewater in the stream, and also the rate of abstraction. A water level staff gauge is installed at Kohiti Road bridge, about 300 m upstream of the TBP discharge point. Stream flow rate is calculated from a rating curve developed from manual stream gaugings taken at the staff gauge site. The Council undertook four stream gaugings in the 2015-2016 reporting period.

TBP has regularly recorded staff gauge readings since May 2008. Previously, readings were taken less frequently, usually when wastewater was discharging to the stream, and during Council inspections.

The hydrographs for 2015-2016 period, drawn from the staff gauge readings at Kohiti Road, are given in Figure 5, together with a plot of the rate of wastewater discharge to the stream as measured at the v-notch weir at the outlet of Pond 6.

Special condition 6 on consent 2049 requires that minimum dilution rate of 1:300 for effluent discharged to the stream be maintained at all times, and special condition 8 requires that the discharge cease when flows in the stream, as measured at Kohiti

Road Bridge, decrease to below 100 L/s. Special condition 2 on consent 2051 requires that a minimum flow of 25 L/s be maintained in the stream at the point of abstraction.

The results from the monitoring of wastewater and receiving water discharge rates by TBP show that the limit on the minimum dilution rate of 300-fold was achieved for the majority of 2015-2016. However, on 6 October 2015, it was found that a slight breach of the limit had occurred that day, as the dilution calculated by Council was only 295:1. This minor breech in the consented dilution rate was attributed to a calculation error.

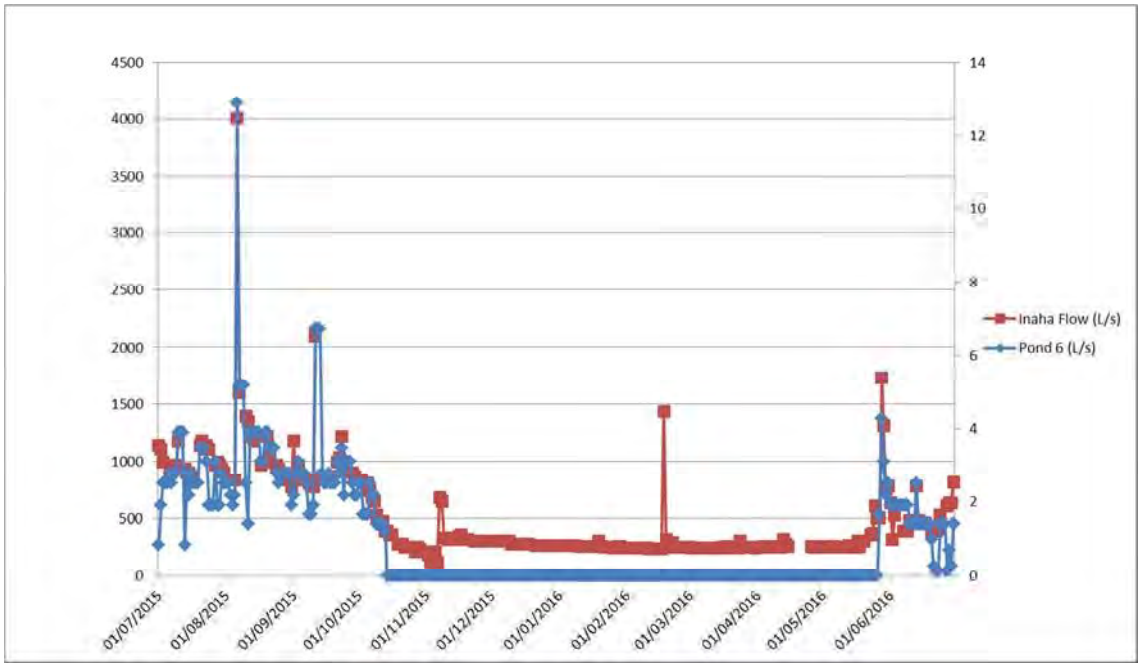

Figure 5 Hydrograph for the Inaha Stream at Kohiti Road, July 2015- June 2016 from daily staff readings with the TBP discharge rate from pond 6

2.1.4.2 Instream temperature

The in-stream temperature recorders were operated throughout the monitoring period. These monitors are located within the unnamed tributary which receives the cooling water discharge and in the Inaha Stream upstream of the confluence with the tributary, and downstream of the confluence at the end of the mixing zone. In September 2013, the Council took over the temperature monitoring from TBP, at TBP's request.

The record over the 2015-2016 monitoring period for the temperature of cooling water discharged, and the increase in Inaha Stream temperature, is given in Figure 6 and Figure 7. The error on the cooling water temperature is ± 0.2 ˚C, and the error on the in-stream temperature increase is ±0.4 ˚C.

For background, special condition 3 on Consent 2050 requires that the temperature of the cooling water discharge must not exceed 35 ˚C. In 2013-2014 and 2014-2015, the limit was complied with fully, for the third and fourth years in succession; this was also complied with in this monitoring year, Figure 6.

Special condition 9 (c) on Consent 2049 and special condition 5 (g) on Consent 2050 require that there be no more than a 3.0 °C temperature differential in the receiving waters below the mixing zone as a result of the wastewater and cooling water discharges, respectively. Results are shown in Figure 7.

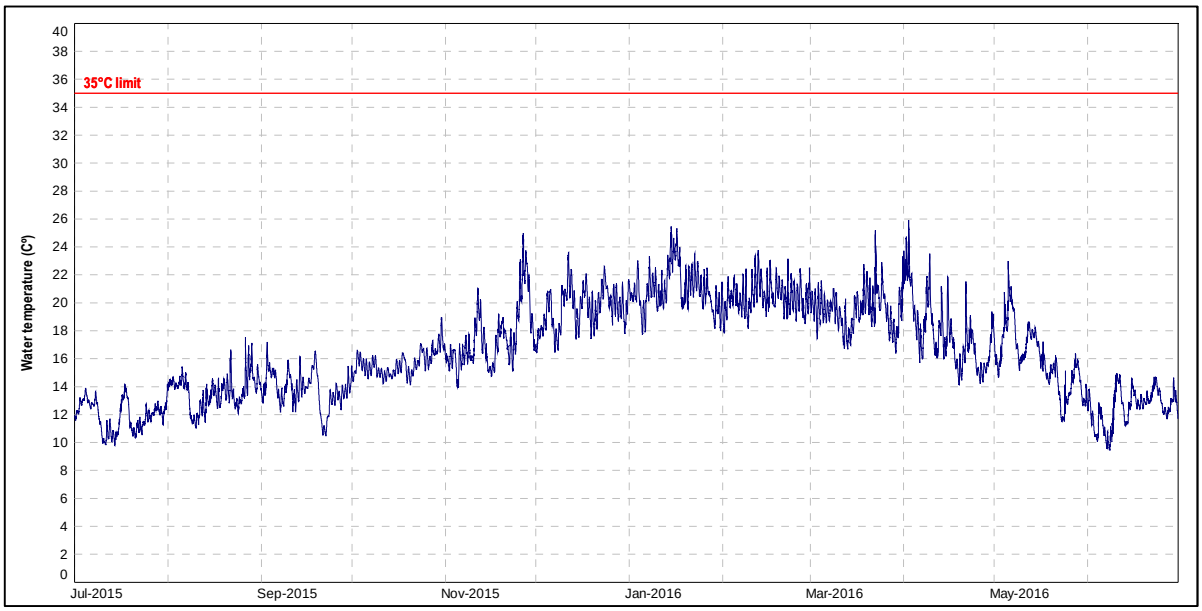

Figure 6 Cooling water temperature 1 July 2015- 30 June 2016

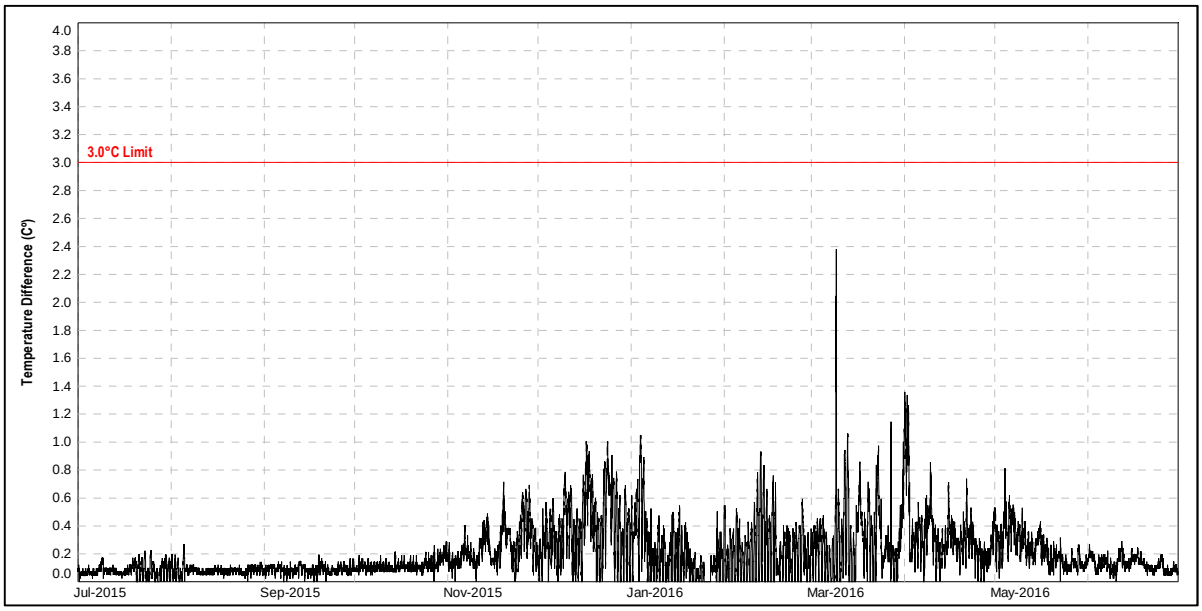

Figure 7 Inaha Stream temperature increase post discharge 1 July 2015- 30 June 2016

In the 2015-2016 reporting period, the maximum allowable temperature increase was not exceeded for the whole period, which is the second year running to achieve full compliance with this temperature differential.

In relation to Figure 7, on 9 March 2016 at 7 am was the largest temperature differential observed throughout the year. The discharge increased the temperature of the receiving waters by 2.39 °C; the second largest differential occurred on 1 April

2016 at 15:30, with an increase of 1.35 °C. Note the consented limit from 2050-1 is that the differential should not be larger than 3.0 °C.

2.1.4.3 Water chemistry

Five sampling runs were undertaken on the Inaha Stream in this monitoring period. The analysis is provided in Table 9. Site locations are detailed in Figure 1, Table 3 and Table 8, below for easy reference.

Table 8 Surface water sample collection locations

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
1	Ahipaipa Road	1703013	5625271	**INH000334**
3	Bridge, 420 m u/s Kohiti Road	1702138	5624345	**INH000348**
4	Unnamed northern tributary at Inaha confluence	1701947	5624362	**INH000397**
5	Kohiti Road	1701874	5624322	**INH000400**
6	110 m d/s cooling water discharge and 30 m d/s pond 6 discharge	1701861	5623980	**INH000408**
7	500 m d/s pond waste discharge	1702021	5623745	**INH000420**
8	Normanby Road bridge, 1,450 m d/s discharges	1701650	5623262	**INH000430**
9a	Unnamed western tributary, 3,500m u/s Inaha confluence	1701109	5625496	**INH000433**
9	Unnamed western tributary 2,550 m u/s Inaha confluence	1700816	5624558	**INH000435**
9b	Unnamed western tributary ~2,000 m u/s Inaha confluence	1700818	5624175	
9c	Unnamed western tributary ~1,450 m u/s Inaha confluence	1701183	5623577	
9d	Unnamed western tributary ~900 m u/s Inaha confluence	1701013	5623963	
10	Unnamed western tributary 250m u/s Inaha confluence	1701518	5623227	**INH000440**
11	State Highway 45	1700393	5620330	**INH000470**

Table 9 Inaha Stream water quality analysis

	Parameter	TEMP	DO	PERSAT	BOD_5	BODCF	TURB	COND	pH	NH_4	NNN	DRP	FC
Site ID	Date	°C	g/m^3	%	g/m^3	g/m^3	NTU	mS/m@20°C	pH	g/m^3 N	g/m^3 N	g/m^3 P	/100ml
INH000334	24 Jul 2015	10.1	11	97.4	1.5		12	19	7.7	0.014	3.32	0.026	200
INH000348	24 Jul 2015	10.2	11.25	99.6	1.4		12	19.3	7.7	0.019	3.35	0.025	170
INH000397	24 Jul 2015	10.1	11.02	97.4	1.7		16	26.1	7.6	0.036	3.88	0.022	250
INH000400	24 Jul 2015	10.2	11.23	99.4	1.4	<0.5	12	20.6	7.6	0.021	3.46	0.025	330
INH000408	24 Jul 2015	10.5	11.24	100	2.1	<0.5	18	21.4	7.5	0.134	3.74	0.037	290
INH000420	24 Jul 2015	10.6	11.22	99.6	2	<0.5	16	21.7	7.5	0.22	3.83	0.052	340
INH000430	24 Jul 2015	10.9	11.2	100	2	<0.5	17	21.8	7.6	0.212	4.08	0.052	170
INH000470	24 Jul 2015	10.4	11.05	98.6	2.5		16	24.3	7.5	0.128	4.55	0.048	280
INH000334	16 Sep 2015	11.7	10.47	97.4	1.6		10	19	7.6	0.011	3.14	0.027	350
INH000348	16 Sep 2015	11.9	10.75	100	1.1		11	19.4	7.6	0.014	3.41	0.028	590
INH000397	16 Sep 2015	12.1	10.39	97.1	1.4		15	26.4	7.6	0.059	4.19	0.024	2,900
INH000400	16 Sep 2015	12.1	10.89	99.9	1.4	<0.5	10	20.9	7.7	0.024	3.44	0.028	830
INH000408	16 Sep 2015	12.3	10.63	99.9	1.5	<0.5	11	21.6	7.6	0.148	3.99	0.045	650
INH000420	16 Sep 2015	12.5	10.63	100.4	1.4	0.6	11	21.9	7.7	0.258	3.81	0.073	360
INH000430	16 Sep 2015	12.7	10.58	100.3	1.6	<0.5	11	22.1	7.7	0.236	3.93	0.075	380
INH000470	16 Sep 2015	12.6	10.17	95.9	2.3		15	24.9	7.6	0.195	4.61	0.073	600
INH000334	16 Dec 2015	16.3	9.17	93.6	1.8		3.1	23.2	7.6	0.011	1.92	0.057	1,100
INH000348	16 Dec 2015	16.2	10.64	110.6	0.9		2.9	25	8	0.018	2.97	0.042	690
INH000397	16 Dec 2015	14.9	10.38	104.4	0.9		4.2	28	7.7	0.014	2.52	0.021	1,400
INH000400	16 Dec 2015	16.4	10.68	110.7	0.9	0.8	2.9	26	8	0.016	2.89	0.037	870

	Parameter	TEMP	DO	PERSAT	BOD_5	BODCF	TURB	COND	pH	NH_4	NNN	DRP	FC
Site ID	Date	°C	g/m^3	%	g/m^3	g/m^3	NTU	mS/m@20°C	pH	g/m^3 N	g/m^3 N	g/m^3 P	/100ml
INH000408	16 Dec 2015	17.4	10.14	107.6	1.4	0.6	4	29.7	7.9	0.28	3.95	0.055	1,600
INH000420	16 Dec 2015	17.6	10.27	107.3	1.6	0.7	3.7	29.5	7.9	0.182	3.93	0.051	370
INH000430	16 Dec 2015	19.5	10.94	121	2	0.9	4.9	29.8	8.7	0.042	4.27	0.044	140
INH000470	16 Dec 2015	18.3	10.7	115.4	1.2		3	33.5	8.3	0.028	4.44	0.05	340
INH000334	20 Jan 2016	17.1	8.09	84.9	1.5		3	26	7.6	0.032	1.81	0.077	2,700
INH000400	20 Jan 2016	18.5	9.44	101.4	1.7	0.7	4	28.1	7.9	0.086	2.47	0.059	2,700
INH000408	20 Jan 2016	19.8	9.09	100.3	2.1	0.8	3.2	29.3	7.8	0.23	2.76	0.067	2,500
INH000420	20 Jan 2016	20	8.52	94.7	2.6	0.9	2.8	29.4	7.8	0.133	2.88	0.067	2,700
INH000430	20 Jan 2016	17.5	9.26	100.3	2	0.8	2.7	29.8	7.8	0.04	2.88	0.053	1,300
INH000470	20 Jan 2016	18.9	10.03	108.1	1.6		3.1	33	8	0.061	3.24	0.057	1,500
INH000334	04 May 2016	14.6	8.9	88.1	<0.5		1.1	18.2	7.7	0.017	1.04	0.053	420
INH000348	04 May 2016	14.4	10.65	104.6	0.6		1.2	19.4	8	0.01	1.66	0.043	820
INH000397	04 May 2016	14	8.6	85.7	0.5		3.7	31.2	7.5	0.026	1.98	0.023	2,100
INH000400	04 May 2016	14.5	12.2	119.8	0.5	<0.5	1.3	20.5	8.1	0.009	1.79	0.038	1,200
INH000408	04 May 2016	15.2	10.63	106.4	1.1	0.8	1.8	22	8	0.199	2.36	0.054	760
INH000420	04 May 2016	15.5	10.64	107.5	1.4	0.9	2.2	22	8	0.101	2.08	0.051	540
INH000470	04 May 2016	15.4	11.24	112.3	2.1		13	29.9	8.2	0.072	3.28	0.084	590

BOD_5 = total 5-day biochemical oxygen demand, g/m^3
g/m^3N
$fcBOD_5$= filtered carbonaceous 5-day biochemical demand, g/m^3
Cond = conductivity, mS/m at 20˚C
DO = dissolved oxygen, g/m^3
DRP = dissolved reactive phosphorus, g/m^3P
FC = faecal coliforms, cfu/100 ml
NH_4 = ammonia, g/m^3N
NNN = nitrate + nitrite,

%Sat = percentage oxygen saturation
pH
Temp = temperature, ˚C
Turb = turbidity, NTU

TBP holds discharge consent 2049. This consent allows for the discharge of treated wastewater from TBP's rendering plant to Inaha Stream. It places specific limits on the combined effect of all discharges from the plant on dissolved oxygen, BOD, total ammonia and pH levels on the receiving waters in the stream, beyond the boundary of a 30 m mixing zone.

The effect that the discharge has on the receiving environment is a function of the relative flow rates of the stream and effluent, the strength of the effluent, and the quality of the stream above the discharge point. Results for individual parameters are discussed separately below.

It is noted that TBP was not discharging treated wastewater during three of the five monitoring runs in 2015-2016, as all wastewater was being discharged to land during relatively low stream flows. This allowed assessment of the effects of leaching from the rendering plants' site, and of the minor discharges, such as cooling water, via the tributary that flows through the site.

Dissolved oxygen

Consent 2049 requires that the discharge shall not reduce the concentration of DO of the receiving water to below 80% of saturation concentration, that is, about 6-9 g/m^3 in the case of Inaha Stream, depending on the stream temperature. This limit is set for the protection of fish populations. Sampling runs were timed to take place when dissolved oxygen concentration is at its lowest, in early to mid-morning.

DO was monitored on all five occasions in the 2015-2016 monitoring year, the results were in compliance with the limit on all occasions.

Monitoring in recent years has shown that, during lower flows, there tends to be a slight increase in dissolved oxygen between Ahipaipa Road and Kohiti Road, and a slight decrease below the rendering plants at the second and third sites downstream, 500 m downstream and at Normanby Road. During winter and spring flows, when TBP wastewater is being discharged, there tends to be a slight decrease at the first site downstream.

Biochemical oxygen demand
Consent **2049** requires that the discharge shall not raise the filtered carbonaceous biochemical oxygen demand (filtered cBOD) above 2 g/m^3 in the receiving waters of the stream. This limit is set to control excessive bacterial or fungal slime growths. The Council monitored for both total and filtered cBOD on five occasions in 2015-2016. Total BOD is monitored to assess the potential for dissolved oxygen sag.

The limit was complied with on each monitoring occasion, the maximum downstream filtered cBOD value ranged from <0.5 g/m^3 to 0.9 g/m^3. The highest readings were recorded during January and May sampling occasions at times of low stream flow when the tributary that carried cooling water from the site contained a higher concentration of BOD than the Inaha.

Total BOD concentration increased below the TBP discharge points during lower flows and when wastewater was being discharged, to a maximum of 2.6 g/m^3.

BOD determinations with and without nitrifier inhibition (carbonaceous and total BOD) showed that oxygen demand exerted by TBP's effluent was largely nitrogenous. This is supported by the observed conversion of ammonia to nitrate (nitrification) and concurrent slight DO sag in the stream, and is consistent with the discharge of wastewater containing active nitrifying bacteria together with a significant amount of ammonia.

Total ammonia and pH
Consent 2049 requires that the discharge shall not raise the total ammonia concentration (reported as NH_4) in the receiving water above 1.5 g/m^3 if the pH of the receiving water is below 7.75, or above 0.7 g/m^3 if the pH lies between 7.75 and 8.0, or above 0.4 g/m^3 if the pH is above 8.0. The permit also requires that the discharge not cause a fall of more than 0.5 pH units in the receiving water. These limits are set for the protection of fish populations.

During the monitoring period of 2015-2016, there was no exceedance with the ammonia values when compared to the pH level. There was however, the highest pH recorded during this monitoring period with a pH of 8.7, recorded at INH000430 on 16 December 2016. These high pH values are ascribed to algal activity, following the removal of shading willows along the stream in November 2014.

The maximum pH change recorded in the 2015-2016 monitoring year, while the wastewater discharge was occurring was 0.2 units, from 7.7 to 7.5 pH. Note that the first two sample runs in Table 9 are when the plant was discharging to the Inaha

Stream, in July and September 2015. The remaining three sample rounds were undertaken when the plant was not discharging.

Tributaries in irrigation areas
Physico-chemical monitoring of the two tributaries which run through irrigated areas on the western side of Inaha Stream were carried out to determine the effects of wastewater irrigation. The locations and descriptions of the monitoring sites are given in Figure 1 and Table 3, respectively.

The water quality of the two tributaries is more mineralised (having higher conductivity) than the main stem, reflecting the closer proximity of their catchment to the sea but also potentially reflecting activities within the sub-catchments. Nitrate concentration is the factor most likely to be affected by irrigation.

Northern tributary
The northern tributary joins the Inaha Stream immediately above Kohiti Road. It runs a distance of about 0.64 km through the Kohiti block of TBP's farm, about 0.42 km adjacent to potentially irrigated areas. The tributary is monitored at its confluence with the main stream at Site 4/INH000397. The analysis of the samples collected in this monitoring period are provided in Table 10. Historical data from location INH000397 is provided to allow the reader to compare with historical values for this location.

Analysis of the northern tributary detailed a slight increase in the maximum value for combined nitrite/ nitrate nitrogen in this monitoring period; the previous maximum of 3.66 g/m^3 N was exceeded in September 2015. The reason for this increase was due to the elevated concentration of nitrate in the tributary. Un-ionised ammonia concentrations (NH_3) remained low, as did ammoniacal nitrogen levels (NH_4).

Western tributary
The western tributary joins the Inaha Stream immediately below Normanby Road. It runs a distance of about 3.5 km through land that is irrigated on both sides with TBP wastewater. The distance of the stream in its valley to the irrigated areas on the plateau above is about 50 to 100 m. The tributary is monitored at three points: Site 9a (INH000433) which is above the TBP farm; Site 9 (INH000435) which was the original upstream site is situated 2.5 km above the Inaha confluence, before the irrigation area was extended; Site 10 is the downstream site, immediately above Normanby Road, about 0.22 km above the confluence (INH000440).

The results of physico-chemical monitoring of the western tributary are presented in Table 11.

Table 10 Northern tributary 2015-2016 monitoring year results, with historical data since January 1999

INH000397	Parameter	BOD	CL	COND	DO	DRP	FC	NH3	NH4	NNN	NO2	NO3	PERSAT	PH	TEMP	TURB
Date	Time/unit	g/m³	g/m³	mS/m@ 20°C	g/m³	g/m³ P	/100ml	g/m³	g/m³ N	g/m³ N	g/m³ N	g/m³ N	%	pH	°C	NTU
24 Jul 2015	08:35	1.7	33.4	26.1	11.02	0.022	250	0.00033	0.036	3.88	0.017	3.863	97.4	7.6	10.1	16
16 Sep 2015	09:40	1.4	34.5	26.4	10.39	0.024	2,900	0.00062	0.059	4.19	0.022	4.168	97.1	7.6	12.1	15
16 Dec 2015	09:57	0.9	36	28	10.38	0.021	1,400	0.00023	0.014	2.52	0.011	2.509	104.4	7.7	14.9	4.2
04 May 2016	09:55	0.5	46	31.2	8.6	0.023	2,100	0.00025	0.026	1.98	0.008	1.972	85.7	7.5	14	3.7
1999-2015	Max	1.8	44.9	33.3	11.6	0.071	4,000	0.00664	0.568	3.66	0.017	3.603	99.4	7.7	18.1	31
1999-2015	Median	0.6	37.4	26	9.9	0.027	750	0.0002	0.022	2.03	0.008	2.396	91	7.6	11.4	9.4

Table 11 Water quality in the western tributary of the Inaha Stream 2015-2016 monitoring year

	Parameter	BOD	CL	COND	DO	DRP	FC	NH_3	NH_4	NNN	NO_2	NO_3	PERSAT	PH	TEMP	TURB
Site	Date	g/m^3	g/m^3	mS/m@20° C	g/m^3	g/m^3 P	/100ml	g/m^3	g/m^3 N	g/m^3 N	g/m^3 N	g/m^3 N	%	pH	°C	NTU
INH000433	24-Jul-15	0.6	38.5	29.3	10.59	0.02	100	0.00011	0.012	3.89	0.006	3.884	94.6	7.6	10.5	7.2
INH000435	24-Jul-15	0.6	42.5	30.5	10.7	0.013	80	0.00007	0.008	4.79	0.003	4.787	94.8	7.6	9.9	2.4
INH000440	24-Jul-15	0.6	47	33	11.1	0.015	140	0.00018	0.026	6.66	0.003	6.657	97.4	7.5	9.9	9.8
INH000433	16-Sep-15	0.6	37.9	28.9	9.9	0.014	350	0.0001	0.009	4.07	0.004	4.066	93.5	7.6	12.4	6.8
INH000435	16-Sep-15	<0.5	41	30	10.01	0.01	290	0.00009	0.008	4.92	0.006	4.914	94.4	7.6	12.4	3.9
INH000440	16-Sep-15	<0.5	38.2	32.3	10.47	0.011	380	0.00016	0.015	5.89	0.005	5.885	97.9	7.6	12.7	9.3
INH000433	16-Dec-15	1.2	38.8	29.5	9.11	0.024	510	0.0035	0.279	2.14	0.002	2.138	91.1	7.6	14.5	23
INH000435	16-Dec-15	0.6	46.9	34.1	9.16	0.024	1,300	0.00026	0.014	4.83	0.004	4.826	96.2	7.7	16.9	5.2
INH000440	16-Dec-15	0.6	59.9	38.3	11.21	0.014	250	0.00029	0.004	8.04	0.005	8.035	117.5	8.3	16.9	1.6
INH000433	20-Jan-16	0.9	41	30.8	7.46	0.016	860	0.0003	0.028	0.93	0.003	0.927	78.4	7.5	15.4	6.8
INH000435	20-Jan-16	0.7	50.5	34.1	8.15	0.022	1,700	0.00028	0.018	2.66	0.005	2.655	85.5	7.6	17.2	3.1
INH000440	20-Jan-16	1.1	64.5	39	9.46	0.015	680	0.00045	0.018	5.57	0.009	5.561	99.6	7.8	17.6	4.7
INH000435	04-May-16	1.4	64.2	39.1	8.59	0.018	610	0.00037	0.04	6.79	0.015	6.775	83.1	7.5	13.6	6
INH000440	04-May-16	<0.5	77.4	45.8	8.82	0.008	680	0.00011	0.012	9.79	0.005	9.785	84.7	7.5	13.4	2.3

Between 2006 and 2010, nitrate concentration increased, both upstream and downstream of the irrigation area, with seasonal peaks in winter/spring that rose from about 1.5 to 4 g/m³ N. In 2014, after a relatively stable period, the time of the seasonal peak at the downstream site changed to summer/autumn. Peak values of 7.1 and 10.7 g/m³ N were recorded in January 2014 and May 2015, respectively.

In February 2015, Council carried out investigations to trace the location of nitrate inflow to the tributary. Three additional sites, 9b, 9c and 9d, spaced approximately 500 m apart, were surveyed between Site 9 and Site 10. The nitrate inflow was found to be between about 1.5 and 2.0 km above Normanby Road (between Site 9b and Site 9c). This is an area where springs enter the tributary from both sides, above which wastewater irrigation and nitrogen fertiliser application has occurred. TBP was required to reduce nitrogen application in these areas. Monitoring frequency of the tributary by the Council was increased to monthly. In July 2015, TBP commenced weekly monitoring of the tributary for nitrogen species.

In this monitoring period, the value for nitrite/nitrate nitrogen, NNN, varied between 0.93- 9.76 g/m³ N in the five sampling runs of the western tributary (Table 11). However, as the concentration of NNN observably doubled in concentration at each sample collection location, the Council collected additional samples to assess the concentrations in this tributary (Table 12).

Table 12 Specific testing of INH000440 final sample location on western tributary for NNN testing

	Parameter	CL	COND	NH3	NH4	NNN	NO2	NO3	PH	TEMP	TURB
Site	Date	g/m³	mS/m@20°C	g/m³	g/m³ N	g/m³ N	g/m³ N	g/m³ N	pH	°C	NTU
INH000440	17-Aug-15	47.5	32.8	-	0.014	7.12	-	-	7.4	11.3	-
INH000440	20-Oct-15	60.1	34	0.00027	0.015	6.95	0.004	6.946	7.8	13.1	5.9
INH000440	17-Nov-15	52.4	34.8	-	0.095	6.04	-	-	7.7	13.8	-
INH000440	15-Feb-16	80	46.3	0.00043	0.012	13	-	-	7.9	19.6	4.7
INH000440	23-Mar-16	75.6	46.9	-	-	9.94	-	-	7.6	16.8	2.1
INH000440	18-Apr-16	78.9	45.3	-	0.006	9.08	-	-	7.4	13.2	-
INH000440	04-May-16	77.4	45.8	0.00011	0.012	9.79	0.005	9.785	7.5	13.4	2.3

An additional seven samples were collected throughout the monitoring year; these were supplementary to the five sample runs which occurred throughout the year. The main rationale was to assess the maximum concentration of nitrate in this water way. The highest reading was 13 g/m³ N NNN which was collected in February 2016.

In response to the elevated nitrate concentration in the western tributary, TBP was asked to limit applications of wastewater in this specific locality. Moving forward, certain areas will not be utilised for application of wastewater or fertiliser and instead, will be used directly for application of dairy shed effluent from TBP cowshed. The Council is interested to see how this will influence the concentrations of NNN in the coming monitoring period in this tributary.

2.1.4.4 Biomonitoring

Condition 9 of consent 2049, specifically sub-condition (i):

Condition 9

The discharge (in conjunction with any other discharges pertaining to the same property), shall not cause or give rise to any of the following effects, at any point in the receiving waters below the mixing zone

(i) Any significant adverse effects on aquatic life, habitats or ecology;

In order to quantify whether there have been any impacts/ adverse effects on the instream communities, the Council undertook two bio-monitoring surveys of the Inaha Stream and its tributaries. The following text is extracted from the specific bio-monitoring surveys carried out on the Inaha stream in the 2015-2016 monitoring year. These surveys were undertaken in October 2015 and February 2016. These dates would reflect spring and later summer conditions in the stream. The full bio-monitoring survey reports are attached in Appendix II

TBP holds a number of consents for discharges to land and to water associated with the operation of a rendering plant and a neighbouring farm owned and operated by TBP. The discharge consents most relevant to this biomonitoring survey are summarised in Table 13 below.

Table 13 Summary of discharge consents held by Taranaki By-Products Ltd

Consent no.	Purpose
2049-4	To discharge up to 940 m^3/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream
2050-4	To discharge up to 2,160 m^3/day of cooling water and backwash water from a rendering operation into an unnamed tributary of the Inaha Stream
3941-2	To discharge up to 1,400 m^3/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries between 1700909E-5625245N, 1700631E-5625092N and 1700921E-5625046N
5426-1	To discharge up 1,095 L/s of stormwater from an animal rendering site into an unnamed tributary of the Inaha Stream

Bio-monitoring methods

A biomonitoring survey was undertaken at eight sites on 20 October 2015 (Table 14). Five of the eight sites surveyed were in the Inaha Stream and the remaining sites were in an unnamed tributary of the Inaha Stream (Figure 8 & Table 14). The locations of sampling sites in relation to the discharges from the rendering plant are discussed below.

Site U (INH000334) was established in the 2003-2004 monitoring period as an appropriate control site on the Inaha Stream above the rendering plant discharges and irrigation areas. Site 1 (INH000400) is located upstream of the wastewater and cooling water discharge points but downstream of part of the treated wastewater irrigation area. Sites 2d and 3 (INH000420 and INH000430) are located downstream of these two discharges and above the confluence with the unnamed tributary of the Inaha Stream which drains land upon which wastewater is irrigated.

The area of land authorised to be irrigated to under consent 3941-2 has increased on several occasions since the consent was granted in December 1999. Sites UT, MT and DT (INH000433, INH000435 and INH000440) were established to monitor the effects of the expanded irrigation area on an unnamed tributary of the Inaha Stream. Site UT was established as a 'control site' for the expanded irrigation area. Site MT is located within the authorised irrigation area and site DT is situated downstream of the irrigation area but upstream of the unnamed tributary's confluence with the Inaha Stream.

Site 4 (INH000450) on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 14 Biomonitoring sites in the Inaha Stream and in an unnamed tributary relating to the Taranaki By-Products plant

Stream	Site No.	Site code	Location	Sampling method used
Inaha Stream	U	INH000334	Upstream of irrigation area, near Ahipaipa Road	Streambed kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Streambed kick
	2d	INH000420	500 m downstream of cooling water discharge	Streambed kick
	3	INH000430	Upstream of Normanby Road	Streambed kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Kick-sweep
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Streambed kick
	MT	INH000435	Middle site within the new irrigation area	Kick-sweep
	DT	INH000440	50 m upstream Normanby Road	Streambed kick

Two different sampling techniques were used to collect streambed macroinvertebrates in this survey. The Council's standard '400 ml kick-sampling' technique was used at sites U, 1, 2d, 3, UT and DT, and a combination of the 'kick-sampling' and 'vegetation sweep' techniques were used at sites 4 and MT (Table 14). The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-bottomed, semi-quantitative) 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 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 individuals or more.

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

site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value. A difference of 11 units or more in MCI values is considered significantly different (Stark 1998).

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, therefore $SQMCI_s$ values range from 1 to 10, while MCI values range from 20 to 200.

Where necessary, sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa (undesirable biological growths) at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream. Such heterotrophic growths have been recorded on numerous past occasions at sites downstream of the TBP plant as a result of organic nutrient enrichment from the wastewater discharge.

Discussion
In the past, heterotrophic growths such as 'sewage fungus' have occurred in the Inaha Stream downstream of the rendering plant which were most likely the result of the discharges from the plant. However, no 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this suggests an improved management of the wastewater discharge since that time.

Spring survey summary
Overall, there was some evidence that discharges from TBP had impacted on the freshwater macroinvertebrate communities present in the Inaha Stream. However, changes in habitat and habitat variation between sites make drawing strong conclusions from the data difficult.

Late summer survey
Overall, there was no evidence that discharges from TBP had impacted on the freshwater macroinvertebrate communities present in the Inaha Stream. However, changes in habitat and habitat variation between sites make drawing strong conclusions from the data difficult.

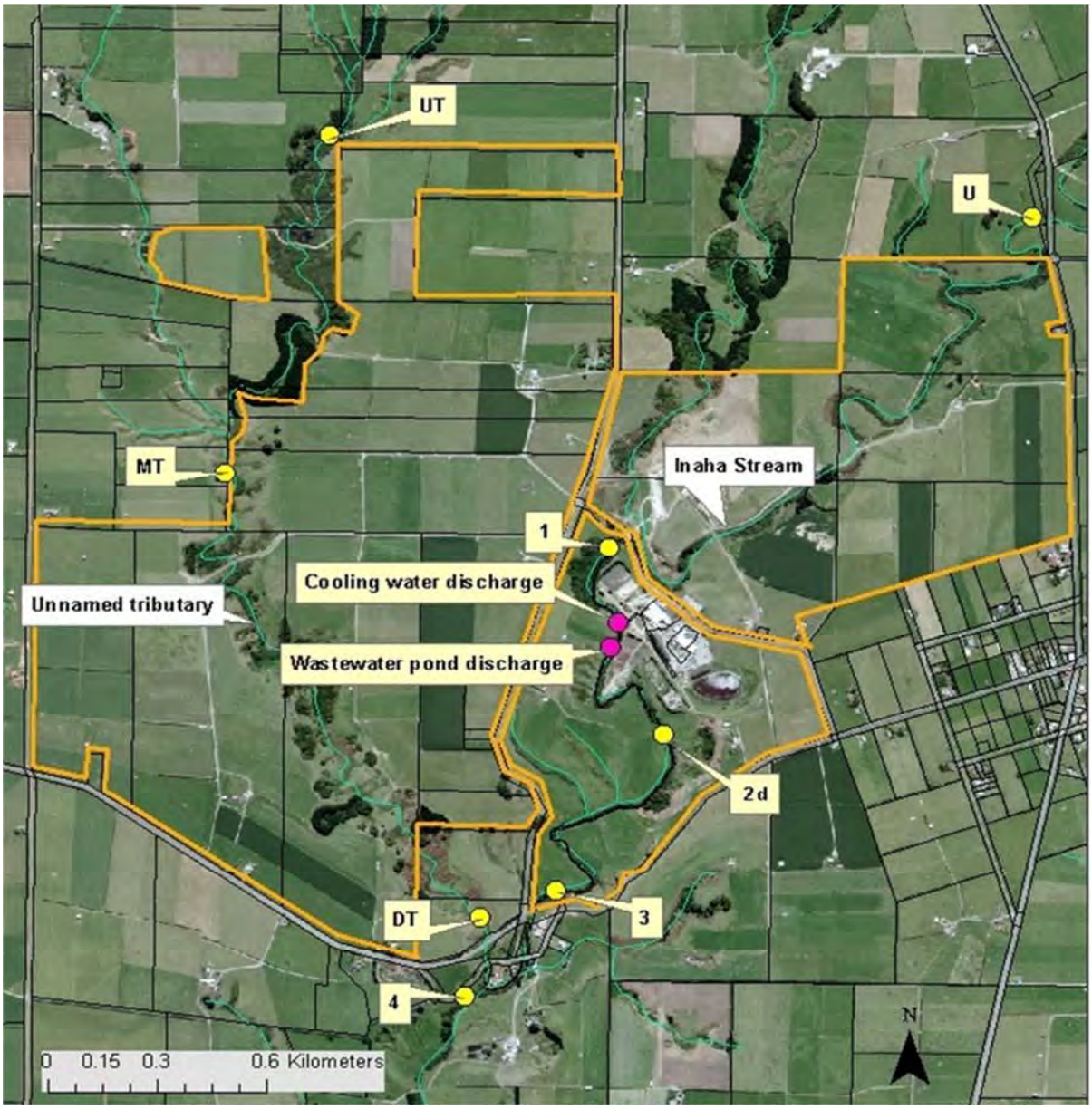

Figure 8 Aerial photo detailing the biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant.

2.1.5 Irrigation and groundwater monitoring

2.1.5.1 Irrigation background

TBP holds consent 3941-2; this consent allows for the discharge of up to 1,400 m^3 per day of treated wastewater from their rendering operation onto and into the land in the vicinity of the of the Inaha Stream and its tributaries.

The wastewater is monitored by both TBP and the Council. TBP measures and records wastewater volumes discharged on each paddock daily, and analyses nitrogen constituents of the wastewater at approximately weekly intervals. Some soil testing has been carried out.

Monitoring by the Council included inspection of irrigation areas, effluent analysis, chemical and biological surveys of the Inaha Stream, sampling from groundwater

bores drilled around the irrigation areas and of a spring situated near an irrigation area that is used to supply several households.

2.1.5.2 Irrigation area and system

The spray irrigation system employs low-medium pressure travelling irrigators with a 30 m or 50 m swath. Use of a 'Rotorainer' irrigator with a 100 m boom, that requires less maintenance, commenced in May 2008. A second Rotorainer was employed from January 2009.

The area irrigated has progressively increased, as TBP has purchased or leased more land around the rendering plants. Prior to 2006, irrigation occurred on four blocks, three owned by TBP on Kohiti Road (38.83 ha), Normanby Road (37.95 ha) and Katotauru Road (20.15 ha), and a block owned by Mr and Mrs Shearer on Katotauru Road (19.27 ha).

An extension followed the change of consent 3941 in December 2005, which provided for two additional blocks to be irrigated, one leased on Katotauru/Normanby Roads (about 110 ha), the other purchased on Ahipaipa Road (about 48 ha). The blocks were developed in stages by re-fencing and reticulation in 2006 and 2007.

TBP bought or leased further parcels adjacent to the existing irrigation areas, and in November 2009 was granted a change of consent 3941-2 to provide for irrigation on them. Part of this additional land, adjacent to the Katotauru Road block, 17.4 ha area in total, was irrigated from December 2009. Irrigation of "Maori Trust land", 20.6 ha in area beside Upper Inaha Road, started in December 2010. A further area of about 19.1 ha, in the "Kingi Block" to the north, that spans the Inaha Stream tributary between Katotauru and Upper Inaha Roads, was reticulated in December 2010 and irrigated from October 2011, after a groundwater monitoring bore (BH9) was installed down-gradient.

2.1.5.3 Previous monitoring year loadings

In the 2013-2014 season, approximately 319 ha was available (licensed, including Shearers' property) for irrigation, of which 252 ha was utilised. A total area of 75 ha was planted in maize and beet, 15 ha of which was irrigated with wastewater before the growing season.

For 2013-2014, records produced by TBP show that, on the basis of weekly effluent tests for ammonia-nitrogen, nitrate nitrogen and nitrite-nitrogen, and assuming 15 g/m^3 organic nitrogen, the total mass of nitrogen discharged to land was 44,355 kg. This represented a reduction of 31% from the previous year, which is attributed by TBP to improved wastewater treatment and housekeeping. The 246 ha area utilised on the TBP farm received effluent nitrogen loading of 180 kg N/ha, and the 6.7 ha on Shearers' farm received 38 kg N/ha.

Recorded loadings on the 61 individual paddocks irrigated on the TBP farm ranged from 18 to 523 kg N/ha/y, with an area of 23 ha (9 paddocks) exceeding 300 kg N/ha/y and an area of 14 ha (6 paddocks) exceeding 400 kg/ha/y. On Shearers' Farm, nitrogen loadings ranged from 34 to 44 kg N/ha/y.

In the 2014-2015 season, the paddocks on the TBP farm continued to be restructured, enlarging them from 3.0 to about 7.4 ha on average and reducing their number from 113 to 46. An area of approximately 319 ha again was available for irrigation, of which an estimated 226 ha was utilised. A total area of 61 ha was planted in maize, beet or oats, or a combination of two of these, 19 ha of which was irrigated before planting.

For 2014-2015, the TBP records show that the total mass of nitrogen discharged to land was 31,122 kg. The 216 ha area utilised on the TBP farm received effluent nitrogen loading of 140 kg N/ha, and the 9.8 ha on Shearers' farm received 83 kg N/ha. This significant reduction in nitrogen loading was ascribed by TBP to further improvement in wastewater treatment and housekeeping.

2.1.5.4 Current monitoring period wastewater irrigation

In the 2015-2016 monitoring year, TBP had a total of 183 ha available for applications of wastewater to land, of which 31 ha were utilised for crops. The TBP records detail that a total mass of wastewater nitrogen discharged to land was 32,255 kg. Thus the average concentration of nitrogen per hectare was 176 kg N/ ha. However there are specific loadings per paddock and this is further discussed below.

Recorded loadings on the 82 paddocks available for application ranged from 18-318 kg N /ha. The limit on consent 3941-2 for annual nitrogen loading is 300 kg N/ha, while for the Shearer block it is set at 200 kg N/ha.

In this monitoring period there were two exceedances in nitrogen loading with respect to application of wastewater. Paddock 34 received an additional 135 kg N, which resulted in an exceedance of the loading rate per hectare by 18.5 kg N/ha, giving an overall loading rate of 318 kg N/ha over the year. Paddock S-26, which is limited to 200 kg N/Ha, received an additional 8 kg N, which resulted in an exceedance by 11 kg N/ha of the consented loading rate per hectare, with an overall loading rate of 211 kg N/ha.

During the 2015-2016 monitoring period, compliance with the annual nitrogen loading limits was achieved, the average nitrogen loadings for the 300 kg N/ha areas were 31% and 37% for the 200 kg N/ha. For individual paddocks, compliance was recorded for 97% of the irrigated areas where the limit is 300 kg N/ ha and 97% for Shearer block where the limit is 200 kg N/ha.

2.1.5.5 Fertilisers

In August 2011, TBP produced its first annual "fertiliser budget", the outcome of a procedure TBP had developed for recording of nitrogen fertiliser application, including Zeal Grow (stickwater), urea and other chemical fertilisers used on crops and new grass, and soil conditioners such as dairy and rendering plant wastewater treatment pond solids.

2.1.5.6 Previous monitoring period fertiliser application

For 2013-2014, estimated nitrogen application from fertilisers and soil conditioners, in addition to wastewater irrigation, amounted to around 17,000 kg, comprising about 8,000 kg from Zeal Grow (assuming nitrogen concentration of 3,900 g/m^3, based on previous measurement), and about 8,640 kg in chemical fertiliser, with the remainder in dairy solids. Zeal Grow was disked into the ground over an area of about 95 ha at an estimated rate ranging from 29 to 230 kg/ha/y. Urea was applied over an area of about 24 ha that was cropped in maize at a rate of 357 kg/ha. The fertiliser was applied largely on paddocks that had not recently been irrigated.

For 2014-2015, the reported nitrogen application from fertilisers and waste solids increased significantly, by a factor of over 150 % to about 44,000 kg. This is attributed to increased application of Zeal Grow (stickwater), by a factor of about 450 % over an area of 276 ha, equating to an average application of 160 kg N/ha/y. Application rate was high in some areas, notably near the corner of Normanby and Upper Inaha Roads, and adjacent to Ahipaipa Road, Reported application rate exceeded 300 kg N/ha/y in four paddocks, over a total area of 30 ha, with a maximum of 536 kg N/ha/y.

In 2014-2015, the combined annual nitrogen application rate of wastewater and fertiliser exceeded 300 kg/ha/y in most of the paddocks along the middle reaches of the western tributary that joins Inaha Stream below Normanby Road, with a maximum combined rate of 520 kg/ha/y. The maximum recorded combined nitrogen application rate on the farm was 701 kg/ha/y, adjacent to Upper Inaha Road (new P29).

2.1.5.7 Current monitoring period fertiliser application

In this monitoring period, 2015-2016, the reported nitrogen application of fertilisers decreased slightly from the previous period, with a reduction of 9 %, from 44,000 kg N to 40,069 kg N. In comparison to the discharge of wastewater to land discussed in the previous section, which is limited to 300 and 200 kg N/ha, the application of fertiliser has no limit.

In this period, six of forty four paddocks received applications of fertiliser greater than 300 kg N/ha, with the highest receiving 404 kg N/ha, paddock 6.

The combined budget of both fertiliser and wastewater in terms of kg nitrogen to land amounted to eleven paddocks with an application greater than 300 kg N/ha, with six over 400 kg N/ha, five over 500 kg N/ha. The largest combined application in this period was 587 kg N/ha, on paddock 40.

2.1.5.8 Combined application discussion

For reference, the Council's Regional Fresh Water Plan limits the application of nitrogen through wastewater to a maximum of 200 kg N/ ha/yr. This limit is used throughout New Zealand as the generally accepted upper limit beneficial to pastures. A higher rate may result in high nitrate levels in groundwater[2].

Thus when this value is compared to the total combined loadings, twenty paddocks of eighty, received in excess of 200 kg N/ha/yr.

Noteworthy of mention is that depending on the paddocks usage, whether it be for crop or arable land, permitted activity rules may allow the operator to increase the fertiliser application to 300 kg N/ha/yr, as in this case, whereas the applications of wastewater are limited by consent conditions to specific 300 kg/N/ha/yr and 200 kg N/ha/yr areas.

However, applications of combined wastewater and fertiliser which exceed a total of 300 kg N/ha/yr may have detrimental affects on the groundwater concentration of nitrate. In terms of the sustainable management of this resource by TBP, TBP must be mindful to limit the combined concentrations to 300 kg/N/yr as the current sustained application is unsuitable for crop assimilation, and has resulted in elevated nitrate concentrations in the groundwater.

2.1.5.9 Groundwater

Background

Groundwater sampling of the irrigation areas commenced in February 2000 and was undertaken on a monthly basis until June 2006, when the frequency was reduced to two-monthly. Initially, four bores on Kohiti and Normanby Road blocks and a spring on Shearers' property were monitored. In September 2001, two bores were commissioned on Katotauru block, four months before irrigation started there. In January 2005, two bores were drilled in proposed new irrigation areas, at least one year before irrigation commenced, and two existing bores were replaced because of access difficulty. In October 2011, two further bores were drilled, at the downslope boundaries of the "Kingi" and Inaha Road blocks at the northern and western extents, respectively, of the irrigation area. The locations of the groundwater monitoring bores and spring are described in Table 15 and shown in Figure 9. Individual well analysis is discussed in Section 2.1.5.8.1.

Table 15 Groundwater monitoring well information

Site name	Site code	Depth m	Grid reference, NZMP	
			Easting	Northing
BH1	GND1054	13.5	1702469	5624829
BH2	GND1055	6.8	1702001	5624440
BH3	GND1056	12.8	1702359	5623913
BH4	GND1057	11.0	1702308	5623294
Shearers' Spring	GND1058		1701770	5623022

[2] Appendix 7A Taranaki Regional Council Regional Fresh Water Plan 2001

Site name	Site code	Depth m	Grid reference, NZMP	
			Easting	Northing
BH5	GND1171	9.5	1701358	5624353
BH5B	GND1346	8.6	1701352	5624536
BH6	GND1172	11.8	1701575	5623867
BH6B	GND1347	12.2	1701586	5623914
BH7	GND1348	13.5	1702671	5624594
BH8	GND1349	13.6	1701013	5623526
BH9	GND2225	11.5	1701186	5624945
BH10	GND2226	10.4	1700548	5623806

Bore 1 and Bore 5 were installed as control sites, situated at the (then) upslope boundaries of Kohiti and Katotauru blocks, respectively. Bore 5B was placed up-gradient of Bore 5 after a new farm track covered it in September 2004. Bore 2 was on the flat beside an unnamed tributary of Inaha Stream, at the bottom of Kohiti block. Bore 3 is beside Kohiti Road on the south-eastern plateau above TBP's plant. Bore 4 is in the centre of Normanby block. Bore 6 is in a swale beside the road at the downslope boundary of Katotauru block. Bore 6B was emplaced on the flat above Bore 6 after a series of floodings by ponded rainfall and wastewater. Bore 7 is downgradient of the southern side of the Ahipaipa block. Bore 8 is downgradient of the western side of the Katotauru/Normanby Roads block. Bore 9 is downgradient of the eastern side of Kingi block. Bore 10 is downgradient of the "Maori Trustee" block beside Upper Inaha Road.

Shearer Spring

The spring on Shearers' property is used as a water supply for a number of households. It is therefore monitored to ensure that it meets NZ Drinking Water Standards as well as to assess any off-site effects of effluent irrigation at TBP. The spring is relatively close to the boundary with Normanby block, though there is a shallow gully in between. Maize was grown in the nearest TBP irrigated paddock (old 95), about 100 m away up-gradient from the spring, in 2013-2014. The New Zealand health standard for nitrate-nitrogen concentration in drinking water for domestic supply is 11.3 g/m^3 N. Monitoring showed that nitrate levels in the spring, while remaining moderate, increased from 1.4 to 5.2 g/m^3 N over a period of about fifteen years to June 2015.

In this monitoring period the concentration of nitrate detailed its largest fluctuation to date, from 5.17 g/m^3 N in July 2015 to 7.18 g/m^3 N in August 2016 before dropping back to 4.27 g/m^3 N in July 2016 (Figure 10).

The loading rate and timing of the combined wastewater and fertiliser must be factored into this spring location, GND1058, Figure 10. Paddocks 13, 14, 15, 16 and 17 are located to the east and the north east of the spring, these paddocks with a combined area of 35 ha received an average application of 370 kg N/ha this term.

This is the combined concentration. However, one paddock, paddock 17 received a combined loading of 513 kg N/ha. This is not a sustainable application rate for this area as consideration should be given due to the location of these paddocks in relation to the spring at Shearer's property where the nitrate concentration is slowly rising (Figure 10).

The parameters of most interest with regard to operation of the wastewater irrigation system are the groundwater level, conductivity and nitrate concentration. Figure 11 demonstrates how the groundwater fluctuations correlate with increases in nitrate and conductivity. It can be inferred that rainfall is mobilising irrigated effluent and or applied fertiliser through the soil and into the shallow groundwater. Concentrations of nitrate rise and fall quite quickly, which is consistent with the application of high strength wastewater.

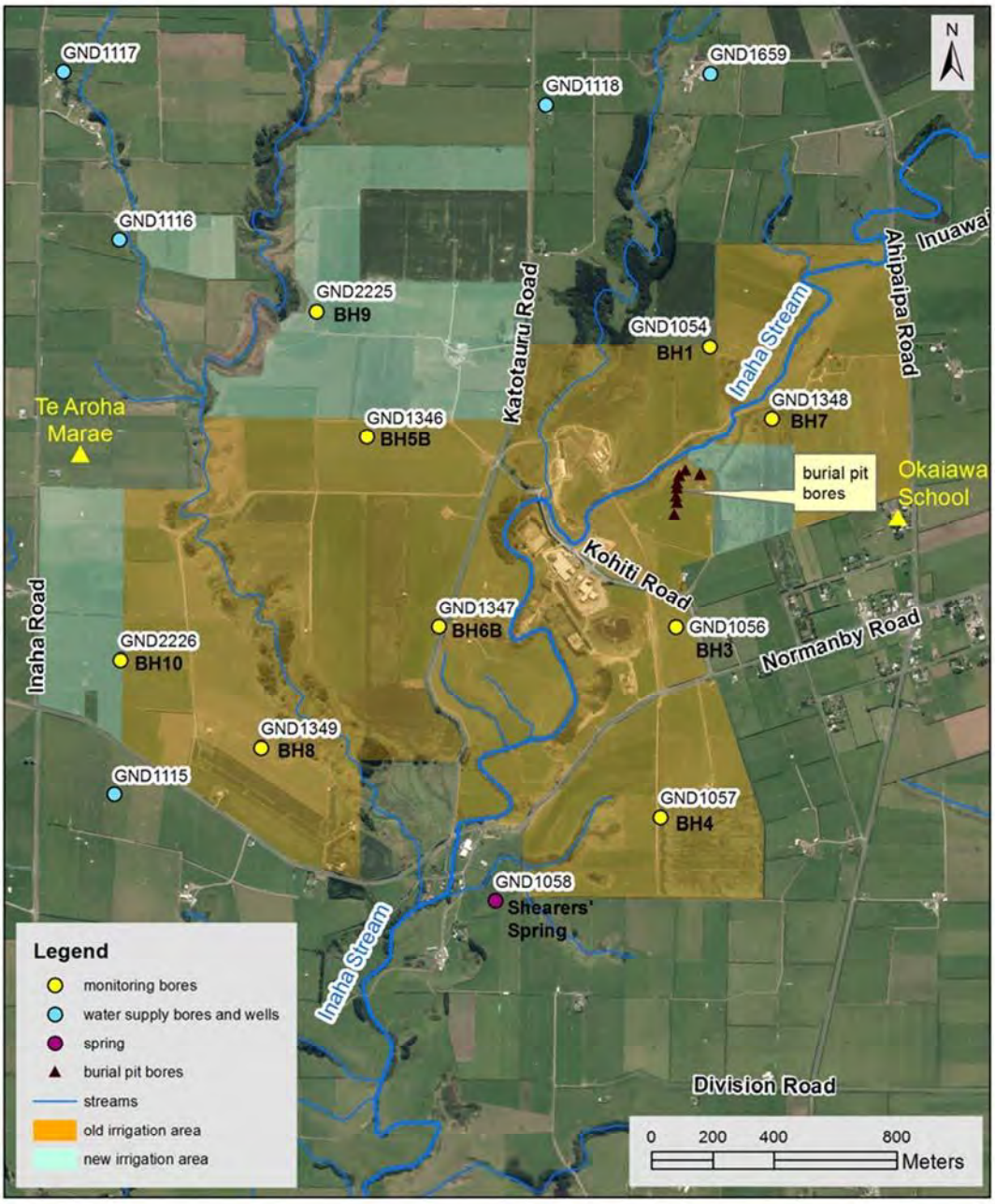

Figure 9 Wastewater and fertiliser application areas with groundwater monitoring well locations

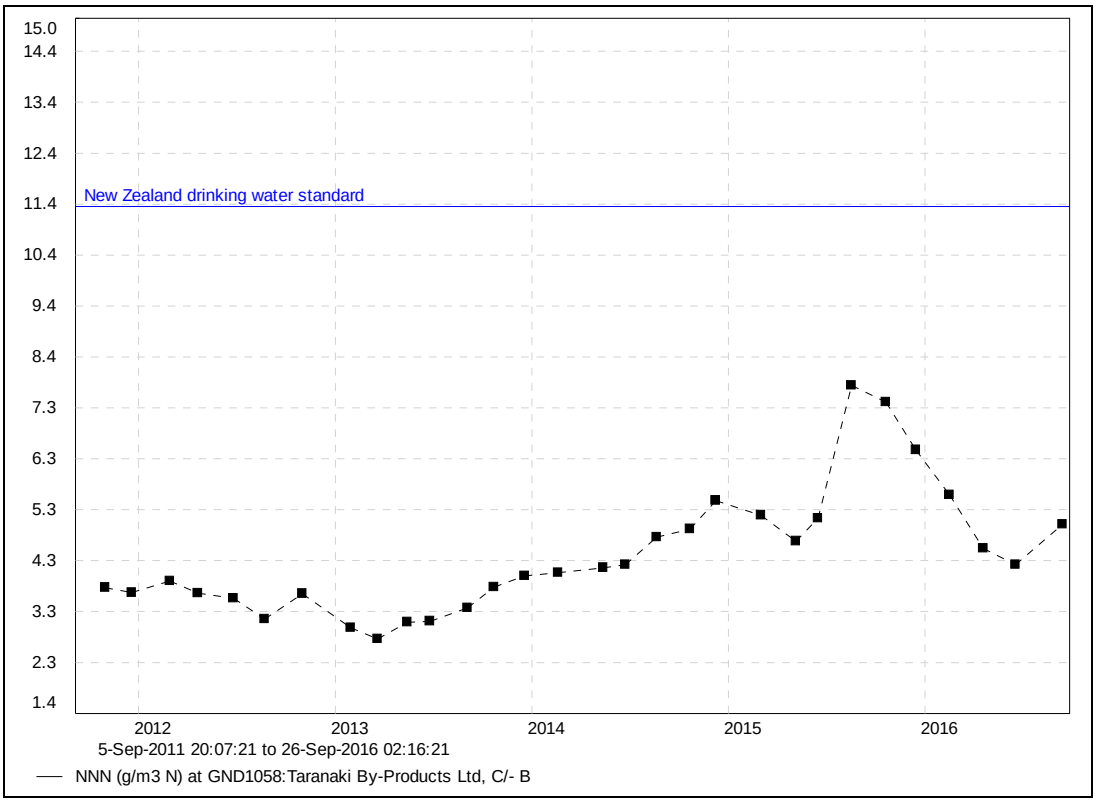

Figure 10 Nitrate/ Nitrite concentration at GND1058 Shearer 2011-2016 long term record

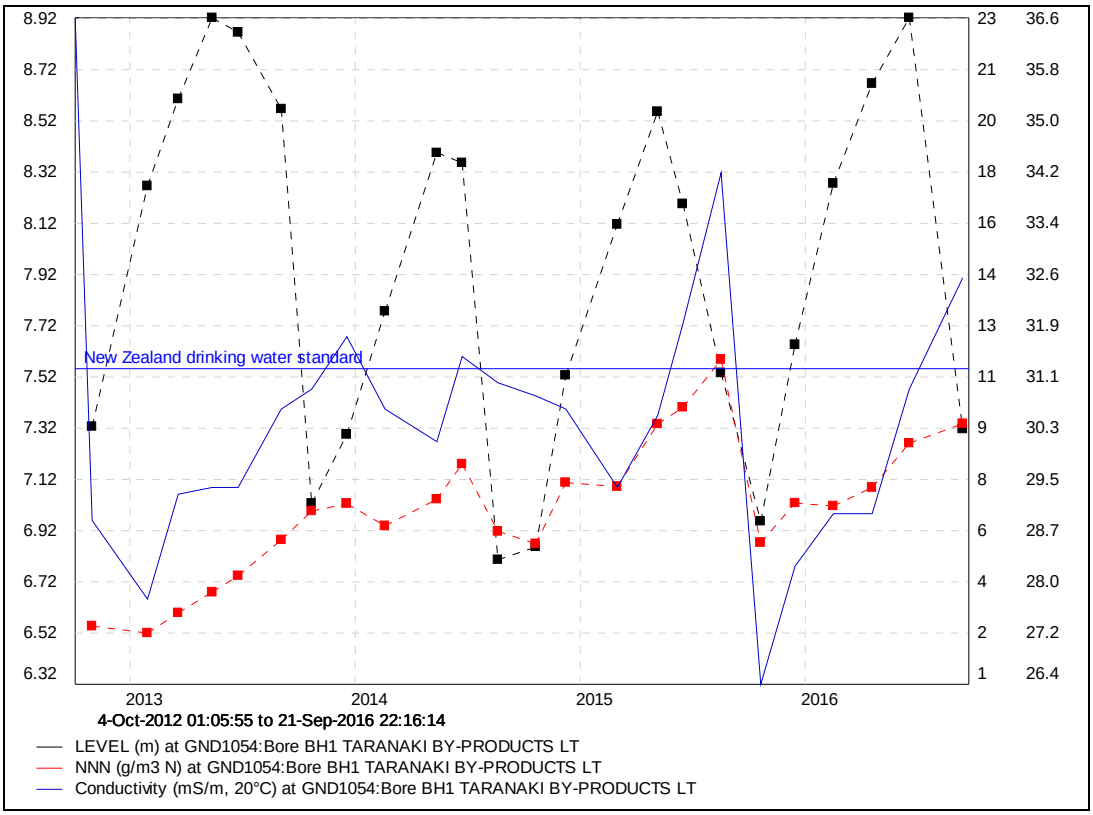

Figure 11 Groundwater level, Nitrate/Nitrite concentrations and conductivity in BH1 GND1054 2012-2016

2.1.5.9.1 Irrigation area groundwater monitoring well analysis data

GND1054: Control bore. Background nitrate concentrations were originally found at this location. Expansion of the irrigation area will require additional control bores to be installed. Nitrate concentrations continued to fluctuate at this location throughout the 2015-2016 monitoring period, as is graphically displayed in Figure 12. All samples were above median value for nitrate when compared to the longterm record (Table 16).

Table 16 Borehole 1 GND1054 TBP groundwater monitoring well 2015-2016

BH 1 GND1054	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	pH	SO^4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			52.4		34.2			7.54			<0.003	11.6	6.3		13.8
20-Oct-15	47	12.6	39.3	<5	26.4	57.3	3.1	6.96	7.3	31.9	<0.003	5.46	6.5	9.9	14.1
15-Dec-15			41.7		28.2			7.65			0.004	6.79	6.6		14.3
15-Feb-16			43.9		29			8.28			0.004	6.69	6.4		14.2
18-Apr-16			45.9		29			8.67			0.025	7.31	6.5		13.9
17-Jun-16			45.9		30.9			9.04			0.035	8.8	6.4		13.5
N	4	66	50	20	122	2	66	123	66	66	122	122	12 3	4	121
Min	40	13.5	44	<5	22.4	50	2.7	6.34	12.5	22.7	<0.003	0.85	6.1	13.9	13.3
Max	47	30.4	124	10	69	51.2	4.4	9.7	13.3	36.2	0.051	29.7	6.8	19.3	16
Median	42	22.2	64	2	34	50.6	3.5	7.89	12.4	29.3	0.003	3.11	6.4	15.2	14
Mean	42	22	72.1	6	34.6	50.6	3.48	7.948	12.9	29	0.007	3.69	6.4	15.9	14

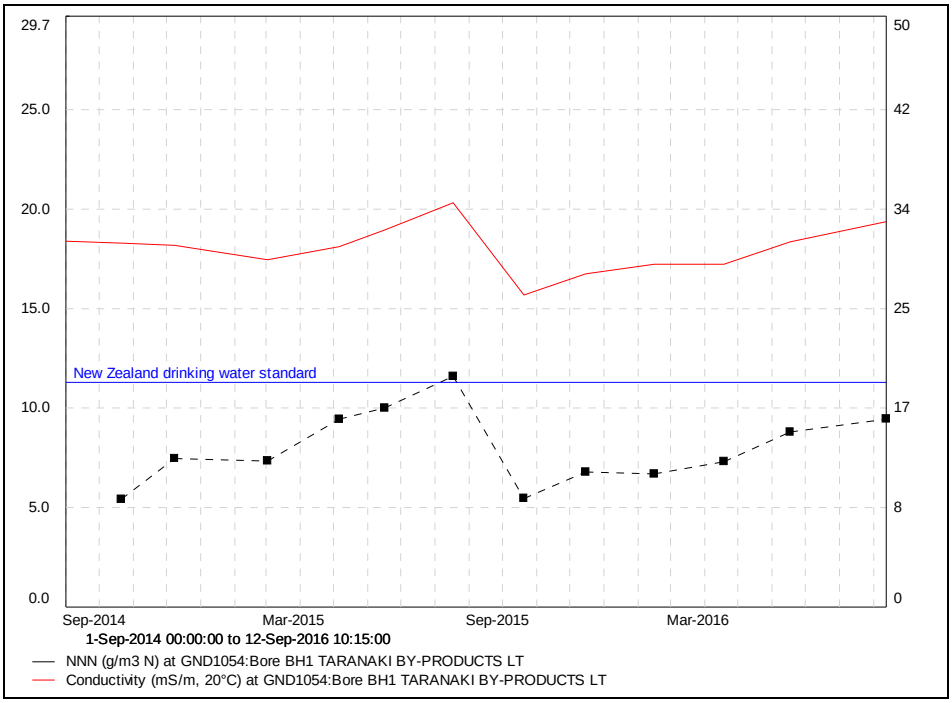

Figure 12 Nitrite/Nitrate concentration and conductivity at BH 1 GND1054 September 2014-September 2016

GND1056: The monitoring well BH 3 GND1056 detailed a decreasing trend in this monitoring period (Figure 13), falling from 20.7 g/m^3 to 6.77 g/m^3 (Table 17). The reason for this decline is due to TBP not irrigating on this paddock for the entirety of the monitoring period, the paddock was put to crop.

Table 17 Borehole 3 GND1056 TBP groundwater monitoring well 2015-2016

GND 1056 BH3	ALKT	CA	CL	COD	CONDY	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	pH	SO4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			63.9		43.5			7.49			<0.003	20.7	6.2		14.1
20-Oct-15	46	16.1	52.2	<5	32.9	56.1	3.4	7.32	8.5	40.4	0.018	10.2	6.4	6.7	14.3
15-Dec-15			45.2		27			8.49			0.008	5.25	6.5		14.3
15-Feb-16			44.4		27.5			9.51			0.008	6.2	6.4		15
18-Apr-16			46.1		28			10.35			<0.003	6.52	6.4		14.6
17-Jun-16			46.6		28.6			10.81			0.017	6.77	6.4		13.9
N	4	66	50	20	121	2	66	122	66	66	122	122	12 2	4	120
Min	32	11.3	41.6	<5	23.3	46.4	2.5	6.51	5.8	23.6	<0.003	3.51	6	4.2	11.6
Max	42	84.5	106	21	111	51.2	3.9	11.51	45.3	60.9	0.054	111	6.7	6.1	15.8
Median	40	16.7	50.4	2	30.4	48.8	3	9.69	9.2	31.8	0.002	9.48	6.4	4.8	14.3
Mean	38	24	55.5	6	38.4	48.8	3.1	9.614	13.1	34.5	0.008	20.62	6.4	5	14.3

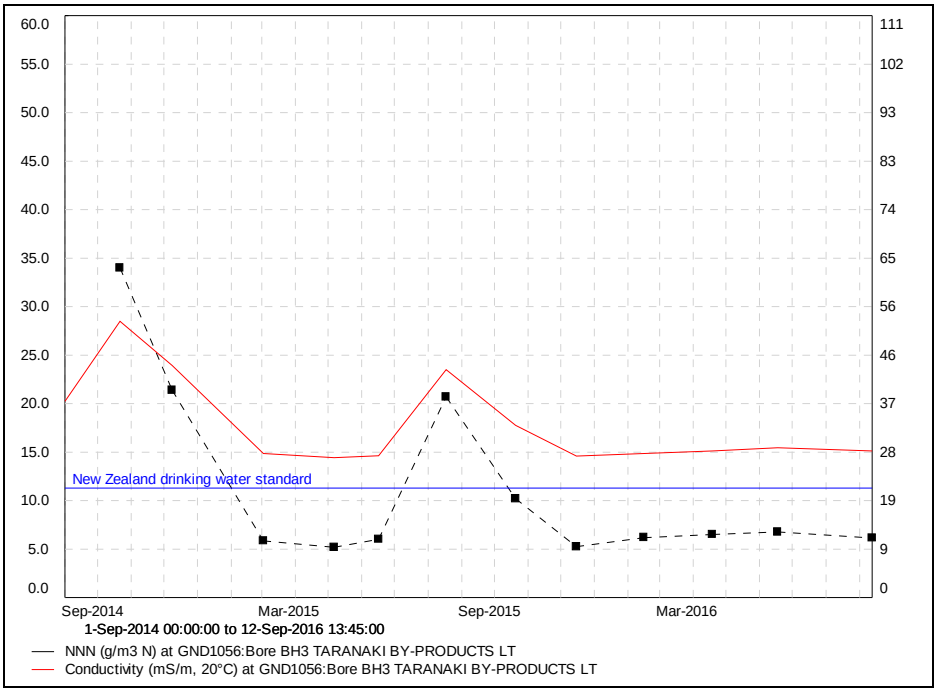

Figure 13 Nitrite/Nitrate concentration and conductivity at BH3 GND1056 July 2014-September 2016

GND1057: Nitrate levels showed a decreasing trend in this monitoring period in BH 5 GND1057 (Table 18), prior to an increase just at the cut off of the period for this report (1 July 2016), from 18.9 g/m^3 to 11 g/m^3 (Figure 14). Combined nitrate loadings across paddocks in the direct locality of this bore hole, paddocks 13-17 inclusive were between 205 kg N/ha and 513 kg N/ha, with three of the five paddocks receiving in excess of 300 kg N/ha in this monitoring period.

Table 18 Borehole 4 GND1057 TBP groundwater monitoring well 2015-2016

GND1057 BH4	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	pH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			56.2		40.7			4.68			0.013	18.9	6.2		14.1
20-Oct-15	47	18.1	54.3	<5	37.7	57.3	3.9	5.41	11.2	43.2	0.005	14.9	6.4	14.1	14.1
15-Dec-15			47.6		38.5			6.3			0.004	14.3	6.4		14.4
15-Feb-16			54.1		36.2			7.03			0.004	12.9	6.4		14.8
18-Apr-16			53		35.3			7.64			0.007	9.75	6.4		14.4
17-Jun-16			53.5		35			7.86			0.028	11	6.4		13.9
N	4	66	49	20	121	2	66	122	66	66	122	122	122	4	120
Min	46	15.3	50.4	<5	26	56.1	2.7	3.85	7.5	25.2	<0.003	4.58	6.1	11.5	11.1
Max	48	17.5	121	12	102	58.6	7.7	7.86	41.6	79.4	0.117	85.2	6.7	19.4	15.6
Median	47	15.6	62.3	2	33.1	57.4	3.5	6.601	9.1	36.8	0.002	7.26	6.4	16.4	14.2
Mean	47	16.7	67.5	5	37.2	57.4	3.76	6.484	11.2	39.4	0.006	12.14	6.4	16	14.2

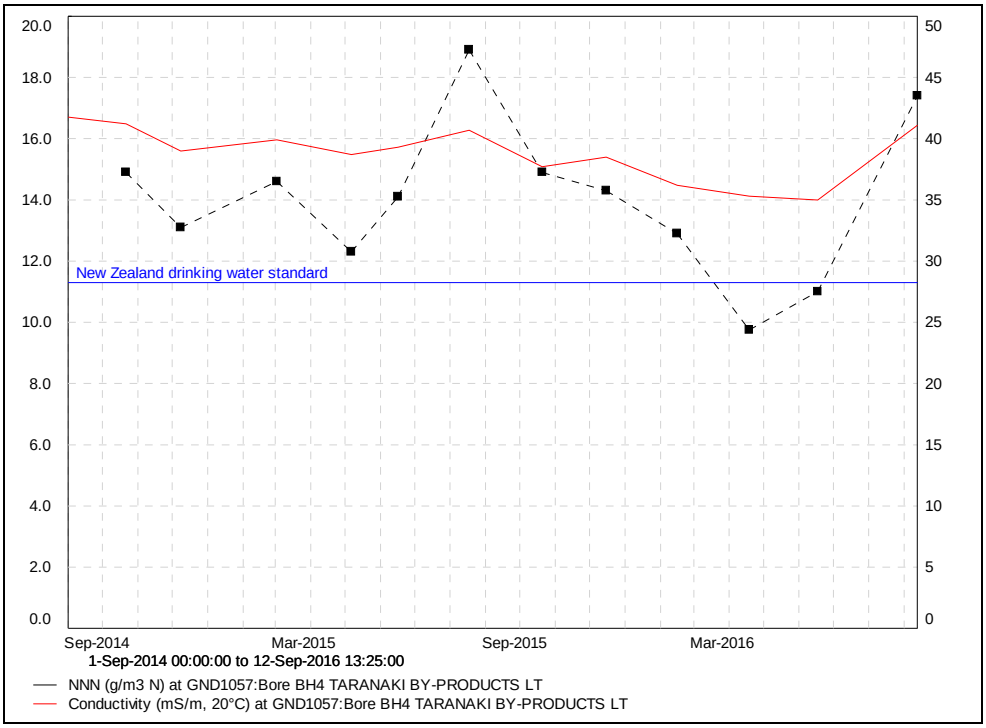

Figure 14 Nitrite/Nitrate concentration and conductivity at BH4 GND1057 September 2014-September 2016

GND1058: The spring on Shearers' property (GND1058) is used as a water supply for a number of households. It is therefore monitored to ensure that it meets Drinking Water Standards as well as to assess any off-site effects of effluent irrigation at TBP. The spring is relatively close to the boundary with Normanby block, though there is a shallow gully in between.

In this monitoring period the concentration of nitrate detailed its largest fluctuation to date (Table 19), from 7.79 g/m^3 N in August 2015 before dropping back to 4.27 g/m^3 N in July 2016, Figure 15. The New Zealand health standard for nitrate-nitrogen concentration in drinking water for domestic supply is 11.3 g/m^3 N. Monitoring

showed that nitrate levels in the spring, while remaining moderate, increased from 1.4 to 5.2 g/m^3 N over a period of about 15 years to June 2015, Figure 10 and 15.

Table 19 Shearer bore GND1058 2015-2016

GND1058 Shearer	ALKT	CA	CL	COD	CONDY	HCO_3	K	MG	NA	NH_4	NNN	pH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			88.2		37.3					0.007	7.79	6.5		14.7
20-Oct-15	39	21.8	79.2	<5	39.2	47.6	2.9	14.8	34	<0.003	7.46	6.5	6.6	14.6
15-Dec-15			75		36.4					<0.003	6.52	6.6		15.2
15-Feb-16			71.3		34.3					<0.003	5.64	6.6		16.7
18-Apr-16			68		33.5					<0.003	4.59	6.5		15.6
17-Jun-16			65.3		33.2					0.016	4.27	6.7		14.8
N	4	66	49	20	122	2	66	66	66	123	123	12 3	4	103
Min	41	13	51.5	5	24.5	52.5	2.37	7.9	23.6	<0.003	1.35	6.4	6.4	10.6
Max	45	21.3	86.5	33	37	54.9	3.4	13.8	32.5	0.024	5.53	7.1	8.5	16.9
Median	42	14.7	64.6	2	29.5	53.7	2.8	9	27.4	0.002	2.44	6.6	7.4	14.6
Mean	43	16.1	65.8	6	29.4	53.7	2.86	9.9	27.8	0.004	2.61	6.6	7.4	14.6

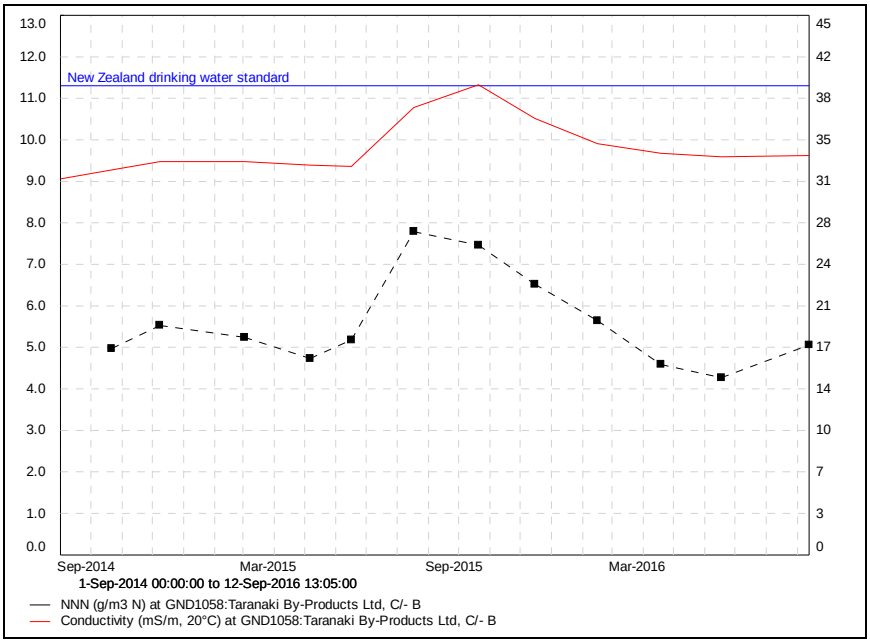

Figure 15 Nitrite/Nitrate concentration and conductivity at GND1058 Shearer September 2014-September 2016

GND1346: Nitrate concentrations continued to steadily increase in well GND1346 in the 2015-2016 monitoring period (Figure 16). The increase, from 31 g/m^3 N in August 2015, to 58 g/m^3 N in February 2016 (Table 20) was a 27 g/m^3 N in a six month period. These concentrations are not sustainable. TBP should be mindful to not overload the paddocks, as paddock 40 received in excess of 500 kg N/ha, which is in the direct locality of this monitoring well.

Table 20 Borehole 5B GND1346 TBP monitoring well 2015-2016

GND1346 BH5B	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	PH	SO_4	TEMP
	g/m3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20˚C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	˚C
17-Aug-15			49.1		47.5			2.65			<0.003	31.8	6.3		14.5
20-Oct-15	39	39.4	53.7	<5	55.2	47.6	5.9	3.97	19.6	41.8	0.018	41.7	6.3	12	13.9
15-Dec-15			64.1		63.5			4.78			<0.003	51.9	6.4		14.2
15-Feb-16			70		64.1			5.36			<0.003	58.8	6.2		14.5
18-Apr-16			74.3		65.9			5.71			<0.003	52.9	6.1		14.1
17-Jun-16			71.9		67.8			6			0.012	52.1	6.3		13.5
N	4	26	41	20	64	2	26	64	26	26	64	64	64	4	64
Min	28	11.9	35.2	<5	21.3	34.2	3.6	1.8	6.8	25.3	<0.003	4.11	6.1	4.7	13.4
Max	42	74.6	112	20	118	37.8	8.9	5.59	41	70.3	0.062	101	6.9	11.6	15.1
Median	32	26	60.5	2	47.2	36	5.1	4.44	14	35.7	0.004	29.2	6.4	7	14
Mean	33	33.2	64.2	6	51.9	36	5.4	4.23	17.6	39.4	0.011	35.4	6.4	7.6	14.1

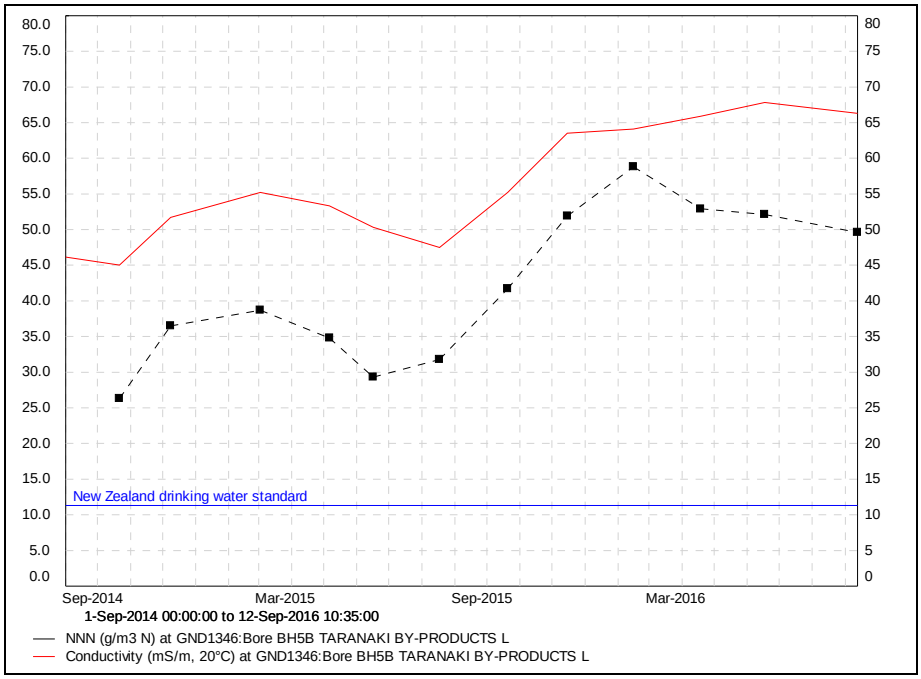

Figure 16 Nitrite/Nitrate (black squares) concentration and conductivity (line) at GND1346 September 2014-September 2016

GND1347: Analysis of borehole 6B in the 2015-2016 monitoring period is provided with historical, since 2005 (Table 21), monitoring data. This monitoring period marked the peak nitrate concentration at this location; which is graphically provided in Figure 17. The range of nitrate in this period was 51.3 to 75.9 g/m^3 N.

This concentration of nitrate within the groundwater is not sustainable and will require limited or no applications in the upcoming monitoring period future. The combined application average of nitrate loadings across paddocks 6, 7 and 8 was 384 kg N/ha, ranging from 254-565 kg N/ha.

Table 21 Borehole 6B GND1347 TBP monitoring well 2015-2016

GND1347 BH6B	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH4	NNN	PH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20˚C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	˚C
17-Aug-15			103		80.3			6.31			<0.003	63.4	6.2		13.9
20-Oct-15	26	66.6	115	<5	94.3	31.7	5.6	7.14	40.1	60.3	0.004	75.9	6.1	<1.0	13.9
15-Dec-15			120		93.8			8.49			0.006	73	6.1		14.2
15-Feb-16			125		93.9			9.26			<0.003	51.3	6		14.7
18-Apr-16			130		94.9			9.54			0.025	73.7	6.2		14.4
17-Jun-16			121		95.2			9.88			0.007	74.8	6.1		13.6
N	4	26	41	20	63	2	26	64	26	26	64	64	64	4	64
Min	20	10.3	36.1	<5	18.4	24.4	2.1	6.08	5.9	21.1	<0.003	0.89	6	1.1	11.5
Max	23	61.2	128	48	92.6	25.6	5.3	10.19	32.6	54	0.197	70.7	6.7	3.4	15.8
Median	22	19.2	82.7	2	41.4	25	3	7.94	10.9	28.6	0.004	27.4	6.3	2.5	14.1
Mean	22	27.2	74.7	7	50.1	25	3.4	7.96	15.3	33.6	0.011	33.9	6.3	2.4	14.19

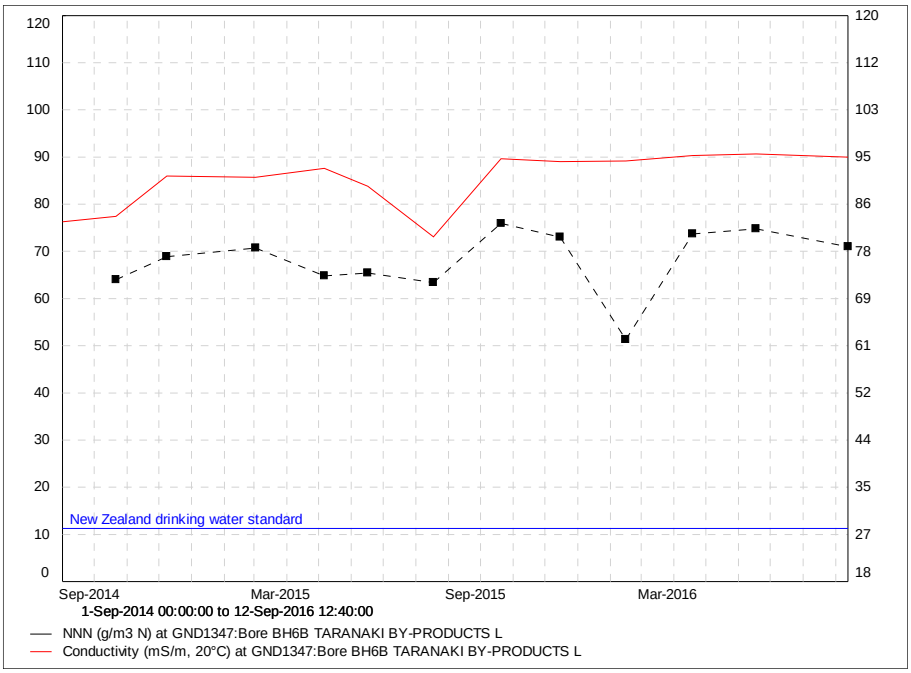

Figure 17 Nitrite/Nitrate (black squares) concentration and conductivity (line) at BH6B GND1347 September 2014-September 2016

GND1348: The groundwater analysis of GND1348, borehole 7, is provided in Table 22. This table also provides background analysis data from this well since 2005. This well contains a great deal of variation, for example records detail a variation of ground water level of almost four meters over the course of a one year period in the 2011-2012 monitoring period.

The variation is evident in Figure 18, where by in this period the fluctuations were 18 g/m^3 N to 72 g/m^3 N over the course of four months, from October 2015 to February 2016, which is closely linked to when TBP ceases discharging to the Inaha Stream and begins discharging to land. Nitrate/nitrite concentrations of 72 g/m^3 N is not a sustainable concentration, TBP will be required to limit applications moving forward.

Table 22 Borehole 7 GND1348 TBP monitoring well 2015-2016

GND1348 BH7	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	pH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			51.9		39.2			8.88			0.021	20.7	6.2		13.8
20-Oct-15	43	10.7	51	<5	38.4	52.5	4.7	9.14	13.6	35.8	0.008	18.8	6.4	12.7	14.3
15-Dec-15			75.9		69.6			10.31			<0.003	58.2	6.4		14.2
15-Feb-16			86.5		81.7			10.77			0.007	72.8	6.2		14.8
18-Apr-16			84.9		78.5			11.41			0.035	62.4	6.2		14.4
17-Jun-16			83.1		78.8			11.8			0.05	68.1	6.3		13.5
N	4	26	40	20	63	2	26	63	26	26	63	63	63	4	63
Min	35	11.2	37	<5	19.5	42.7	2.8	8.62	6.1	22.2	0.003	2.59	6.1	4.9	12.9
Max	37	51.2	103	37	98.1	45.1	5.8	11.63	27.1	47.3	0.096	83.3	6.9	9.7	16.3
Median	36	13.7	59	2	28.3	43.9	3.6	10.7	8.4	26.2	0.004	7.97	6.5	5.3	14.1
Mean	36	18.3	63.4	8	39.9	43.9	3.9	10.41	10.5	28.7	0.015	20.9	6.5	6.3	14.3

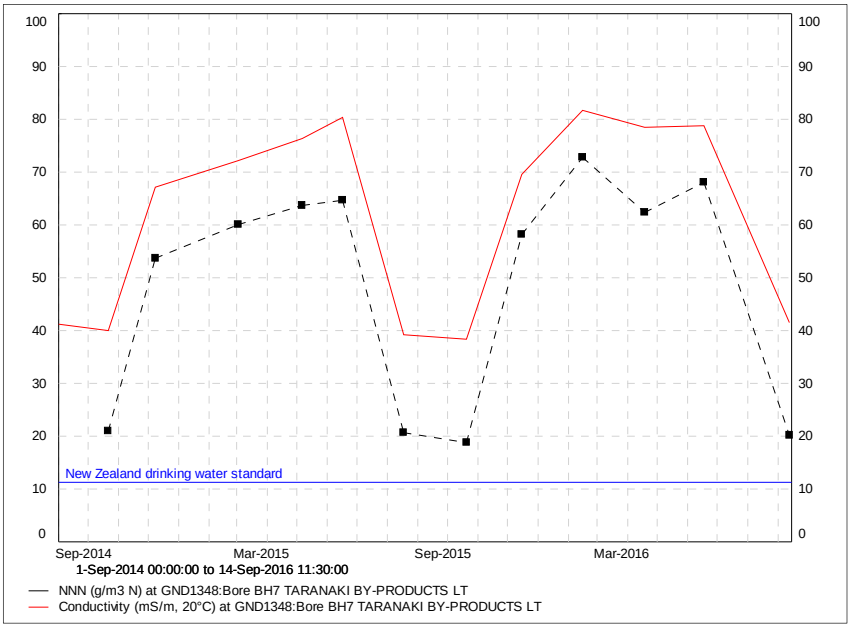

Figure 18 Nitrite/Nitrate concentration and conductivity at BH7 GND1348 September 2014-September 2016

GND1349: Borehole 8/GND1349 is located on the western side of Katotauru/ Normanby block. In this monitoring period the nitrate concentration fluctuated between 42 g/m^3 – 15g/m^3 N. The trend for nitrate in this well was one of a decreasing trend, most likely as direct a result of TBP limiting application of wastewater and associated fertiliser in this specific area in this monitoring when compared to the previous one.

Combined application of wastewater and fertiliser were below 300 kg N/ha across all paddocks in the immediate vicinity of this monitoring bore.

Table 23 Borehole 8 GND1349 TBP monitoring well 2015-2016

GND1349 BH8	ALKT	CA	CL	COD	CONDY	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	pH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			89.4		69.7			9.15			0.019	42.8	6.2		14
20-Oct-15	66	56.6	163	<5	78	80.5	5	9.13	33.6	50.4	<0.003	25.5	6.2	6.7	14.3
15-Dec-15			177		84.9			9.95			0.008	32.7	6.2		14.3
15-Feb-16			116		61.1			10.64			0.01	21.5	6.2		14.6
18-Apr-16			114		56.3			10.08			0.006	15.4	6.1		14.3
17-Jun-16			98.3		57.1			11.36			0.005	15.5	6.3		13.9
N	4	26	41	20	64	2	26	64	26	26	64	64	64	4	64
Min	37	14.2	39.6	<5	23	45.1	2.6	8.64	8	25	0.003	3.01	6.1	2.2	13.5
Max	49	128	388	18	154	53.7	6.7	11.49	76.5	65.2	0.031	53.4	7	8.8	16.7
Median	43	42.8	125	2	53.3	49.4	4.2	10.82	24.8	40.7	0.002	14.8	6.3	5.1	14.2
Mean	43	43.5	138.8	7	59.5	49.4	4.1	10.68	25.1	39.7	0.006	17.5	6.3	5.3	14.3

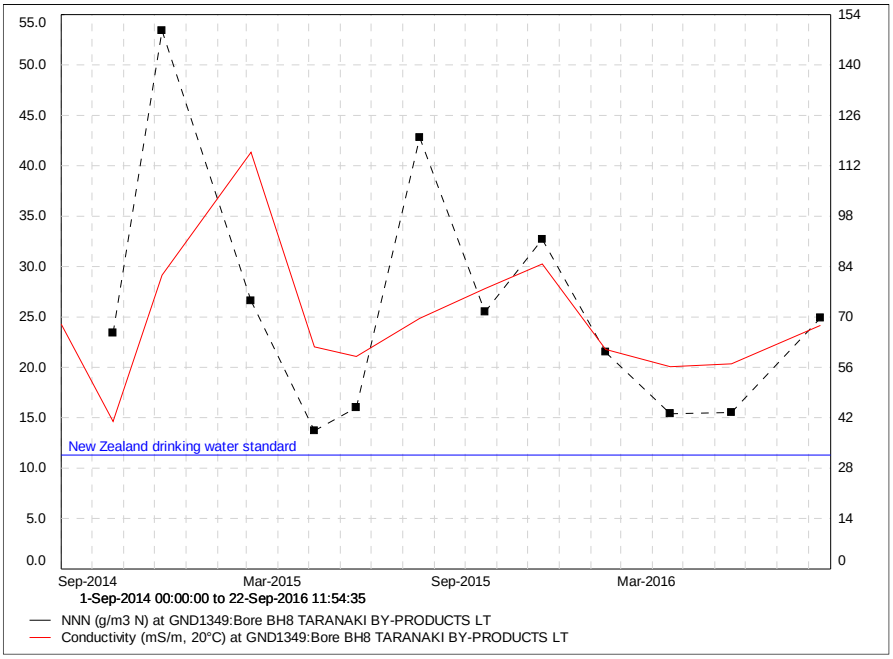

Figure 19 Nitrite/Nitrate concentration and conductivity at BH8 GND1349 September 2014-September 2016

GND2225: Borehole 9/ GND2225 is located down gradient on the eastern side of the Kingi block. In this monitoring period Nitrate values were all below median values when compared to the historical database for this location (<21.9 g/m^3 N) which has been collected since 2011 (Table 24). In Figure 20, the link between conductivity and nitrate can be clearly seen, with a decrease in concentrations of nitrate and conductivity observed to have occurred between May and October 2015. This lines up with when TBP would have been discharging to the Inaha Stream as the wastewater is no longer discharged to land.

Table 24 BH 9 GND2225 TBP monitoring well 2015-2016

GND2225 BH9	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	PH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			38.9		29.1			4.78			0.037	13.2	6.3		15
20-Oct-15	36	18.6	47.4	<5	34.4	43.9	2.7	5.51	13.8	30.8	0.006	16.6	6.4	4.2	14.1
15-Dec-15			56.7		35.4			6.15			<0.003	17.8	6.4		14.2
15-Feb-16			53.2		34.3			6.74			0.025	16.7	6.3		14.3
18-Apr-16			50.5		34			6.75			<0.003	16.9	6.2		14.2
17-Jun-16			47.9		34.2			6.05			0.017	16.1	6.4		13.6
N	4	6	19	6	21	2	6	24	6	6	21	21	21	4	21
Min	31	18	44.9	5	33.1	37.8	2.7	5.12	12.5	31	0.003	14.8	6.2	2.5	13.2
Max	37	28.5	98.2	8	46.6	37.8	3.5	>10.34	17.1	39	0.129	32.9	6.6	4.8	15.9
Median	34	23.5	51.5	4	37.3	37.8	3	6.02	16	35	0.005	21.6	6.4	3.2	14.4
Mean	34	23.7	54	6	39	37.8	3.1	6.64	15.3	35.2	0.013	23	6.4	3.4	14.44

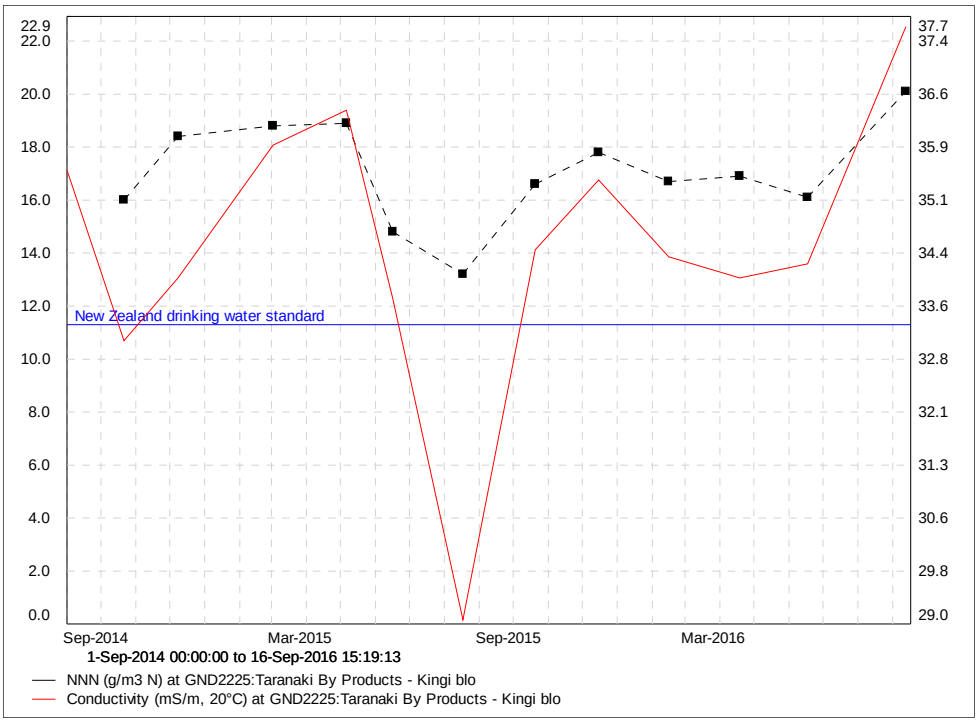

Figure 20 Nitrite/Nitrate concentration and conductivity at BH9 GND2225 September 2014-September 2016

GND2226: Borehole 10/GND2226 is located at the edge of the 200 meter buffer zone along Normanby Road (Figure 9). Measured nitrate values have fluctuated at this monitoring well in this monitoring period (Figure 21 & Table 25), slightly trending up from 55 g/m^3 N to 63.5 g/m^3 N. The analysis in this period was very close to the median value for NNN, 58.9 g/m^3 N. Note analysis began at this well location in October 2011.

In the previous monitoring period, the combined application of wastewater and fertiliser in this specific area was 701 kg N/ha, in this period the combined total was

much lower, 75 kg N/ha in paddock 29 upon direction from the Council. The surrounding loadings were 268 kg N/ha Paddock 28 and 226 kg N/ha paddock 30. This concentration of nitrate within the groundwater in not sustainable and is an example of overloaded wastewater application and fertiliser.

Table 25 Borehole 10 GND2226 TBP monitoring well 2015-2016

GND2226 BH10	ALKT	CA	CL	COD	COND	HCO_3	K	LEVEL	MG	NA	NH_4	NNN	PH	SO_4	TEMP
	g/m^3 $CaCO_3$	g/m^3	g/m^3	g/m^3	mS/m@20°C	g/m^3 HCO_3	g/m^3	m	g/m^3	g/m^3	g/m^3 N	g/m^3 N	pH	g/m^3	°C
17-Aug-15			93.4		73.5			4.51			<0.003	55.5	6.2		14.2
20-Oct-15	32	53.9	92.3	<5	76.9	39	4.4	5.25	33.6	51.1	0.004	56.1	6.2	2.5	13.9
15-Dec-15			103		76.6			6.85			<0.003	57.7	6.2		14.3
15-Feb-16			104		77			7.69			0.004	61.2	6.1		14.6
18-Apr-16			113		81.7			8.25			0.007	63.5	6		14.4
17-Jun-16			104		82.3			8.02			0.01	58.4	6.2		13.8
N	4	6	21	6	23	2	6	24	6	6	23	23	23	4	23
Min	22	39.8	68.2	<5	63.1	26.8	3.7	4.99	25.3	45.6	<0.003	50.7	6.2	1.6	13.3
Max	29	59.4	104	8	90.8	35.4	4.8	9	39.2	56	0.089	79.8	6.4	3.4	16.7
Median	28	48.3	86.6	2	74.2	31.1	4.6	5.88	32.4	50.8	0.006	58.9	6.2	3.3	14.1
Mean	26	48.4	87.6	6	76	31.1	4.4	6.69	32.3	51.2	0.019	61.6	6.2	2.9	14.3

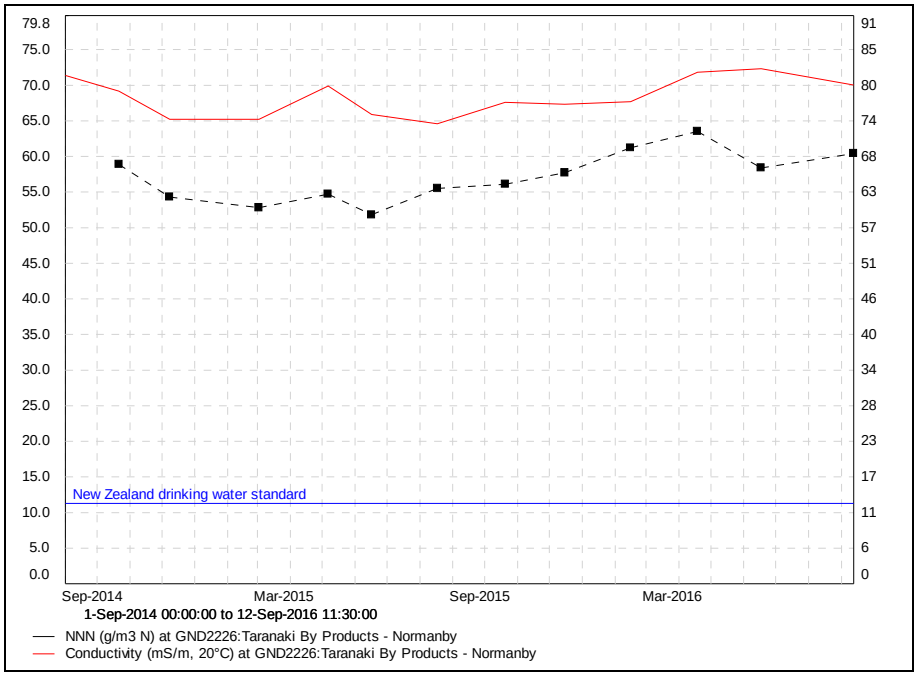

Figure 21 Nitrite/Nitrate concentration and conductivity at BH10 GND2226 September 2014-September 2016

2.1.5.9.2 Groundwater discussion

Analysis of the wastewater specific groundwater monitoring wells detailed that four wells currently contain nitrate concentrations greater than 50 g/m^3 N. This would indicate that the combined applications of wastewater and fertiliser have been over applied to such a degree that the physical nutrient uptake by crops/ grasses is less than what would be required to utilise the available nutrients.

TBP has complied with their consented obligation, whereby the total amount of nitrate to be applied from wastewater is limited to specifically 300 kg N/ha and 200 hg N/ha in their irrigation area, however it is with the applications and the application method of fertiliser which will require mitigating moving forward.

The use of an injection spreader to apply stickwater/Zeal Grow fertiliser by-passes the vegetation soil interface and directly injects high strength nitrogen rich fertiliser in to the soil which then percolates and infiltrates in to the relatively shallow groundwaters. While this method has been successful in mitigating the odour generation potential associated with this form of fertiliser it is not necessarily the correct method for controlling groundwater nitrate. TBP began the use of stickwater fertiliser in the year 2010; the long term record provided in Figure 22 denotes the sharp increase in NNN concentrations within the groundwater at monitoring well GND1346.

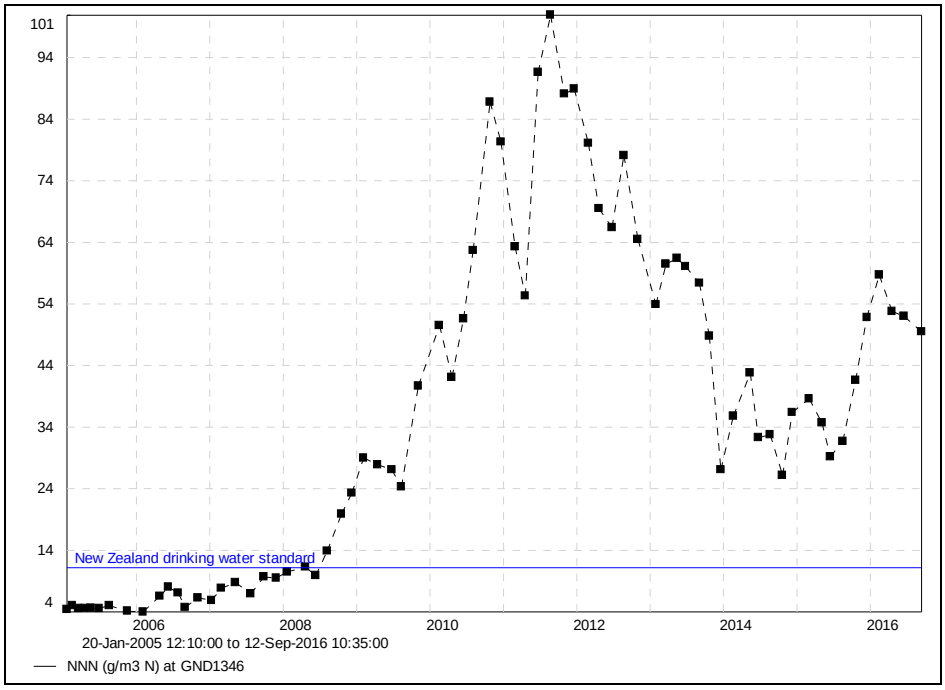

Figure 22 Nitrate/Nitrite Nitrogen concentrations long term record GND1346

The Council does not believe the current high concentrations of nitrate as a direct result of the TBP irrigation and fertiliser application is sustainable. TBP will now look to remove stickwater/fertiliser application from their current method of disposal. If they do not remove the application of stickwater they will be required to meet a strict total paddock loading rate[3] which will take into account the leachable component of the wastewater/fertiliser and safeguard the groundwater from future occurrence of significantly elevated nitrate concentrations.

2.1.6 Solid waste burial

The disposal of solid wastes from meat rendering operations under consent 5495-1 is undertaken in accordance with a management plan that has been approved by the

[3] Potential proposed paddock loading rate; all forms of nitrogen to 250-300kgN/ha including fertiliser 2016-17 monitoring year

Council. Raw material that cannot be processed is buried on the Kohiti Road property opposite the rendering plant (Figure 10 & Figure 22). Pits must be dug to certain specifications after notification of Council; material placed in the pits must be covered with soil within four hours to control odour and stormwater must be diverted away.

Figure 23 Location of the burial pit monitoring wells

The monitoring undertaken by the Council in respect of the burial pits includes the following:

- Monthly inspections of the burial pit location;
- Quarterly groundwater monitoring of the burial pit specific groundwater monitoring wells; and
- In addition TBP will inform the Council when they intend to undertake burial pit operations.

These wells which are in addition to the wastewater irrigation monitoring wells discussed in the previous section are specific for assessing the groundwater downgradient of the burial pits.

In this period there were five burial operations, of which four were related to the burial of feathers from a process malfunction and a single burial of sand trap waste. Feather burials were in the region of 15 ton per occasion.

The burial pits as detailed above were monitored on four separate occasions (Table 26). The long term analysis has inferred that a plume exists of nitrate rich groundwater which is a direct result of the burial operations. The Council installed an additional bore in this monitoring period, GND2506, analysis in this period detail a variation from 20 g/m^3 NNN to 25.9 g/m^3. The new location also accounts for the highest concentration of NNN in this monitoring period (Figure 24).

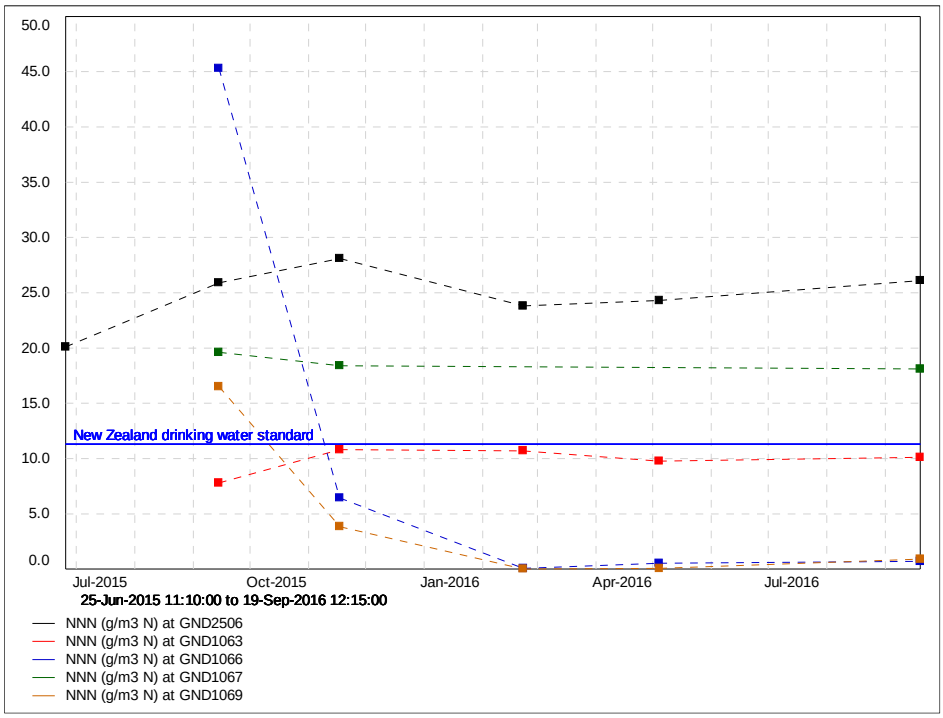

Figure 24 Nitrite/Nitrate concentrations in the active burial pit monitoring

Table 26 Burial specific groundwater monitoring wells 2015-2016

Well ID	Parameter	COD	COND	LEVEL	NH_4	NNN	pH	TEMP
	Date	g/m^3	mS/m@20°C	m	g/m^3 N	g/m^3 N	pH	°C
GND1063	14 Sep 2015	5	45	6.8	<0.003	7.78	6.4	14
GND1063	17 Nov 2015	<5	36.5	7.27	<0.003	10.8	6.7	14.1
GND1063	22 Feb 2016	16	30	8.66	0.004	10.7	6.3	14.5
GND1063	04 May 2016	<5	28.2	9.45	0.005	9.77	6.5	14.3
GND1066	14 Sep 2015	33	177	5.45	34.5	45.3	6.6	14.7
GND1066	17 Nov 2015	40	260	5.67	126	6.44	7	14.6
GND1066	22 Feb 2016	34	274	5.99	154	0.06	6.8	15.1
GND1066	04 May 2016	44	280	6.3	165	0.53	6.9	14.8
GND1067	14 Sep 2015	12	84.6	5.29	0.004	19.6	6.2	14.6
GND1067	17 Nov 2015	17	101	5.72	18.4	18.4	6.8	15.8
GND1067	22 Feb 2016			6.27	N/S			
GND1069	14 Sep 2015	14	91.5	4.86	6.87	16.5	6.4	14.8
GND1069	17 Nov 2015	<5	18.8	5.72	<0.003	3.84	6.9	15.1
GND1069	22 Feb 2016	42	216	6.41	119	0.01	6.7	16.6
GND1069	04 May 2016	80	214	6.84	137	0.06	7.2	15.9
GND2506	14 Sep 2015	35	52.8	3.83	<0.003	25.9	6.5	14

Well ID	Parameter	COD	COND	LEVEL	NH_4	NNN	pH	TEMP
	Date	g/m^3	mS/m@20°C	m	g/m^3 N	g/m^3 N	pH	°C
GND2506	22 Feb 2016	55	51.8	5.77	0.004	23.8	6.3	14.4
GND2506	04 May 2016	-	52.7	6.76	-	24.3	-	14.4

However, elevated ammonia and COD concentrations were clearly evident this monitoring period, with monitoring wells GND1066 and 1069 containing the highest concentrations and the largest range (Table 26). Remedial actions such as a denitrification trench may need to be considered by TBP if adverse effects are noted on the main stem of the Inaha Stream. At present there are no measureable effects on the main stem of the Inaha Stream, as a result of these burial operations.

In similarity to last year, a watching brief is being maintained by TBP.

2.2 Air

No emission monitoring or deposition gauging is undertaken as part of the air quality monitoring for TBP. Instead, an odour survey of the surrounding area is carried out at each of the monthly air quality inspections. These inspections identify any issues that need to be addressed (as set out in Section 2.2.1).

Consent 4058 has as its main effects criterion a requirement that the odour is not to be noxious or offensive or objectionable, at or past the legal boundaries of the property. Further details of air-related incidents can be found in the Register of Incidents in Section 2.3.

2.2.1 Inspections

24 July 2015
No objectionable odours or visible emissions were found beyond the site boundary. Noticeable sulphur pond odours were found along Kohiti Road adjacent to the bridge. Ponds 1 and 2 were low and the liner was visible, it was outlined by staff that the stormwater from the western side of the main building has been directed to the fire pond which has significantly reduced the volume of water going to pond 1. The crust across both ponds was complete and looked dry, no gas bubbles were observed to be discharging through the crust at the time of inspection.

The stormwater catchment around the load-in area was clean and no product or bins were stored outside, all load-in doors were closed. Pond 3 had a healthy looking pasture cover across its surface and very little odour was noted around the area. Pond 4 had three aerators operating, the DO was measured to be 7.1 (TRC) and 7.4 (TBP). Ponds 5 and 5A were both in use, pond 6 had all four aerators operating, the discharge from the V-notch was measured to be 9.5 cm (equivalent to 2.17 L/s). The Inaha staff gauge (SG) was 3.45 (equivalent to 1.179 L/s), and dilution factors were being achieved during the inspection.

The transport yard had some minor hydraulic oil patches on the sealed surface. Bark-like odours were found around the bio-filters, no visible emissions were sighted during the inspection. Works were occurring to stabilise the stormwater outlet concrete. The discharge from the fire pond was slightly turbid but was not affecting the receiving

waters. It was outlined that production had dropped off lately due to the season. Two irrigators (rain-guns) were operating (paddocks 7 and 89); no ponding or run-off was observed. The burial pit had not been recently used. Stream and discharge samples were taken during the inspection, inter-lab comparisons to occur for the pond 6 and 3 unnamed tributary sites. No incidents were reported.

25 August 2015
Wind was variable from the North. Odour surveys conducted downwind of site found intermittently noticeable cooking type odours along Normanby Road which were considered extremely light.

Ponds 1 and 2 were found to be low with a visible liner. Strong sulphur type odours were noted downwind and bubbles observed to be discharging through the crust of pond 1 essentially across its entire surface. One pump was operating and conveying the liquid to pond 3. The crust at the inlet end was split but very little odour was noted downwind of the pond. Pasture across the rest of the pond appeared healthy and was completely covering the surface. Pond 4 had four aerators operating, the DO was measured to be 4.62 g/m^3 O_2, and surface foam remained localised. A musty type odour was found immediately downwind of the pond. Ponds 5 and 5A were both in use, pond 6 had four aerators operating and was at 0.24 m. The discharge at the V-notch was measured to be 9 cm, SG at Kohiti Road bridge 3.4 m. Dilution factors were being achieved.

The Inaha Stream was inspected at points throughout the site and no detrimental effects were observed and no fugitive inputs were found. The discharge from the fire pond was clear and free of hydrocarbon sheen, the stormwater input into the pond was minor and clear. The load-in area was considered clean and the main doors were shut in between product deliveries. No product was stored outside during the inspection.

All ducting and pipework appeared in good repair, noticeable 'musty bark' type odours were present around the bio-filters and visible emissions were discharging, the leachate was being directed to the sump and being pumped to pond 3. No irrigators were operating during the inspection, no recent burial had occurred and the pit was covered with soil. No incidents were reported. Discussions held regarding quarterly news-letters, it was outlined that TBP is waiting on date confirmation for the rugby club rooms before advertising the meeting in the news-letter.

16 September 2016
The wind was North West and variable, speed 4-5. Odour surveys conducted beyond the site boundary found noticeable intermittent plant odours at the corner of Normanby and Kohiti Roads. The pond odours were found beyond the site boundary along Kohiti Road near the bridge. The odours were distinct but not continuous due to the gusty wind conditions at the time. Pond 6 was discharging 11 cm at the V-notch, the Inaha Stream was variable between 3.4-3.6 m at the staff gauge at the bridge. Dilution factors were being achieved.

Ponds 1 and 2 were quite low, the liner was visible, the fatty crust was intact across both ponds except where the wastewater inputs into pond 1. No bubbles were observed to be discharging through the crust. Works were occurring around the area to level the surroundings through the use of soil from earthworks which were occurring for the new cow shed under construction on the northern side of Katotauru Road. Pond 3 had a healthy looking vegetative crust across the entire pond. Pond 4 had 5 aerators

operating. A musty type odour was present and surface foam was remaining localised. The DO was measured to be 3.45 g/m^3 O_2 (TRC probe), the TBP probe was reading 2.68 g/m^3 O_2. Ponds 5 and 5 A were both in use, four aerators were in use in pond 6 and the DO of the discharge was measured to be 1.85 g/m^3. No effects were observed in the receiving waters downstream of the discharge point. The fire-pond had a slight green tinge and lots of ducks were present, the discharge was free of hydrocarbon sheen and essentially clear.

No fugitive inputs into the Inaha Stream were observed during the inspection. The stormwater input into the fire pond was clear but a slight fragrant odour was found. Waste management area contained mainly scrap metal, drums of oil were secure with lids in place, and the fire pit was not in use at the time of inspection. No visible emissions were observed from any bio-filters, the leachate was being pumped to pond 3. Load-in doors were open as product was being moved around; fallen stock were stored outside the beef room load-in area, the stormwater catchment around the area was essentially clean.

No recent burials had occurred. Rain gun irrigators were operating in paddocks 84 and 97, no ponding or run-off was observed. No Zeal Grow was being applied during the inspection. No incidents were reported. Stream and discharge samples were taken during the inspection.

4 November 2015
At the time of inspection the wind was variable from the South, speed 4. Odours surveys conducted downwind of the plant found intermittently distinct pond and cooking odours along Katotauru Road. Localised odours were found around the blood room during load-in operations. Engineering works were continuing within the plant at the load-in area. The main load-in doors were closed except during product deliveries. The stormwater catchment around the main building had a small volume of spilled product, regurgitated material was also outside in the bunded area.

Ponds 1 and 2 were found to be relatively low with liner visible, the fatty crusts were complete across the surface and bubbles were discharging through. Pond 3 had a small area of liquid visible at the inlet end and straw had been spread around recently. Pond 4 had four aerators in operation and the DO was 5.13 g/m^3 O_2. Pond 6 had three aerators operating, no discharge was occurring and the level was 0.36 m.

Run-off into the fire pond from the transport yard was turbid brown and discolouring the initial 1/3 of the pond, the discharge from the fire pond into the receiving waters was clear and free of hydrocarbons. Several 200 L drums of oil were stored unbunded adjacent to the fire pond near the outlet into the Inaha Stream. The potential for any spills to escape the site is considered high risk.

The bio-filters were inspected, fugitive emissions from the exposed concrete pipe along the southern wall were found to have a distinct meaty odour. All other emissions from the bio-filters had a barky odour, the leachate from the system was being pumped to pond 3.

The waste management area was also found to have several 200 L drums of waste oil stored in the vicinity, of which two drums were found to not have lids and some spilled emulsified oil was present around the base of the drums. The oil was not found to be tracking anywhere during the inspection. Work was progressing on the new cow

shed, it was outlined that a large sand trap/separator will be installed at the shed and from there the effluent will be discharged into the TBP ponds.

No recent burial of product had occurred. One irrigator was in operation, no ponding or run-off was observed. No incidents were reported. The Inaha Stream was turbid throughout its length and the SG was 3.18 m.

The following action is to be taken: Block off the fugitive emissions from the bio-filter to ensure discharges occur through bark to treat the odours. Recover the oil from the waste management area and ensure all drums are stored with lids in place. Ensure storage of bulk oils occurs with consideration of potential spill risks.

30 November 2015
At the time of inspection the wind was from the East, turning West throughout the morning. Odour surveys conducted downwind of plant found essentially constantly noticeable plant odours along Katotauru Road. These were considered to be a mixture of the anaerobic ponds and a meaty odour. The plant was not operating during the inspection. All factory doors were open as engineering works were occurring at full pace on the new beef line. The site was busy with contractors and staff were cleaning all aspects of the site. Strong meaty odours were found around the factory when down wind of the open doors. Feather and regurgitated product was sighted inside the load-in area, the new load-in area doors were shut, some regurgitated product was stored outside as well as empty/clean offal bins.

The storm water catchment was tidy. Some dried blood product had spilled around the blood room area. The storm water discharge into the fire pond was crystal clear and minor, no effects were observed within the pond. Ponds 1 and 2 were found to be quite low and the fatty crust was intact across both ponds. Strong sulphur odours were noted downwind. Pond 3 had a good cover, pond 4 had four aerators operating, the DO was 6.5 g/m^3 and the surface was very foamy, pond 5 and 5A were both in use. Pond 6 was not discharging and was at 0.4 m, three aerators were operating. Works were occurring on the DAF plant to repair a crack in the separation chamber. Works were also occurring on sections of the newer bio-filter to reduce back pressure. The mat over the perforated pipe was being removed as fat was unable to escape and so was blocking the perforations causing fugitive discharges from the main line. Since the works began the pressures have lowered and the bio-filter was operating more effectively. No fires were occurring at the site. Roto-rainer irrigator was operating in paddock 42 and the Williams travelling irrigator was operating in paddock 65. No ponding or run-off was observed. The burial pit was covered and no product had been recently buried.

No incidents were reported. The Inaha Stream was flowing clear throughout and was at 3.08 m at Kohiti Road Bridge. Works were progressing on the new cow shed, the concrete for the effluent sump was being poured, effluent will continue to be pumped to the TBP ponds as per the current situation, the solids separator will likely be installed on the TBP site.

16 December 2015
At the time of inspection the wind was from the West. Odour surveys conducted beyond the site boundary found general plant odours were noticeable along Kohiti Road directly downwind of the factory. The bio-filter was continuing to have works undertaken to remove the blocked cloth, no laterals were exposed, visible emissions were discharging through the areas where the cloth had been removed and the odour

was distinct. Staff outlined more cooling would be required as the extracted air temperature entering the bio-filter is currently too high, this results in increased visible emissions and reduced treatment of odours. All other bio-filters were free of visible emissions, with very little leachate discharging from the system.

The scrubber return line had been excavated and was being repaired, a temporary line had been run since Friday. Ponds 1 and 2 had filled significantly and pond 6 was very low, staff gauge 0.18 m, with the sludge island clearly visible in the middle of the pond. Three aerators were operating, no discharge from pond 6 was occurring and no irrigators were operating. Pond 3 had new straw on the surface at the inlet and fresh bales were on standby. Pond 4 had 5 aerators were operating with lots of surface foam, DO only at 0.48 g/m^3 O_2 (TRC probe). Musty odours were present and some of the foam was being wind blown across to pond 6.

The load in area was clean and all factory doors were closed when not in use. The transport area was dry and dusty during traffic movements. Foundation works were continuing around the tank area for more tanks. The new cow shed was progressing well, as was the effluent infrastructure. Fresh water was discharging into the fire-pond from TBE due to a leaking pipe, storm water input into the fire-pond approximately 1 L/s and had a slight meaty and sweet odour, the discharge into the Inaha Stream was clear and no effects were observed within the receiving waters.

The Inaha Stream was in low flow and clear, SG 3.08. Stream and tributary samples were taken. A stick water sample was extracted, initial results from TBP testing had found that the total nitrogen concentration had been in general, less than what had been budgeted for, weekly sampling by TBP is to remain in effect. One internal odour complaint reported since last inspection, TBP staff responded but didn't find anything occurring, considered likely the complainant was making contact prior to Christmas as was the case last year.

20 January 2016
During the inspection the following was occurring. The wind was variable from the West, speed 3. Odour surveys conducted beyond the site boundary found light and intermittently noticeable 'cooking' odours along Normanby Road, the same odour was also found along Manu Road but was lighter.

Distinct pond odours were also noted along Kohiti Road when down-wind of ponds 1 and 2. The main load-in doors were opened when trucks were loading-in, the secondary load-in area doors were also open as the area out front was having spilled product cleaned up. The stormwater catchment around the load-in area was essentially clean and attention was being paid to recovering spilled product.

There was a small blood spill at the rear of a parked trailer unit near the cooling water input into the fire pond, a swarm of flies covered the spill and quite a strong odour was noted from the spill.

Ponds 1 and 2 were quite low and the liner was visible. Bubbles were found to be discharging through the fatty crust. The pond 3 cover was intact and straw had been applied to the surface around the inlet end. Pond 4 had five aerators operating, the DO was measured to be 1.91. Ponds 5 and 5A were in use. Pond 6 had three aerators operating, the sludge island in the middle was visible. No discharge to surface water was occurring from the pond. A minor hydrocarbon odour was found around the truck

yard area and the site surface was darkened from the application. Ponded water around the area had hydrocarbons present.

All bulk chemicals stored in the TBE area adjacent to the truck park were secure. The storm water discharge into the fire pond was clear, the discharge from the fire pond into the Inaha Stream was clear and free of hydrocarbon sheen. Bio-filter 2 was still not operational, it was outlined by staff that the works are expected to be completed within two weeks. The works to remove the cloth covering laterals of the new bio-filter are nearly completed and the back pressure has dropped, no visible emissions were found from any of the bio-filters. The leachate was being contained to the sump area and being pumped to pond 3. The fire pit was not operating, observed were lots of wood and pallets stacked around the area. 200 L oil drums stored below the bio-filters were secure and all lids were in place.

No fugitive discharges into the Inaha were found during the inspection, the stream was in low flow, the staff gauge reading 3.05 at the Kohiti Road bridge. Feathers had recently been buried due to a plant breakdown. The scrubber water source will likely utilise bore water when a ground water bore is reworked rather than using only pond water, the reason for the change is due to the high temperature of the pond water, it is thought that by using cooler cleaner water the scrubber effectiveness will be improved.

One 'roto-rainer' irrigator was operating in paddock 33, on the eastern side of the unnamed tributary. No ponding or run-off was observed and pasture was coping with the application. Samples were collected during the inspection and interlab comparisons are to occur.

4 February 2016
The wind was from the North East. Odour surveys were undertaken at sites down wind of plant during normal operations. Surveys found intermittent 'cooking' type odours were present along Normanby Road at the pull-off area uphill from Old Normanby Road. The odour was light and infrequent due to the gusty wind conditions, no other odours associated with plant activities were found.

11 February 2016
During a brief inspection the following was observed. The wind was variable westerly. Odour surveys were undertaken downwind of plant during normal operations. Very light and intermittent 'cooking' type odours were found at the corner of Normanby and Ngutu Road, the odour was barely noticeable and very infrequent.

25 February 2016
At the time of inspection the following was observed. The wind was westerly. Odour surveys undertaken beyond the site boundary found noticeable 'cooking' odours at the corner of Ngutu and Normanby Roads, and along Kohiti Road also, the odour was intermittent.

No recent burial of product had occurred and the pit was filled in. The load-in doors were shut and the stormwater catchment was clean. The blood bund at the load-in point had blood inside and a distinct odour was noted around the area, the blood room doors were also open which was adding to the odour around the area.

Ponds 1 and 2 were low with visible freeboard. The crust was dry looking and no gas bubbles were observed discharging through it. Pond 3 had a good pasture cover which

appeared healthy. Pond 4 had five aerators operating and the DO was 1.2 g/m^3 O_2 , with localised musty odours noted. Pond 6 had three aerators operating, no discharge was occurring. Boiler blow down water was bypassing a drain conveying the liquid to pond 1 and was instead discharging into the fire pond. Staff outlined the area around the drain was to be cleared of debris to allow the liquid to enter the drain.

The bio-filters were inspected, a distinct odour was noted around the area, the bark cover looked complete and no fugitive emissions were found to be escaping the exposed concrete pipe. The waste management area had three drums of used oil which did not have lids in place, oil present on the grass around the drums but not tracking beyond the immediate area.

The fire pit was not in use during the inspection. Solids had been removed from the sediment trap stored alongside pond 1. All leachate had been directed into the pond, the solids are to be buried in the near future. All tanks, pipes and ducting appeared in good repair.

The discharge from the fire pond was clear, no effects were observed within the receiving waters, the Inaha was in low flow, SG showed 3.02 at the Kohiti Road Bridge. One travelling irrigator operating in paddock 1, pasture coping with the application and no run-off or ponding was observed. Staff outlined that regular sampling of the unnamed tributary had shown the nitrate levels to be variable. A spring on the eastern side was unblocked and sampled and found to have elevated nitrate levels which continued to rise during subsequent sampling, other inputs into the tributary are also being sampled as they are identified. The new cowshed on Katotauru Road is operational; the old one is still in use as well at this stage.

30 March 2016
During the inspection the following had occurred. The wind was South East, speed 2-3. No objectionable odours or visible emissions were noted beyond the site boundary. Odour surveys conducted downwind of the site found 'pond' type odours along Kohiti Road.

A smoke odour was noted along Katotauru Road from a box thorn vegetation fire occurring in a paddock upwind of the rendering plant. Strong pond odours were noted around the inlet to pond 3. Regurgitated product odour was also found at the load-in area where the regurgitated product was stored. The main load-in doors were open during the inspection as a huff was working the area. No deliveries were occurring at the time of inspection. Staff outlined that the plant through-put had been low of late but expected volumes to increase towards the end of this dairy season.

Lots of spilled feathers and bone were around the area and further down the hill, staff outlined the area was to be cleaned before the end of the shift. No recent burial of product had occurred and no pit was excavated. No fugitive inputs into the Inaha Stream were found during the inspection. A discharge of water was occurring adjacent to Kohiti Road from a leaking shower drainage pipe. Plumbers were being contracted to fix the pipe. The discharge was minor and soaking away before tracking to surface water.

Ponds 1 and 2 were found to be low with visible liners at the top, both crusts were dry and no bubbles were observed to be discharging through the crust. Pond 3 pasture

cover was intact across the entire surface, straw had been added to the inlet end around the inlet pipe. Strong pond 2 odours were prevalent downwind of the inlet. Pond 4 had five aerators operating and the DO was reading 1.89 g/m^3 O_2. Pond 6 had three aerators operating, no discharge was occurring from the pond.

Bio-filters were inspected and the cover appeared complete across all beds, no visible emissions were observed to be discharging through and no leachate was leaving the beds. The fire pit was in use. It was evident from the scorched earth surrounding the area that the fire which was lit the previous day had got slightly out of control. Staff outlined that water was used to bring the fire back under control, a digger was adjacent to the pile to keep re-stacking the pile as it burned down, no prohibited materials were observed within the pile.

The fire pond was inspected and found to have a green turbid appearance from algal growth, lots of ducks were on the pond. The stormwater and cooling water discharges were clear, no effects were observed within the Inaha Stream from the inputs.

The SG was measuring 3.03 m at the Kohiti Road bridge. No irrigators were sighted operating during the inspection. The new milking shed on Katotauru Road was discharging into the current pond system at the plant but plans are being investigated to separate the effluent and irrigate it straight onto the paddocks. The sump was full at the time of inspection.

26 April 2016
The wind was variable from the West, no objectionable odours or visible emissions were found during the inspection. Odour surveys conducted beyond the site boundary found noticeable site odours at the edge of Okaiawa township along Ahipaipa Road, the odour was intermittent and quite weak. Strong pond odours were noticed directly downwind of ponds 1 and 2 along Kohiti Road.

The Inaha Stream was in low flow, SG was 3.04. The stream was flowing clear throughout the length of the site influence, the discharge from the fire pond was clear and no effects were observed in the receiving waters, no discharge into the stream was occurring from pond 6.

No processing of product was occurring during the inspection, however deliveries of product was occurring. The load-in doors were shut in between deliveries. The site was tidy throughout and further cleaning was occurring. Ponds 1 and 2 were found to have a wet looking crust with bubbles discharging through around the surface of pond 1, both ponds had liners visible. The pasture across pond 3 appeared healthy and complete. Pond 4 had five aerators operating and a musty odour was noted directly downwind. Irrigators were operating in paddocks. All pasture was coping with applications and no ponding or run-off observed.

Dairy shed effluent ponds were inspected and found to be tidy. Both shed systems will be directed onto land separately in the near future to reduce the loading on the site ponds. The fire pile was not lit during the inspection, timber and other materials were awaiting incineration. No visible emissions were found at the bio-filters and no odours were present. A small volume of leachate from the beds was discharging into the sump. The oil drums stored in the waste management area need addressing as lids

have been removed and some oil/water is ponded around the drums. No recent burial of material has occurred and no pit was excavated.

27 May 2016
At the time of inspection the wind was from the North. No objectionable odours or visible emissions were found beyond the site boundary. General plant odours were found at the corner of Kohiti and Normanby Roads.

Both load-in doors were closed except when the huff was working the area or deliveries were occurring. The stormwater catchment around the load-in area was considered clean, all drains around the site which convey wastewater to the ponds were clear of blockages and coping with inputs.

Ponds 1 and 2 were found to be quite full. The fat crust was wet at the inlet of pond 1 and gas bubbles were observed to be discharging through the crust. Strong localised sulphur/pond type odours were present downwind of the pond. Pond 3 had a complete cover and very little odour was noted around the area. Pond 4 had four aerators operating, the DO was showing 0.16 g/m^3 O_2 but the probe was inspected and found to be dirty. Pond 5A was in use; pond 6 was at 0.6 m and was discharging through the V-notch at 9 cm or 1.9 L/s. The Inaha Stream SG measured 3.2 m, or 640 L/s, dilution factors were being achieved.

The stream was running clear, no fugitive inputs were found and no effects were observed through the length of the site influence. The discharge from the fire pond was clear although the pond was turbid at the far end due to the run-off from the Jackson Transport yard.

Thick steam emissions were discharging from the final bio-filter and the odour was found to be 'musty bark'. The leachate was discharging into the sump and being pumped to pond 3.

The waste management area was inspected, the oil drums which had overflowed had mixed with stormwater creating a rainbow sheen on the ponded water, due to stockpiles of dirt the liquid could not discharge into the Inaha Stream. Site staff agreed to remediate the area and address the stored oil drums to prevent future occurrences.

No recent burial of product has occurred. It was outlined by staff that a gas powered generator at the site had been experiencing low power output and a part is being sourced. In the interim a diesel generator has been hired to provide power for the irrigators. No irrigation was occurring during the inspection as the hired generator was experiencing issues, which were being worked on at the time.

It was also outlined that the plant had recently been experiencing fan shut-downs due to electrical issues, the trip switch for the system was altered to prevent future failures. The effluent generated at the two dairy sheds was still being processed through the wastewater ponds but this is likely to be separated in the near future, both dairy shed effluent ponds were satisfactory at the time of inspection.

30 June 2016
During the inspection the following was observed. The wind was from the South East. No objectionable odours or visible emissions were found during the inspection. A noticeable cooking/pond/bio-filter odour was noted along Katotauru Road. The odour was distinct and essentially constant.

Due to saturated ground conditions no irrigators were found to be operating at the time of inspection. The run-off from the Jackson Transport yard was turbid and as a result the fire pond was quite discoloured. The discharge into the receiving waters was not changing the clarity of the stream due to its high flow.

Pond 6 was discharging 9 cm at the V-notch, the SG was 3.34 m at the Kohiti Road bridge, dilution factors were being achieved. The water intake structures were clear of obstructions. Ponds 1 and 2 were low and the liner was visible, the crust was wet looking across its surface, bubbles were observed discharging through and the odour was strong directly downwind of the ponds. Pond 3 had a good cover which appeared healthy. Pond 4 had four aerators operating and the surface of the pond was very foamy. Some of the foam was being wind-blown towards pond 3. Pond 5 had one aerator operating to reduce sludge within the pond. Pond 6 was at 0.2 m with two aerators operating.

Works have occurred to fix a leaking join in the buried irrigation line in the paddock across the Inaha Stream adjacent to the factory water intake. Two more minor leaks have been identified further up the paddock towards Katotauru Road and have been scheduled for repair.

Works are also to occur on the TBE bio-filter to repair the main concrete line and to fix a slump in the north east corner of bed 1. Visible emissions were discharging from all beds, the odour was distinctly musty, all beds were saturated and ponded water was present on the beds in low points, the leachate from the system was being pumped to pond 3. The pump was coping with the inputs. The channel which conveys leachate to the sump was recently cleared of bark debris. The waste management area was tidy. The oil drums had been removed from site and all ponded water was free of hydrocarbon sheen. The fire pit was not in use and very little material was in the area. No recent burial of product had occurred. Staff outlined the throughputs had been slow of late and are expected to slow further in the coming weeks. No incidents were reported.

2.3 Investigations, interventions, and incidents

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

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The incident register includes

events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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

In the 2015-2016 period, the Council was required to undertake significant additional investigations and interventions, or record incidents, in association with TBP's conditions in resource consents or provisions in Regional Plans. These are discussed in the following Table 27.

Table 27 Unauthorised incidents reported from 1 July 2015 to 30 June 2016

Date	Incident	Description	Outcome
15 January 2016 at 4:16 pm	Odour	This notice is to advise that a complaint was received concerning odour (offensive) discharging from TBP	A visit to the complainant's property in Okaiawa found no odour present during the first 15mins. During the next 15 mins 4-5 light/distinct "by product" odours were detected in short durations of 2-5 secs. The odour was not considered offensive. The wind was blowing from the north-west.
16 January 2016 at 12:39 pm	Odour	This notice is to advise that a complaint was received concerning odour (offensive) from TBP.	A visit to the complainant's property in Okaiawa found no odour present during a 30 minute period. The wind had changed direction from north-west to west.
17 January 2016 at 9:30 pm	Odour	This notice is to advise that a complaint was received concerning odours (offensive) discharging from TBP.	A visit to the complainant's property failed to identify any odours associated with TBP. A distinct "TBP" odour was detected along Katotauru Road.
20 January 2016 at 1 pm	Odour	Inspection undertaken in response to a complaint received regarding objectionable odours discharging beyond the site boundary.	Infrequent 'factory cooking odours' were intermittently noticeable along Manu Road. The same 'cooking odour' was also noted to be infrequently present and slightly stronger along Normanby Road. Distinct pond 1 and 2 odours were present along Kohiti Road when directly down wind of ponds 1 and 2. The complainant was given a selection of wastewater samples to smell and identified the 'stick water' odour to be the one which was impacting on his property frequently. The 'stick water' has in the opinion of the Investigating Officer an odour similar to that of the 'cooking odour' which was intermittently noticeable at the complainant's property. Discussions were held with the complainant at length about the factory operations and odour elimination technology used at the site. It was requested that a meeting is held with the complainant and TBP management to discuss the perceived ongoing impact that factory operations are having on the complainant's ability to enjoy his property, and possible solutions going forward. The following action is to be taken: Ensure no objectionable odours discharge beyond the site boundary, ensure noticeable odours are not continuously present for two hours or more, or frequently present for four hours or more, as required by special condition 3 of resource consent 4058-4.

Date	Incident	Description	Outcome
20 January 2016 at 9:00 pm	Odour	In response to a complaint an odour survey was carried out in and around TBP at Okaiawa.	Found no objectionable and or offensive odour at complainant's property. Slight intermittent noticeable odour from ponds and plant was detected in vicinity of cow underpass on Normanby Road. Plant manager was phoned and informed of outcome from odour survey.
21 January 2016 at 5:00 pm	Odour	In response to a complaint an odour survey was conducted on Manu Road, Okaiawa.	Found intermittent noticeable odour. No objectionable and or offensive odour detected.
26 January 2016 at 9:46 am	Fire	Notification was received from N.Z. Fire Service of a tier three fire at TBP.	Fire was plant internal only. No smoke or odour offsite. Site compliant at time of inspection.
1 February 2016 at 8:06 pm	Odour	An inspection was undertaken in response to a complaint regarding odour emanating from TBP on Kohiti Road, Okaiawa.	Investigation found intermittent noticeable odour beyond the boundary of the property. Inspection of the site found that the doors were open to the plant - these were closed on officer's arrival to the site. The following action is to be taken: Ensure that no objectionable or offensive odour discharges beyond the boundary of the property.
20 February 2016 at 3:18 pm	Odour	An inspection was undertaken with regards to an odour complaint.	The inspection found a strong gusty Westerly blowing. There were infrequent intermittent noticeable odours at various down wind sites from the plant. Nothing objectionable or offensive could be detected at these sites.
29 February 2016 at 11:10 am	Odour	Odour surveys undertaken beyond the site boundary in response to a complaint received regarding objectionable odour.	Wind west, speed 4-5. No odours attributable to site activities were found at the complainant's property and the complainant acknowledged that it was not present at the time. Strong site odours (mix of pond and product) were found along Kohiti Road and chicken litter fertiliser odours were found along Katotauru Road from the paddocks upwind of the plant. The complainant outlined that during the previous night and early in the morning the odour discharging from the factory was strong.
7 March 2016 at 6:40 am	Odour	An inspection was undertaken with regards to an odour complaint.	A very strong gusty West wind blowing at the time of inspection. Various downwind sites were checked with no odour detected at any site. Nothing detected at various upwind sites of the plant.
29 April 2016 at 7:02 am	Odour	An inspection was undertaken for an odour complaint.	A NW to WNW wind blowing at the time of inspection. A noticeable odour was detected at the corner of Ngutu and Ahipaipa Roads. The odour was present for approximately 20 minutes until the wind had built up and the odour dissipated. The odour was noticeable along Ahipaipa Road to Division Road and part way down Division Road. The odour was not objectionable or offensive.
6 May 2016 at 11:00 am	Odour	In response to a complaint an odour survey was carried out in the vicinity of TBP.	Intermittent mild noticeable odour was detected beyond site boundary. No objectionable and or offensive odour detected beyond site boundary at time of odour survey. Site compliant at time of inspection.
7 May 2016 at 10:30am	Odour	A complaint was received regarding odours about the plant.	Inspection found that only noticeable odours were detected by the old factory on Normanby Road - in the Inaha Stream hollow. The doors were shut during the inspection - then opened up for normal access- this did not cause a waft of odour - Paul Drake was on site doing his normal rounds - Nothing untoward was noted.

Table 28 Summary of registered incidents relating to TBP 2000-2016

Year	Total	Water	Land	Air		
				Total	Odour	Substantiated odour
2000-2001	55	3	0	52	49	3
2001-2002	20	1	0	19	16	5
2002-2003	22	4	5	13	12	5
2003-2004	26	6	2	18	18	3
2004-2005	36	4	2	30	30	5
2005-2006	28	5	4	19	19	2
2006-2007	34	8	3	23	23	5
2007-2008	55	6	3	46	45	8
2008-2009	28	1	2	25	25	2
2009-2010	11	1	0	10	10	0
2010-2011	19	1	1	17	17	0
2011-2012	13	0	0	13	13	0
2012-2013	41	2	1	38	37	6
2013-2014	14	3	1	10	9	1
2014-2015	7	0	0	7	7	0
2015-2016	14*	0	0	13	13	0
*one compliant was related to a fire at the facility 26 January 2016 at 09:46am						

Over the 2015-2016 monitoring period a total of 14 complaints were registered in connection with emissions to air from the rendering plants' operation (Table 27 & 28). Twelve of the thirteen incidents were related to complaints by members of the public; the other complaint was from the NZ Fire Service.

All of the complaints are investigated and assessed by officers of the Council as soon as practicable after each complaint has been lodged. Whereby an officer would visit the location of the complaint and also assess the surrounding area for evidence of the incident.

In this monitoring period none of the complaints were substantiated, on seven occasions (50%) the Council officer found odour from the TBP site to be noticeable but not objectionable. On six occasions (43%) there was no odour detected by the officer. On one occasion (7%) the complaint was related to a fire at the facility.

A summary of complaints against TBP since 2000 is provided in Table 28.

2.4 Community consultation

A community liaison group was set up in July 2000. Its purpose is to facilitate communication between TBP, the Okaiawa community and the Council regarding resource consent matters. The group members are the Okaiawa Community Liaison Officer, representatives from TBP (Managing Director and Plant Manager), staff of the Council (Director - Resource Management, Compliance Manager, and Inspecting Officer), and site neighbours. Initially meetings were held monthly, then on an 'as required' basis.

The reviewed consents for discharge to land by spray irrigation (3941-2) and for discharge of emissions to air (4058-4) both had a condition inserted that requires liaison with interested parties on exercise of the consent.

Special condition 19 on discharge permit 3941-2 to discharge treated wastewater onto or into land by spray irrigation, imposed on 21 December 2005, reads:

The consent holder and staff of the Regional Council shall meet as appropriate, quarterly or at such other frequency as the parties may agree, with representatives of Ngati Manuhiakai Hapu and other interested submitters to the consent, and any other interested party at the discretion of the Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of the resource consent, in order to facilitate ongoing consultation.

Special condition 4 on the replacement discharge permit 4058-4 to discharge emissions to air, issued on 11 October 2011, reads:

The consent holder shall consult and inform the local community about activities on the site, specifically those relating to the exercise of this consent, by:

a. Four times per year, providing a newsletter to all land owners and/or occupiers of properties within 3 kilometres of the site; and
b. Convening a meeting with the Director – Resource Management, Taranaki Regional Council (or their delegate), and the local community annually or at such other frequency as the parties may agree.

A meeting under consent 3941-2 was held at Te Aroha marae on 13 August 2016, during the monthly hapu meeting. About 15 members of Ngati Manuhiakai attended, together with representatives of the TBP (1) and the Council (2).

Some of the topics discussed included:

- Plant operation, raw material sources, and local employment
- Wastewater treatment
- Buffer zones
- Effects on Inaha Stream and bio-monitoring
- Areas of particular importance to the hapu
- Riparian planting
- Communications
- Potential for marae funding
- Biological training
- Signage for urupa

A meeting under consent 4058-4 was held at Okaiawa Rugby Club rooms on 29 October 2015 and another by request of the community on 3 March 2016. A newsletter with an invitation to the meeting was hand delivered to local residents, and mailed to a number of community organisations and groups. In the first meeting held in October two persons attended, including a representative of the rugby club, together with TBP (2) and Council (3) staff. In the second meeting of the year 22 persons from the community attended with TBP (2) and Council (4).

Matters covered included:

- Plant operation, performance and events with regard to odour
- Recent, planned and considered improvements for odour control
- Odour generation locations
- Odour assessment criteria
- Increased ducting
- Licensed irrigation areas and buffer zones
- Community newsletters
- Planning of development at the facility.

Two community newsletters were produced during the 2016-2016 reporting period. Additional newsletters were not required.

2.5 Riparian management

TBP have a riparian management plan (RMP) to help manage the natural waterways that are on the property. Originally there were four separate RMPs (RMP 90014, 90921, 90938 and 901363) but in 2015 these were merged into one large plan that covers all the waterways associated with TBP and they now have RMP 90014. The plan relates to the Inaha stem between Ahipaipa and Normanby Roads, covers the area upstream of Kohete Road bridge and the western tributary that runs through the Katotauru/Upper Inaha Roads irrigation area (Figure 25).

TBP have two resource consents that relate to riparian management on the Inaha Catchment. The first is associated with Permit 2049-4. This permit was issued in 1999 and has special condition 18, requiring a yearly contribution to the Taranaki Tree Trust. This donation is $2,100/year (GST exclusive and adjusted according to the consumer price index). The second consent relates to erecting and placing two culverts in the Inaha Steam. Land use consent 6431-1, it was issued in 2004 with conditions 9 and 10 clearly stating that stock must be keep out of all water bodies upstream of the Kohete Road bridge, and fencing and planting needs to be completed within four year (by 2008) and maintained into the future.

Donation to Taranaki Tree Trust (Permit 2049-4)
The donation to the Taranaki Tree Trust has been made each year since 1999. These donations have been used to subsidise riparian planting along the main stream and its tributaries. The effect of these measures will be to increase shading, with consequent decrease in water temperature and in nuisance algal growth; to reduce stock access and bank erosion; to reduce nutrient and sediment input to watercourses; and to enhance the appearance of the riparian margins.

At the end of 2015-2016, a total of $34,260.86 of TBP funding had been spent on or was committed to riparian management covering planting of stream margins. The works were carried out throughout the catchment, mainly along reaches above the Okaiawa plant. Funding was granted to landholders at a rate of 50% on plants as a rebate.

Figure 25 Riparian management plan for the TBP site

Fencing and planting above Kohiti Road (consent 6431-1)
Placement of two culverts in Inaha Stream for farm access above Kohiti Road, required TBP to meet consent condition agreeing to prevent stock access, fence and plant a section of the waterway approximately 2 km in length, between Ahipaipa and Kokiri Roads.

Since 2009, TBP have undertaken a programme of works to meet this consent condition. This has included, spraying and removal of willows, planting, fencing and replanting.

It was discovered in 2013 that in one section of the stream the fence had not maintained and stock had been let into the riparian margin. This was brought to the attention of TBP and the fencing has been permanently reinstated with new plantings completed in 2015 and 2016. This delay on replanting was due to an opportunity to do some follow up willow spraying and mechanical removal prior to putting in native plants.

At this stage the resource consent conditions for both Permit 2049-4 and consent 6431-1 have been met. TBP was quick to respond when they realised that the fencing was not in place and followed up with immediately. They have also been actively planting other areas on the farm and around the plant.

2.6 Provision of reports, management plans and certification

2.6.1 Reports and plans

TBP is required to provide to the Council various management plans, contingency procedures, certifications and monitoring reports under five consents, as summarised in the following Table 29.

Table 29 Requirements for reports and plans imposed by special conditions

Requirement	Consent Number (and Condition Numbers)	Dates(s) required	Compliance achieved
Emissions to air			
Certification that works, processes and equipment are operated according to good engineering practice	4058-4 (6)	Biennially from 30 April 2013	Certification received 31 July 2015, 3 months late
Air discharge management plan.	4058-4 (7)(9)	2 February 2012, annual review by 31 May, including contingency procedures	Initial plan received 3 July 2012. Annual reviews received 28 June 2016
Monthly report under section 3.2 of management plan on daily activities log, weather, bio-filter performance	4058-4 (7)	Monthly	Reports received, late on the odd occasion
Wastewater to Inaha Stream			
Wastewater disposal management plan	2049-4 (13)(15)	31 December 2000, annual review from 31 May 2007	Plan received and approved Dec 2000. Annual review received 26 June 2016
Monthly report under section 5.2 of management plan on wastewater characteristics, flows and irrigated areas	2049-4 (13)(15)	Monthly	Reports received, late on the odd occasion
Wastewater to Inaha Stream			
Spray irrigation management plan	3941-2 (1)(3)	31 December 2000 annual review from 31 May 2006	Plan received and approved Dec. 2000. Annual review received 26 June 2016
Annual report under section 4.3 of management plan on wastewater characteristics, flows and irrigated areas	3941-2 (1)(3)	Annually	Nitrogen budget received 4 August 2016, then supplied monthly
Burial pits			
(Solid) Waste burial management plan	5495-1 (1)(3)	1 November 2000, subject to review on two months notice	Plan received and approved Oct. 2000. Review received 2 May 2014
Stormwater to Inaha Stream			
Contingency plan for spillage or accidental discharge	5426-1 (4)	31 August 1999	Plan received and approved Nov 2000. Review received 28 May 2014

Management plans (4) are required for the disposal of wastewater to Inaha Stream and to land by spray irrigation, for the burial of solid wastes, and for the discharge of emissions to air. TBP is required to undertake an annual review of both wastewater management plans and the air management plan, the reviewed plans to be provided by 31 May each year.

Certification by a suitably qualified independent person that the works, processes and equipment relevant to all discharges to air from the site are operational in accordance with good engineering practice is required biennially. Contingency plans (2) are required that address situations which could result in a discharge to air of odorous emissions that are offensive or objectionable beyond the boundary of the site, and spillage or accidental discharge to the stormwater catchment.

The air management plan that is required under the new air discharge permit incorporates the operations and maintenance manual and the contingency plan on loss of processing capacity that were required under the old permit.

Monthly monitoring reports are required from TBP under the wastewater management plan on various aspects of wastewater quality and disposal, and under the air consent/management plan about weather and bio-filter performance. An annual report is required under the spray irrigation management plan.

The required management and contingency plans and certification were all produced in 2000, except the air management plan, which was not required until 2012. For the period from 2000-2001 to 2008-2009, none of the required revision or certification documents were received by Council. The TBE plant was constructed in the interim. (It is noted that annual reviews of plans have only been required since wastewater and air discharge consents were changed in 2005 and 2007, respectively upon consent reviews invoked by Council).

In 2015-2016 year, TBP was required to review by 31 May the management plans for wastewater disposal to Inaha Stream and to land by spray irrigation, and for discharge of emissions to air. The reviews were undertaken in time. A review of the solid waste burial management plan was also undertaken in 2013-2014. The reviewed plans were satisfactory.

2.6.2 Air discharge engineering practice certification

The second biennial engineering practice audit under permit 4058-4, in respect of the works, processes and equipment relevant to all discharges to air from the site, was undertaken by air quality engineers Golder Associates on 20 to 22 May 2015. The audit focussed on aspects that contribute to the status of existing 'engineering practice':

- Physical condition of equipment: the state of odour control components, including consideration of materials used for construction
- Instrumentation review: the accuracy of selected instrumentation and the adequacy of instrument for monitoring the odour control system
- Design aspects: the current engineering design with respect to the air extraction, air cooling and bio-filter systems

The report on the evaluation is attached as Appendix III.

The report concluded:

Following Golder's audit of the TBP and TBE odour control system, it is concluded that the associated equipment, including ducts, fans, cooling system and biofilters, appear to be operated in a sound engineering state.

The existing cooling systems are generally achieving inlet airstreams to the biofilters [that] are normally 40°C or lower, which represents good practice. Future upgrades to the cooling systems, and a new WHE plant (as being considered by TBP) is likely to be necessary given the expansion to the bovine rendering systems.

It is concluded that an increased level of temperature and pressure gauge monitoring at various positions along the extraction, cooling and biofilter system would ensure standard engineering practice is achieved. Currently regular manual measurements are undertaken.

The existing biofilters and extraction systems are generally working effectively however most will require some maintenance or remedial actions as follows:

- *The Factory Air 2 biofilter requires a new air distribution and lateral system that can be cleaned.*
- *The Factor Air 2 air extraction from the blood room requires pre-cleaning of this air stream to remove blood dust and blocking up of the biofilter.*
- *The TBP concentrated sources biofilter has excessive water levels and the source and remediation measures need further investigation.*
- *The TBE concentrated sources biofilter has signs of air channelling around its central concrete manifolds that will in time require remediation by re-sealing its connections to the Novaflo laterals.*

The site has comprehensively documented management systems for ensuring reliable operation of process equipment and achieving processing goals. An expansion of the documentation to odour control system temperatures and pressures as well as some additional WHE operational information is recommended.

Finally it is recommended that the TBP concentrated source system is reviewed and upgraded in conjunction with the design and installation of a system that targets an expanded bovine rendering line. The opportunity exists for installing a system that manages emissions from both the new and existing bovine rendering equipment.

3 Discussion

3.1 Discussion of plant performance

By providing a service that utilises offal, fallen stock and other additional by-products of the meat and poultry industry, TBP activities play an important role in the sustainable management of natural and physical resources in Taranaki and the lower North Island.

In this monitoring period 2015-2016, there was continuing contact between TBP and the Council. In addition to the 14 scheduled compliance inspections undertaken by Council Officers in this period, the Council also undertook 13 additional inspections in relation to complaints received from the public, primarily odour related.

The Council's analysis was composed of 192 samples collected across the mediums of discharges, stormwater, fire pond water, surface and groundwater. Each sample was tested for five or more parameters resulting in more than 1,000 tests undertaken in the 2015-2016 monitoring year. The Council also undertook two bio-monitoring surveys of the Inaha Stream and associated tributaries.

The intensity of monitoring was the result of on going concern about the performance of the plant, specifically focused on odour and offensive odour generation, but also to ascertain the quality of the Inaha Stream which had historically been affected by discharges from the rending plant. The irrigation area groundwater is also monitored closely by the Council. TBP have been encouraged to not overload areas with combined applications of wastewater and fertiliser.

Plant performance
Of the management and contingency plans which require annual review by TBP, these were undertaken and supplied occasionally late, however, these were all received before the end of the monitoring year.

Groundwater abstraction rates were complied with for the full year. At no point was the 1,970 m^3 daily water limit exceeded. Stormwater analysis detailed no exceedance when compared to the consent conditions for the full year. Surface water abstraction rates were also complied with, though the data set was missing one month of data, which was attributed to data storage problems.

The Inaha Stream temperature, which TBP must not alter by more than 3 °C, was controlled better since the installation of a new cooling system in April 2014. The largest differential was 2.39 °C. TBP also did not exceed the maximum cooling water temperature of 35 °C.

Control of wastewater discharge so as to maximise application of effluent to land was undertaken. TBP ceased discharges to the stream on 14 October 2015 and commenced again on 26 May 2016. This marked 226 days with wastewater applied to land. When TBP did utilise the Inaha Stream for discharges of wastewater, the minimum dilution rate was complied with for the vast majority of days (note the minimum dilution rate as set by consent 2049 is 300), although on five occasions the dilution rate was below 300, with the lowest dilution rate of 295 on 6 October 2016. This minor breech in the dilution rate was attributed to a calculation error.

During the 2015-2016 monitoring period, compliance with the annual nitrogen loading limits (excluding fertiliser) were mostly achieved, the average nitrogen loadings for the 300 kg N/ha areas were 31 % and 37 % for the 200 kg N/ha. For individual paddocks, compliance was recorded for 97 % of the irrigated areas where the limit is 300 kg N/ ha and 97 % for Shearer block where the limit is 200 kg N/ha.

In terms of application of wastewater to individual paddocks, there were two exceedances in nitrogen loading. Paddock 34 received an additional 135 kg N over the year, which resulted in an exceedance by 18 kg N/ha of the consented loading rate per hectare, with an overall loading rate of 318 kg N/ha. Paddock S-26, which is limited to 200 kg N, received an additional 8 kg N, which resulted in an exceedance by 11 kg N/ha of the consented loading rate, with an overall loading rate of 211 kg N/ha.

In terms of the application of fertiliser, the reported application of fertilisers decreased slightly from the previous period, with a reduction of 9 %, from 44,000 kg N to 40,000 kg N. In comparison to the previous section; to the discharge of wastewater to land, which is limited to 300 and 200 kg N/ha, the application of fertiliser has no limit.

In this period, six of forty four paddocks received applications of fertiliser greater than 300 kg N/ha, with the highest receiving 404 kg N/ha, paddock 6.

The combined budget of both fertiliser and wastewater in terms of kg nitrogen to land amounted to eleven paddocks with an application greater than 300 kg N/ha, with six over 400 kg N/ha, and another five over 500 kg N/ha. The largest combined application in this period was 587 kg N/ha, on paddock 40.

At certain times the housekeeping in the waste management area (this is the laydown location in close proximity to the firepond, biofilters and Inaha Stream) has required prompting from the Council officer undertaking the inspection. The Council would like to see better care of this area moving forward considering its close proximity to the Inaha Stream.

Facility upgrades

The plant upgrades which have taken place in this monitoring period are as follows:

- Doubled water flow to the odour scrubbers has resulted in a significant reduction in odour;
- The installation of a separate air scrubber to the blood plant;
- Improved quality of wastewater transferred to the pond system has reduced the nitrogen loading in this area.
- The development and installation of a second bovine rendering line, to improve the through put of the facility and maintain production if one of the two bovine lines malfunctions.

Note that in the past when the single bovine line has suffered from equipment failure, product could not be processed, resulting in odour production and lost product as it would require burial. The main rationale for the second bovine line was to increase plant through put, meaning product is processed faster, which will result in less odour generation potential.

- The recent up grade of the piping diameters for the ducting, whereby the size was doubled from three inch to six inch.

While these advancements were worthwhile, they did not diminish from the 10 (odour related, 13 in total) complaints received over the course of 1 month, from the end of January until the end of February 2016 (Section 2.3). These complaints were only substantiated in terms of odour actually noticed by the Council (50% of call out had noticeable odour), as opposed to being objectionable which would have constituted a breech of resource consent.

A key consideration was realised and conveyed in the second of the two community meetings held within the review period, whereby the management and maintenance of the equipment must be improved, with the upgrades planned to occur in the cooler months when temperatures do not put added pressure on the production line. This has in the past resulted in line failures and increased odour generation potential. In addition to this, several other concerns were communicated from the community to TBP. These were as follows:

- Trucks carrying product were cited as an issue for odour generation
- Open front doors were cited as an issue for odour generation
- The loading area was identified as source a of putrid short term dour
- Pond emitted odours

Consent 4058-4 permits the generation of odour by TBP. However the intensity and duration of the odour must be controlled so that it is not objectionable beyond the plant boundary.

In terms of the community, there is good communication through the community appointed chair and TBP representatives, whereby if there is any odour generated TBP will be notified quite swiftly by the community. While this is a fall back mechanism, the path forward will be to not have this occur in the future and it is the developments and advancements which will mitigate this. Community meetings have been requested to occur at the end of the summer, to assess the odour mitigation as a community.

In the previous monitoring period, the biennial site audit of odour control systems was carried out by the suitably qualified engineers Golder Associates. This was undertaken in May 2015. The report concluded that the systems and associated equipment appeared to be maintained and operated in a sound engineering state. A review of the design philosophy of the inedibles plant odour control system was promoted, to make the concentrated sources system the primary means of containing odour.

The report noted that the construction of a dedicated bio-filter for concentrated sources from the TBP plant was an improvement. It was recommended that TBP take the opportunity to review and further upgrade the concentrated sources system in conjunction with the design and installation of a system for a proposed expansion of the bovine rendering line.

Recommendations were also made on maintenance and remedial actions for the existing biofilters, and on improvements to the waste heat evaporator control system.

TBP has undertaken to follow the recommendations of the report, with minor modifications.

Taranaki Tree Trust
The contribution to the Taranaki Tree Trust has been made each year since 1999. These donations have been used to subsidise riparian planting along the main stream and its tributaries. The effect of these measures will be to increase shading, with consequent decrease in water temperature and in nuisance algal growth; to reduce stock access and bank erosion; to reduce nutrient and sediment input to watercourses; and to enhance the appearance of the riparian margins.

At the end of 2015-2016, a total of $34,260.86 of TBP funding had been spent on or was committed to riparian management covering planting of stream margins. The works were carried out throughout the catchment, mainly along reaches above the Okaiawa plant. Funding was granted to landholders at a rate of 50 % on plants as a rebate.

Riparian management
At this stage the resource consent conditions for both Permit 2049-4 and consent 6431-1 have been met. TBP was quick to respond when they realised that the fencing was not in place and followed up with fencing immediately. They have also been actively planting other areas on the farm and around the plant.

Conclusion
Overall the performance of the TBP has been to a good standard in the 2015-2016 monitoring period. While there are issues in the application of the wastewater and fertiliser which have resulted in the long term elevation of nitrate in groundwater at certain locations, TBP have recently engaged a suitably qualified consultant to aid them with redeveloping their wastewater application strategy. With this in mind, the management of this resource will be better achieved moving forward.

This brings into line the TBP wastewater application with the air quality, which is also audited by a suitably qualified consultant. Discussions with TBP have detailed that stickwater is to be phased out; this will further safeguard the groundwater from future occurrences of elevated nitrate.

This shows that TBP are prepared to own the emerging environmental trends which have occurred as a result of their business and are prepared to undertake measures to remediate.

3.2 Environmental effects of exercise of consents

The environmental effects associated with the exercise of consents, related to TBP will be discussed by item.

The abstraction of water from the Inaha Stream was undertaken and complied with, although one month of data was missing from the record, attributed to data storage problems. The groundwater abstraction was undertaken and the consented volumes and rate were complied with. No effects were found as a process of undertaking these abstractions.

The discharge of cooling water did not adversely affect the Inaha Stream, with no discharge causing the 3.0 °C limit on temperature increase to be exceeded.

Groundwater nitrate concentrations in some of the wastewater specific groundwater monitoring wells remained high in this monitoring period, namely wells GND1346, 1347, 1348 and 2226, which held concentrations close to or above 60 g/m^3 N. This indicates that these locations are not capable of managing this level of application of wastewater in the future. Crop assimilation of fertiliser should be managed as to not adversely affect the groundwater.

An area which had been subject to high nitrate concentrations in the groundwater had responded swiftly to the reduction in wastewater application in that specific area in this period. GND1056 is an example of this, whereby the surrounding paddock/s had been put to crop for the majority of the monitoring year. This would infer that areas which are put to crop or not irrigated will respond with decreasing concentrations over time.

There were no major measured chemical effects on the main stem of the Inaha Stream in this period. However, in the lower reaches of the stream, in the summer and similar to the previous monitoring period, pH values did increase at times of low flow. This was the result of increased algal activity, which is reflected by the super saturated nature of the surface water at the same location. Note that during these times, the plant was not discharging to the Inaha Stream and land application of wastewater was undertaken.

In November 2014, the willows which were covering much of the stream in the area adjacent to and below the plant site were removed to allow for better stream flows. It was anticipated that this may have an effect on both the physical and chemical nature of the stream in this specific area and may also affect the biology. This is reported in the spring bio-monitoring survey whereby habitat variation made it hard to establish strong conclusions pertaining to subtle differences between monitoring sites, and whether TBP had caused an adverse effect on the stream community. The late summer follow up survey indicated that TBP had not caused adverse effects, though the habitat variation made drawing a strong conclusion difficult.

The Council was interested to observe the bio-monitoring of the western tributary of the Inaha Stream in this monitoring period. This tributary had been subject to an increasing concentration of nitrate since its inception as a monitored tributary in November 2004. In this period its variation was from 6.7 g/m^3 N to 13 g/m^3 over a six month period, before dropping back to 6.5 g/m^3 N in the most recent analysis.

Analysis of the bio-monitoring of the western tributary, specifically the middle reach of the tributary did reveal less specimens than compared to the up stream control site, however, the biologist cited that access to the area was quite difficult and considering the dense vegetation and foliage in this area, it was difficult to undertake the same quality of survey due to the limited space available. The biologist also cited that the results from both sites were inline with what is expected for a similar stream on the Taranaki Ring Plain. Thus overall there has been no conclusive effect on the instream communities from the land irrigation or diluted discharges to the Inaha Stream.

The Council accepts that the willow removal will have affected the assemblages of the stream and it may take a couple of seasons for this to balance out. Stream chemistry

indicated that the discharges were within there consented obligation and this included the temperature differential.

In light of the increased nitrate concentration in the western tributary TBP (at the end of the last monitoring period) was asked to mitigate the high nitrate by reducing the load of wastewater applied to the specific areas surrounding the tributary. This was undertaken for the most part with paddock combined loading of wastewater and fertiliser limited to below 260 kg N/ha in ten of the twelve paddocks in the direct vicinity of the tributary.

The spring at Shearers property; which is used to supply local residents with drinkable water, continued to show an increasing trend this term, with its largest fluctuation increase to date, 5.1 g/m^3 N to 7.8 g/m^3 N in a one month period, prior to dropping back to 4.2 g/m^3 N by July 2016. Paddock loadings in this period ranged from 205 kg N/ha to 513 kg N/ha across the five paddocks in the direct locality. The Council will continue to monitor this water source. It may require further investigation, to find the true source of the elevated nitrate, if the concentrations continue to rise.

In the upcoming monitoring period TBP will seek to mitigate elevated nitrate concentrations in the groundwater, this will occur by two means:

The first will be the gradual removal of stickwater; while this cannot be removed immediately, TBP has begun to reprocess this fluid, and to limit the amount discharged to the environment. They are now aware that its utilisation as a soil fertiliser is not sustainable with the combined wastewater application to land.

If this is not mitigated then the Council will require TBP to limit total combined application rate to below 300 kg N/ha across all paddocks, not including the Shearer block which is already limited to 200 kg N/ha.

The second will be the development of an updated wastewater application plan. As previously discussed TBP has engaged a suitably qualified environmental professional to undertake this task and this will aid TBP in balancing their requirement to discharge to land with the sustainable management of the discharge areas as to lessen the potential for elevated nitrate in this resource.

These two undertakings display a proactive approach by TBP to managing emerging environmental effects as a result of exercising their consents.

This proactive approach will bring in to line their wastewater programme with the internal audits of their air quality system, which is audited by Golder Associates.

Air quality continues to be the primary source of complaints received by the Council regarding TBP. In comparison to the previous monitoring period where seven complaints were received with regard to odour related complaints, thirteen were received this term. 50 % of these complaints were substantiated by Council Officers, in terms of actual noticeable (but not offensive) odour, 43 % were unnoticeable. As a result, the Council undertook additional odour surveys, all of which were inconclusive.

Developments have been undertaken as already discussed and it is the continued progress which the Council is most interested in. TBP undertook what was required

after undertaking the second biannual air quality audit in May 2015, be it with minor modifications, and in the up coming monitoring period this audit will occur again, as it is a consent obligation.

Odour mitigation will continue to be encouraged and monitored moving forward.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 30-42.

Table 30 Summary of performance for consent 2051-4

Purpose *To take water from the Inaha Stream for a rendering operation*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Means of take satisfactory to Council	Inspection and monitoring	Yes
2. Minimum flow of 25 L/s downstream of point of abstraction	Monitoring of flow	Yes
3. Operation of an abstraction measurement device, maintain records	Data provision	Data provided though one month lost
4. Operation of a flow recorder at Kohiti Road, level gauge from Jan 2015	Staff gauge in stream, rated by Council. Daily level record and monthly report by TBP	Yes
5. Report on use of treated wastewater as cooling water by 31 March 2000	Report produced 13 October 2000 and recommendations implemented	N/A
6. Provision for review	Next review date available 1 June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 31 Summary of performance for consent 2049-4

Purpose: *To discharge treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Mixing zone 30 m downstream of discharge	Site inspection and monitoring results	Yes
2. Boundaries of mixing zone to be determined by Council	Site inspection	N/A
3. Point of discharge to enter channel directly to ensure mixing	Site inspection	Yes
4. Advise Council before making changes to alter nature of discharge	Site inspection, monitoring results and liaison	Yes
5. TBP to undertake self monitoring	Review and compare results. Some monitoring in management plan undertaken by Council	Yes

Purpose: ***To discharge treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
6. Minimum discharge dilution rate	Monitoring results	Yes, although on a few occasions it dipped to below 300 to dilution rate of 295
7. No discharge of stickwater, and consult with Council before increasing cow herd	Site inspection, monitoring results and liaison	Yes
8. Discharge to cease when flows in the Inaha Stream drop below 100 L/s	Monitoring of Kohiti Road flow gauge results	Yes
9. Control on effect of discharge in receiving water	Inspection, chemical sampling and bio-monitoring	Yes
10. Limits on receiving water ammonia concentration	Chemical sampling	Yes
11. Recording and reporting of discharge rate	Inspection and review of records	Yes
12. Inaha Stream flow measurement device	Inspection, gaugings by Council	Yes
13. Provision of wastewater disposal plan	Plan received by Council and approved December 2000	Yes
14. Plan to be implemented	Inspections and liaison and receipt of TBP reports	Some reports late
15. Optional and annual reviews of wastewater plan	Liaison. Annual reviews by TBP submitted 28 May 2014 and 20 April 2015	Yes
16. Designated staff member	Part of TBP's Environmental Manager's job description, also Plant and Operations Manager's	Yes
17. Training of staff on wastewater disposal	Liaison and inspection	Yes
18. Donation to Taranaki Tree Trust	Confirmation with Council finance department that donation received	Yes
19. Optional review provision	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 32 Summary of performance for consent 2050-4

Purpose: ***To discharge cooling water to Inaha tributary***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Activity monitoring by TBP as required	Continuous temperature monitoring taken over by Council in September 2013, at TBP's request	Yes
2. Composition not to be different to Inaha Stream, other than heat and solids	Chemical sampling by Council	Yes

3. Maximum temperature limit on discharge	Continuous temperature recording by Council	Yes
4. Limit on suspended solids in discharge	Sampling by Council	Yes
5. Controls on effect of discharge in receiving water	Continuous temperature monitoring, and chemical and biological sampling, by Council. Refer section 2.1.3.2	Yes
6. Discharge temperature measurement and recording	Monitoring carried out by Council	Yes
7. Optional review provision	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 33 Summary of performance for Consent 5426-1

Purpose: ***To discharge stormwater to Inaha tributary***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Notification prior to changing processes that may significantly alter discharge	Inspection by Council	Yes
2. Limits on discharge composition	Chemical sampling by Council	Yes
3. Controls on effect of discharge in receiving water	Chemical and biological sampling by Council	Yes
4. Provision of spillage contingency plan by 31 August 1999	Plan produced in November 2000	N/A
5. Optional review provision	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 34 Summary of performance for Consent 4058-4

Purpose: ***To discharge emissions to air***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option (bpo) to prevent or minimise adverse effects	Checking that standard operating procedures to achieve compliance with consent conditions are followed liaison with TBP and inspection by Council	BPO generally achieved, though further action could mitigate odours further
2. No offensive or objectionable odour beyond boundary	Odour surveys by Council and TBP, and investigation and recording of complaints	Yes 13 odour related complaints, 50% noticeable, non offensive
3. Definition of noxious, offensive or objectionable odour		N/A

Purpose: ***To discharge emissions to air***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
4. Designated staff member for emissions management	Part of TBP Environmental Manager's job description. Also Plant and Operations Manager's responsibility	Yes
5. Prohibition of fish rendering	Inspection by Council	Yes
6. Certification processes and equipment operated according to good engineering practice biennially from 30 April 2013	Biennial certification by suitably qualified independent person. Initial review of TBP and TBE plant operations conducted 20-22 April 2015, report received 31 July 2015	Not assessed this period
7. Preparation of Air Discharge Management Plan	Submission of Plan, on 3 July 2012	N/A
8. Operation in accordance with Air Discharge Management Plan	Inspection by Council	Yes
9. Annual review of Air Discharge Management Plan by 31 May	Liaison. Reviews by TBP submitted 28 June 2016	Yes
10. Limits on dust deposition rate	Inspection	Yes
11. Newsletter production, and community liaison meetings	Three newsletters produced. Community liaison meeting held October 2015 and March 2016	Yes
12. Optional review provision to deal with significant adverse effects	Next review date available June 2015	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Improvement required**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 35 Summary of performance for Consent 3941-2

Purpose: ***To discharge treated wastewater to land***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Irrigation to defined area	Inspection by Council	Yes
2. Provision and maintenance of spray irrigation management plan	Plan received by Council and approved in October 2000	Yes
3. Plan to be followed	Liaison, inspection and provision of monitoring reports	Yes
4. Optional, and mandatory annual reviews of management plan	Liaison. Change to plan to maximise discharge to land, and mandatory annual reviews, required under review of consent 21 December 2005. Revisions submitted 28 June 2016	Yes

Purpose: ***To discharge treated wastewater to land***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
5. Designated staff member	Part of TBP Environmental Manager's job description. Also Plant and Operations Manager's responsibility.	Yes
6. Adopt best practicable option to minimise adverse effects, including total nitrogen minimisation	Liaison and inspection. DAF unit installed October 2004 and enlarged October 2008. Flocculant addition for solids (including nitrogen) removal from November 2007, and pH adjustment from March 2013	No, high application rates of nitrogen have continued despite apparent trends of increasing nitrate in groundwater
7. Seek permission for Inaha Stream discharge when cannot irrigate, and Inaha Stream in low flow	Liaison and inspection	N/A
8. Limit on dissolved oxygen in final pond	Chemical sampling.	No, on three occasions of five, though no adverse effect considered likely
9. No offensive or objectionable odour beyond boundary	Inspection and complaint register	Yes
10. No spray drift beyond boundary	Inspection and complaint register	Yes
11. Limit on sodium absorption ratio	Chemical sampling	Yes
12. Prohibition of ponding and run-off	Inspection and complaint register	Yes
13. Spray buffer zones	Inspection and complaint register	Yes
14. Limit on nitrogen application rate	Monitoring by TBP and review of irrigation records. Record also kept of N fertiliser application to establish total nitrogen loading. Fertiliser application has no limit.	No: one exceedance in 300 kgN/ ha and one exceedance in 200 kgN/ha
15. Report on reducing ammonia concentration by 15 December 2000	Report received by Council on 2 April 2001	N/A
16. Limit on application rate	Inspection and field measurement	Yes
17. Limit on return period	Inspection and provision of records	Yes
18. Installation and maintenance of monitoring bores	Liaison and inspection. Bore recently repaired	Yes
19. Baseline and operational monitoring by TBP	Results of wastewater, irrigation and soil monitoring by/for TBP reviewed by Council	Yes
20. Consultation meetings with interested parties	Imposed by review of 21 December 2005. Meeting held at Te Aroha marae on 14 August 2016	Yes
21. Notification prior to Inaha discharge	Imposed by review of 21 December 2005. Liaison with TBP and Ngati Manuhiakai	Yes

Purpose: ***To discharge treated wastewater to land***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
22. Provisions for contamination of groundwater or water supply	Groundwater monitoring by Council and complaint register	Significant nitrate impacts in groundwater
23. Optional review provision for operational requirements	Not sought by TBP	N/A
24. Optional review provision upon receipt of ammonia reduction report	Under consideration by Council	Under consideration
25. Optional review provision for nitrogen treatment and disposal		
26. Optional review provision for environmental effects	Under consideration by Council	Under consideration
Overall assessment of consent compliance and environmental performance in respect of this consent		**Improvement required**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 36 Summary of performance for Consent 5495-1

Purpose: ***To discharge wastes from meat rendering by burial***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Provision of waste burial management plan by 1 November 2000	Plan received by Council and approved in October 2000	N/A
2. Waste burial management plan to be followed	Inspection by Council, and review of TBP records.	Yes
3. Optional provision for review of waste burial management plan	Not sought by TBP or Council. Revision undertaken by TBP in May 2014	N/A
4. Designated staff member	Part of TBP Environmental Manager's job description. Also Plant and Operations Managers' responsibility	Yes
5. Disposal pits not to intercept groundwater	Inspection by Council	Yes
6. Disposal pits to be constructed as undertaken in consent application	Inspection by Council	Yes
7. Notification of commencement of pit construction outside nominated area	Inspection by Council	N/A
8. All constructed disposal pits to be inspected by Council prior to use	Inspection by Council	Yes
9. Conditions 1-4 to apply to new disposal pits	Inspection by Council	Yes

Purpose: ***To discharge wastes from meat rendering by burial***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
10. Discharged material to be covered within 4 hours	Inspection by Council	Yes
11. Soil cover requirements upon completion of each disposal operation	Inspection by Council	Yes
12. Cover material and surrounding land to be contoured to direct stormwater away	Inspection by Council	Yes
13. Site rehabilitation and pasture re-establishment	Inspection by Council	N/A
14. No irrigation of effluent onto disposal area	Inspection by Council	Yes
15. No direct discharge of contaminants to surface water	Inspection and chemical/biological survey by Council	Yes
16. Installation of monitoring bores	Inspection and sampling by Council. New bore installed 11 May 2015, replacing two bores damaged	Yes
17. Optional review provision for operational requirements	Not sought by TBP	N/A
18. Optional review provision for environmental effects	Next review date available 1 June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 37 Summary of performance for Consent 5560-1

Purpose: ***To discharge waste cheese by burial***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Notification prior to commencement of operations to plan monitoring	No operation during review period	N/A
2. Removal of affected parties during operations	No operation during review period	N/A
3. Discharge in accordance with information submitted, and limit on tonnage	No operation during review period	N/A
4. Site access to Council for inspection and monitoring	Inspection by Council	N/A
5. Keeping photographic record of disposal operation	No operation during review period	N/A

Purpose: ***To discharge waste cheese by burial***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
6. Timeframe for operation	No operation during review period	N/A
7. Interim covering of wastes with soil if timeframe not met	No operation during review period	N/A
8. Immediate covering of wastes with treatment material	No operation during review period	N/A
9. Covering with clean soil upon completion	No operation during review period	N/A
10. No other wastes to be buried	Inspection by Council	N/A
11. Adopt best practicable option to minimise effects on the environment	Liaison and inspection	N/A
12. Covering of material during transportation	No operation during review period	N/A
13. Immediate covering of material discharged during transit	No operation during review period	N/A
14. Discharge only under certain wind conditions	No operation during review period	N/A
15. No emission of odours after 1 Feb 2000	Inspection by Council	N/A
16. Disposal pit liner to be as specified	No operation during review period	N/A
17. Pit not to intercept groundwater	Inspection by Council	N/A
18. Surface contour to direct away stormwater	Inspection by Council	N/A
19. Site rehabilitation and pasture re-establishment	Inspection by Council	N/A
20. No irrigation over disposal area	Inspection by Council	N/A
21. Cover material integrity to be maintained	Inspection by Council	N/A
22. No direct discharge to surface water	Inspection by Council	N/A
23. Optional review provision for environmental effects	Next review date available 1 June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Not exercised
Overall assessment of administrative performance in respect of this consent		Not exercised

N/A = not applicable

Table 38 Summary of performance for Consent 6431-1

Purpose: ***To place culverts in Inaha Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of best practicable option to minimise adverse environmental effects	Liaison, and inspection by Council	Yes
2. Consent to be exercised in accordance with documentation submitted	Inspection by Council	N/A
3. Notification prior to commencement and upon completion of works	Liaison with Council. No work undertaken	N/A
4. Subsequent works prohibited between May and October, without permission	Inspection by Council. Permission for dead willow removal given 4 June 2015	Yes
5. Adoption of best practicable option to minimise discharges, bed disturbance and water quality effects	Liaison, inspection and bio-monitoring by Council	Yes
6. Minimisation of bed disturbance	Inspection by Council	Yes
7. Structure removal and area reinstatement upon redundancy		N/A
8. Fish passage not to be restricted	Inspection by Council	Yes
9. Erection of stock-proof riparian fences on consent holders property above Kohiti Road	Implementation of riparian plan RMP938 and inspection by Council	Yes Fencing completed June 2009
10. Planting of riparian margins within 4 years from 4 October 2004	Implementation of riparian plan RMP938 and inspection by Council. Some replanting/blanking undertaken in winter 2011 and 2015	Yes Planting completed June 2009
11. Placement of culvert inverts and headwall protection structures	Inspection by Council	Yes
12. Lapse of consent if not exercised	Consent was exercised	N/A
13. Optional review provision for environmental effects	Next review date available 1 June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 39 Summary of performance for Consent 7234-1

Purpose: ***To disturb and realign Inaha Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Consent to be exercised in accordance with documentation submitted	Inspection by Council.	N/A
2. Notification prior to commencement of works	Notification given 17 March 2008	N/A
3. Placement and design of rock wall for bank protection	Inspection by Council	N/A
4. Works prohibited between May and October, without permission	Inspection by Council	N/A
5. Riverbed disturbance to be minimised	Inspection by Council	N/A
6. Sediment discharge and effects to be minimised	Inspection by Council	N/A
7. Fish salvage from old channel immediately upon diversion	Council carried out fish salvage on 18 April 2008	N/A
8. Fish passage not be obstructed	Inspection by Council	N/A
9. Vegetation removed not to be buried near stream	Inspection by Council	N/A
10. Lapse of consent if not exercised	Consent was exercised	N/A
11. Optional review provision for environmental effects	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Not exercised**
Overall assessment of administrative performance in respect of this consent		**Not exercised**

N/A = not applicable

Table 40 Summary of performance for Consent 7329-1

Purpose: ***To discharge stormwater and sediment from re-contouring land and realigning Inaha Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Consent to be exercised in accordance with documentation	Inspection by Council. An erosion and sediment control management plan was provided with the application. (Sediment controls initially inadequate)	N/A
2. Limit on maximum soil area disturbed	Inspection by Council	N/A
3. Limit on maximum soil volume disturbed	Inspection by Council	N/A

Purpose: *To discharge stormwater and sediment from re-contouring land and realigning Inaha Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
4. Design criteria for run-off sediments traps to be followed	Inspection by Council	N/A
5. Sediment discharge and effects to be minimised	Inspection by Council	N/A
6. Provision of programme of works prior to exercise of consent	An erosion and sediment control management plan was provided with the application	N/A
7. Stabilization of earthwork areas upon completion of soil disturbance activities	Inspection by Council	N/A
8. Procedure to be followed upon discovery of archaeological site	Liaison with Council (Retrospective)	N/A
9. Lapse of consent if not exercised	Consent was exercised	N/A
10. Optional review provision for environmental effects	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Not exercised**
Overall assessment of administrative performance in respect of this consent		**Not exercised**

N/A = not applicable

Table 41 Summary of performance for Consent 9756-1

Purpose: *To take and use groundwater for industrial water supply*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Limit on maximum take	Water measuring and recording required by consent conditions	Yes
2. Labelling of bore	Inspection by Council	Yes
3. Access to bore for manual measurement of water levels	Inspection by Council	Yes
4. Installation of metering and logging equipment	Inspection by Council and certification under condition 5	Yes
5. Certification of water measuring equipment	Provision of certificate. Supplied 29 May 2014.	Yes
6. Installation of water level measuring equipment	Inspection by Council	Yes
7. Telemetry of monitoring data to	Inspection by Council and receipt of data. Water take from 27 March 2014; water level from 6 June 2014	Yes

Purpose: ***To take and use groundwater for industrial water supply***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
8. Access to monitoring equipment	Inspection by Council	Yes
9. Notification of equipment failure	Inspection by Council and checking of records	N/A
10. Adoption of best practicable option	Liaison and inspection	Yes
11. Lapse of consent if not exercised	Consent was exercised	N/A
12. Optional review provision for environmental effects	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 42 Summary of performance for Consent 10054-1

Purpose: ***To discharge emissions into the air from the burning of pallets, paper and cardboard***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of best practicable option to minimise adverse environmental effects	Liaison, and inspection by Council	Mostly, some control issues noted Inspection 26 March 2016
2. Restrict on materials combusted	Inspection by Council	Yes
3. Prohibition of objectionable odour	Inspection by Council	Yes
4. Supervision of burning	Inspection by Council	Yes
5. Limit on dust deposition rate	Inspection by Council	N/A
6. Control of airborne dust components and particulate concentration	Inspection by Council	Yes
7. Prohibition of toxic components beyond boundary	Inspection by Council	Yes
8. Lapse of consent if not exercised	Consent was exercised	N/A
9. Optional review provision for environmental effects	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall assessment of administrative performance in respect of this consent		**Improvement required**

N/A = not applicable

Table 43 Summary of performance for TBP 2016-2016 monitoring year

Consent Number	Description	Environmental compliance	Administrative performance
2051-4	To take water from the Inaha Stream for a rendering operation	Good	Good
2049-4	To discharge treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream	Good	Good
2050-4	To discharge cooling water to Inaha tributary	High	High
5426-1	To discharge stormwater to Inaha tributary	High	High
4058-4	To discharge emissions to air	Improvement required	Good
3941-2	To discharge treated wastewater to land	Improvement required	Good
5495-1	To discharge wastes from meat rendering by burial	Good	Good
5560-1	To discharge waste cheese by burial	Not exercised	
6431-1	To place culverts in Inaha Stream	High	High
7234-1	To disturb and realign Inaha Stream	Not exercised	
7239-1	To discharge stormwater and sediment from re-contouring land and realigning Inaha Stream	Not exercised	
9756-1	To take and use groundwater for industrial water supply	High	High
10054-1	To discharge emissions into the air from the burning of pallets, paper and cardboard	Good	Improvement required

During the year, generally TBP demonstrated a 'Good' level of environmental and a 'Good' level of administrative performance with the resource consents as defined in Section 1.1.4.

However, specifically two environmental compliance aspects and one administrative performance in respect of significant issues will require improvement moving forward; these aspects are as follows:

Environmental compliance requires improvement in the following areas:

Commitment to mitigating odour (consent 4058-4). The implementation/ recommendations from the upcoming site specific audit, undertaken by Golder Associates will aim to progress with this area. The second audit was undertaken in May 2015 and the third audit will be undertaken in 2017 as it is a consented obligation.

Commitment to mitigating significant nitrate trends in the groundwater (consent 3941-2). The engagement of a suitably qualified consultant (Pattle Delamore and Partners) who will seek to determine appropriate solutions and measures in this area.

Administrative Compliance requires improvement in the following area:

Commitment to the improving control of burning pallets, paper and cardboard on site with respect to 10054-1.

In addition:

House keeping in respect of the laydown area/ oil storage area has required prompting from Council through out the year.

3.4 Recommendations from the 2013-2015 Biennial Report

In the 2013-2015 biennial report, it was recommended:

1. THAT monitoring of air emissions from the rendering operations of Taranaki By-Products Limited in the 2015-2016 year continue at the same level as in 2014-2015.

2. THAT monitoring of water abstraction and of wastewater, cooling water, stormwater and solids discharges from the rendering operations of Taranaki By-Products Limited in the 2015-2016 year continue at the same level as in 2014-2015 with the appropriate adjustments to reflect changes, in wastewater treatment and disposal, and in environmental effects.

3. THAT Taranaki By-Products Limited undertake a detailed investigation at the site to allow an updated site specific environmental management plan to be developed that controls the effects on surface water and groundwater from their wastewater disposal.

4. THAT the Council notes that the option for review of consent 4058-4 (discharge to air) in June 2015, as set out in condition 12 of the consent, was not exercised on the grounds that the current conditions were adequate to deal with any potential environmental effects.

These recommendations have been given effect to as appropriate by the Council, with Recommendation 3 being adopted by the Company

3.5 Alterations to monitoring programmes for 2016-2017

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

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

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that for 2016-2017 that the monitoring regime undertaken by the Council in respect to compliance of the TBP site remain unchanged for the upcoming period.

3.6 Exercise of optional review of consent

The following resource consents provide for an optional review of the consent in June 2017. Each consent will have a specific condition which allows the Council to review the consent, if there are grounds that require a review.

Consent number	Purpose	Volume	Next review date	Expiry date
2049-4	Discharge treated wastewater to Inaha Stream	940 m^3/day	2017	2019
2050-4	Discharge cooling/backwash water to Inaha Stream	2,160 m^3/day	2017	2019
2051-4	Take from Inaha Stream	2,160 m^3/day(50L/s)	2017	2019
3941-2	Discharge treated wastewater to land and air	1,400 m^3/day	2017	2019
4058-4	Discharge emissions to air from rendering operations		2017	2024
5426-1	Discharge stormwater to Inaha tributary	1,025 L/s	2017	2019
5495-1	Discharge meat wastes by burial into land	200 tonne/day	2017	2019
5560-1	Discharge waste cheese by burial, and emit to air	100 tonne	-	2017
6431-1	Place culverts in Inaha Stream		2017	2023
7234-1	Disturb to realign Inaha Stream		2017	2023
7329-1	Discharge sediment during Inaha Stream realignment		2017	2023
9756-1	Take groundwater	22.8 L/s(1,970 m^3/d)	2017	2029
10054-1	Discharge emissions to air from burning		2017	2029

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 grounds that require a review of Consent 3941-2 (Discharge of treated wastewater to land) to be pursued.

The rationale for this primarily relates to the significant nitrate concentrations in the groundwater as a direct result of the exercise of this consent. The remaining consents do not require a review as the current conditions are adequate to deal with any potential environmental effects.

4 Recommendations

1. THAT monitoring of consented activities at Taranaki By-Products in the 2016-2017 year continues at the same level as in 2015-2016.

2. That TBP engage a suitably qualified environmental consultant to help them better manage their wastewater system.

3. THAT the option for a review of resource consent 3941-2 in June 2017, as set out in condition 26 of the consent, be exercised, on the grounds that the exercise of the consent is resulting in highly elevated nitrate in the groundwater in certain areas.

Glossary of common terms and abbreviations

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

Al*	Aluminium.
As*	Arsenic.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20 °C and expressed in mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m^3s^{-1}).
DAF	Dry Air filtration
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.
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.
$g/m^2/day$	Grams/$metre^2$/day.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.

Incident Register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m^2	Square Metres.
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_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO_3	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SG	Staff Gauge
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.

*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.

Bibliography and references

Golder Associates, 2015: Site visit report – Consent 4058-4 certification. Golder Project No. 1530864.

Golder Associates, 2013: Site visit report – Consent 4058-4 certification. Golder Project No. 1378104138.

Golder Associates, 2010: Evaluation of the air discharge control operations, Golder Document No. 1078104234.

Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No 472.

Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research 32(1):55-66.*

Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. Water and Soil Miscellaneous Publication No.87.

Stark, JD and Fowles, C R, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant using artificial substrate, January to March 2003. TRC report.

Taranaki Regional Council, 2015: Taranaki By-Products Ltd Monitoring Programmes Biennial Report 2013-2015. Technical report 2015-65.

Taranaki Regional Council, 2013: Taranaki By-Products Ltd Monitoring Programmes Biennial Report 2012-2013. Technical report 2013-101.

Taranaki Regional Council, 2012: Taranaki By-Products Ltd Monitoring Programmes Biennial Report 2010-2012. Technical report 2012-94.

Taranaki Regional Council, 2010: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2009-2010. Technical report 2010-38.

Taranaki Regional Council, 2009: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2008-2009. Technical report 2009-108.

Taranaki Regional Council, 2008: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2007-2008. Technical report 2008-77.

Taranaki Regional Council, 2007: Taranaki By-Products Ltd Monitoring Programme Triennial Report 2004-2007. Technical Report 2008-08.

Taranaki Regional Council, 2004: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2003-2004. Technical report 2004-67.

Taranaki Regional Council, 2003: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2002-2003. Technical report 2003-81.

Taranaki Regional Council, 2002: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2001-2002. Technical report 2002-73.

Taranaki Regional Council, 2001: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2000-2001. Technical report 2001-88.

Taranaki Regional Council, 2000: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1999-2000. Technical report 2000-25.

Taranaki Regional Council, 1999: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1998-99. Technical report 99-48.

Taranaki Regional Council, 1998: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1997-98. Technical report 98-87.

Taranaki Regional Council, 1997: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1996-97. Technical report 97-59.

Taranaki Regional Council, 1996: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1995-96. Technical report 96-70.

Taranaki Regional Council, 1995: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1994-95. Technical report 95-38.

Taranaki Regional Council, 1994: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1993-94. Technical report 94-72.

Taranaki Regional Council, 1993: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1992-93. Technical report 93-59.

Appendix I

Resource consents held by Taranaki By-Products Limited

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

Discharge Permit

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

Name of Consent Holder:	Taranaki By-Products Limited P O Box 172 HAWERA
Change to Conditions/Review Completed Date:	4 October 2006 [Granted: 31 May 1999]

Conditions of Consent

Consent Granted:	To discharge up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream at or about GR: Q21:118-858
Expiry Date:	1 June 2019
Review Date(s):	June 2001, June 2003, June 2005, June 2007, June 2011, June 2017
Site Location:	Kohiti Road, Okaiawa
Legal Description:	Lots 1 & 2 DP 6457 Blk IV Waimate SD
Catchment:	Inaha

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

Special conditions 1 – 5 (unchanged]

1. The mixing zone in each condition of this consent shall extend for a distance of 30 metres downstream of the point of discharge of treated wastewater.

2. The boundaries of the mixing zone and site of discharge shall be as physically determined by the Chief Executive, Taranaki Regional Council.

3. The point of discharge into the Inaha Stream shall be such that the discharge enters directly into a channel of the Inaha Stream in order to ensure that complete mixing occurs.

4. The consent holder shall advise the Taranaki Regional Council prior to making any change in the processes undertaken at the site which could significantly alter the nature of the discharge.

5. The consent holder shall undertake such monitoring of the activities licensed by this consent, as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991. This monitoring information is to be forwarded to the Chief Executive, Taranaki Regional Council, upon request.

Special condition 6 [amended]

6. A minimum dilution rate of 1:300 shall be maintained at the point of discharge to the Inaha Stream at all times.

Special condition 7 [replaced]

7. a) No stick-water shall be discharged under this consent. Stick-water is defined as juices squeezed out of products that are rendered.

   b) This consent allows the discharge of wastewater from up to 1,200 cows. Prior to this number being increased the consent holder must demonstrate, in writing, to the satisfaction of the Chief Executive Officer, Taranaki Regional Council, that the wastewater treatment system can treat the wastewater without breaching condition 9 of this consent.

Special conditions 8- 12 [unchanged]

8. The discharge shall cease when flows decrease in the Inaha Stream, as measured at the Kohiti Road gauging site, to below 100 litres/second.

9. The discharge [in conjunction with any other discharges pertaining to the same property], shall not cause or give rise to any of the following effects, at any point in the receiving waters below the mixing zone:

   (a) a fall of more than 0.5 pH units;
   (b) an increase in filtered carbonaceous biochemical oxygen demand [20 degrees Celsius, 5-day test] to above 2.00 gm^{-3};
   (c) a temperature rise of more than 3.0 degrees Celsius;
   (d) a reduction in the dissolved oxygen concentration to below 80% of saturation concentration;
   (e) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
   (f) any conspicuous change in the colour or visual clarity;
   (g) any emission of objectionable odour;
   (h) the rendering of fresh water unsuitable for consumption by farm animals;
   (i) any significant adverse effects on aquatic life, habitats or ecology;
   (j) any visible bacterial and/or fungal growths in the receiving water.

10. The discharge, in conjunction with any other discharges pertaining to the same property, shall not raise the total ammonia concentration [expressed as NH_3] in the receiving waters at any point below the mixing zone above 1.5 gm^{-3} if the pH of the receiving water is below 7.75, or above 0.7 gm^{-3} if the pH of the receiving water lies between 7.75 and 8.00, or above 0.4 gm^{-3} if the pH of the receiving water is above 8.00.

11. The consent holder shall install a metal control gate on the discharge outlet, and install and operate a v-notch weir and stage board on the outlet, to the satisfaction of the Chief Executive, Taranaki Regional Council; and shall keep records of the discharge rate during the exercise of this consent; such records to be made available to the Chief Executive, Taranaki Regional Council, upon request.

12. The consent holder shall install and maintain a stage board on the Kohiti Road Bridge and shall gauge the site for the purpose of providing a stream flow monitoring site, to the satisfaction of the Chief Executive, Taranaki Regional Council.

Special condition 13 [amended)

13. The consent holder shall maintain a wastewater disposal management plan [the management plan] for the wastewater treatment system, to the approval of the Chief Executive, Taranaki Regional Council, outlining the management of the system, particularly the use of the spray irrigation system in combination with the pond discharge, which shall demonstrate the ability to comply with consent conditions and shall address the following matters:

    (a) monitoring of the discharge wastewater;
    (b) monitoring of the receiving water;
    (c) management of the wastewater treatment system;
    (d) minimisation of nutrients in the discharge wastewater;
    (e) treatment and disposal of stickwater;
    (f) mitigation of the effects of the discharge;
    (g) guidelines for use of spray irrigation or discharge to surface water; and
    (h) reporting on the exercise of the consent.

    An objective of the plan shall be to minimise discharges to surface water and to maximise discharges to land under consent 3941.

Special condition 14 [unchanged]

14. The consent shall be exercised in accordance with the procedures set out in the wastewater disposal management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and all other matters specified in the management plan, except by the specific agreement of the Chief Executive, Taranaki Regional Council. In case of any contradiction between the management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.

Special condition 15 [amended]

15. The consent holder shall advise the Taranaki Regional Council two months prior to any changes being made to the wastewater disposal management plan. Should the Taranaki Regional Council wish to review the wastewater disposal management plan, two months notice shall be provided to the consent holder. The consent holder shall review the plan annually and shall provide the reviewed plan to the Chief Executive, Taranaki Regional Council, by 31 May each year.

Special conditions 16-18 [unchanged]

16. The consent holder shall designate an officer with the necessary qualifications and/or experience to manage the wastewater treatment system.

17. The consent holder shall ensure that:

    (a) the operation of the wastewater treatment system shall be carried out at all times in accordance with the requirements of the wastewater disposal management plan prepared as required in condition (13) above or subsequent version of that document which does not lessen environmental protection standards;

    (b) all relevant site staff are to be regularly trained on the content and implementation of the wastewater disposal management plan, the maximum period between training sessions being 12 months. New staff are to be trained on recruitment and the training record made available to the Chief Executive, Taranaki Regional Council, upon request; and

    (c) all relevant site staff are advised immediately of any revision or additions to the wastewater disposal management plan.

18. By the agreement of the consent holder, the consent holder shall mitigate the effects of the discharge by donating annually to the Taranaki Tree Trust $2100 [goods and services tax exclusive] for the purpose of providing riparian planting and management in the Inaha Stream catchment. The amount shall be adjusted annually according to the consumer price index, or similar index, to account for the effects of inflation.

Special condition 19 [amended]

19. 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 2007, June 2011, and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 4 October 2006

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

TRK992050

DISCHARGE PERMIT

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

Name of Consent Holder:	TARANAKI BY-PRODUCTS LIMITED PO BOX 172 HAWERA
Renewal Granted Date:	31 May 1999

CONDITIONS OF CONSENT

Consent Granted:	TO DISCHARGE UP TO 2,160 CUBIC METRES/DAY OF COOLING WATER AND BACKWASH WATER FROM A RENDERING OPERATION INTO AN UNNAMED TRIBUTARY OF THE INAHA STREAM AT OR ABOUT GR: Q21:118-858
Expiry Date:	1 June 2019
Review Date[s]:	June 2001, June 2003, June 2005, June 2011 and June 2017
Site Location:	KOHITI ROAD OKAIAWA
Legal Description:	LOTS 1 & 2 DP6457 BLK IV WAIMATE SD
Catchment:	INAHA 351.000
Tributary:	UNNAMED TRIBUTARY

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

TRK992050

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 undertake such monitoring of the activities licensed by this consent, as deemed reasonably necessary by the General Manager, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991. This monitoring information is to be forwarded to the General Manager, Taranaki Regional Council, upon request.

2. THAT the discharge shall not contain concentrations of any chemical, biological or physical contaminant [other than heat and suspended solids] greater than those found in the water abstracted from the Inaha Stream.

3. THAT the cooling water discharge to the Inaha Stream shall not exceed 35.0 degrees Celsius in temperature at the point of the discharge to the unnamed tributary of the Inaha Stream.

4. THAT the cooling water discharge to the Inaha Stream shall not contain a concentration of suspended solids in excess of 100 gm^{-3}

5. THAT after allowing for a mixing zone of 45 metres extending downstream of the confluence of the unnamed tributary with the Inaha Stream, the discharge [in conjunction with any other discharge pertaining to the same property], shall not give rise to any of the following effects in the receiving waters:

(a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
(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, habitats or ecology;
(f) any visible bacterial and/or fungal growths; and
(g) an increase in temperature of more than 3.0 degrees Celsius.

6. THAT the consent holder shall operate and maintain, to the satisfaction of the General Manager, Taranaki Regional Council, a discharge temperature measuring device and shall keep records of the discharge temperature during the exercise of this consent; such records to be made available to the General Manager, Taranaki Regional Council, upon request.

TRK992050

7. 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 2001, June 2003, June 2005, June 2011 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 31 May 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

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DIRECTOR—RESOURCE MANAGEMENT

Water Permit

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

Name of Consent Holder:	Taranaki By-Products Limited PO Box 172 Hawera 4640
Decision Date (Change):	21 January 2015
Commencement Date (Change):	21 January 2015 (Granted: 31 May 1999)

Conditions of Consent

Consent Granted:	To take up to 2,160 cubic metres/day (50 litres/second) of water from the Inaha Stream for a rendering operation
Expiry Date:	1 June 2019
Review Date(s):	June 2017
Site Location:	Kohiti Road, Okaiawa
Legal Description:	Lot 3 DP 378038 Lot 2 DP 410593 Lots 2-3 DP 6457 (Site of take)
Grid Reference (NZTM)	1701884E-5624101E
Catchment:	Inaha

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

General conditions

a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

    i) the administration, monitoring and supervision of this consent; and
    ii) charges authorised by regulations.

Special conditions

1. That the means of taking water shall be maintained to the satisfaction of the Chief Executive, Taranaki Regional Council.

2. That a minimum flow of at least 25 litres/second shall be maintained in the stream at all times downstream of the point of abstraction.

3. That the consent holder shall install and operate to the satisfaction of the Chief Executive, Taranaki Regional Council, an abstraction rate measuring device and shall keep records of the dates and daily quantities of water abstracted during the exercise of this consent; such records to he made available to the Chief Executive, Taranaki Regional Council, upon request.

4. That the consent holder shall to the satisfaction of the Chief Executive, Taranaki Regional Council, monitor and keep daily records of the flows in the lnaha Stream at the Kohiti Road Bridge; such records to be made available to the Chief Executive, Taranaki Regional Council, upon request.

5. 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 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 21 January 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	Taranaki By-Products Limited P O Box 172 HAWERA 4640
Change To Conditions Date:	9 November 2009 [Granted: 15 December 1999]

Conditions of Consent

Consent Granted:	To discharge up to 1400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries
Expiry Date:	1 June 2019
Review Date(s):	June 2011, June 2014, June 2017
Site Location:	Kohiti Road, Okaiawa
Legal Description:	Existing areas: Lot 1 DP 6457 Pt Sec 93 Blk IV Waimate SD [factory site], Lot 1 DP 378038, Pt Sec 93 Lots 2 & 3 DP 6457 Ngatimanuhiakai 17B2 17A2 17A3 Sec 88 Pt Sec 90 Lot 1 DP 10174 Lot 1 DP 11864 Pt Secs 90 & 94 DP SO219 Pt Sec 8 Sec 9 Pt Sec 154 Pt Sec 87 & Sec 89 Lot 2 DP 10412 Sec 92 Ngatimanuhiakai 3B Pt Sec 149 Ngatimanuhiakai 17B1 Lots 1 & 2 DP 4415 Sec 151 Blk IV Waimate SD New areas: Ngatimanuhiakai 3A Blk IV Waimate SD, Ngatimanuhiakai 2A & 2B Blk, Ngatimanuhiakai 4A Blk IV Waimate SD, Ngatimanuhiakai 10A2 Blk IV Waimate SD, Lot 1 DP 5153 Sec 86 Blk Waimate SD, Lot 1 DP 10412 Lot 2 DP 11864 Pt Sec 94 Blk IV Waimate SD, Ngatimanuhiakai 7C1 Blk IV Waimate SD [between the following points; NW (1700589E-5625245N), NE (1700909E-5625245N), SW (1700631E-5625092N), SE (1700921E-5625046N)
Catchment:	Inaha

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

Condition 1 – new

1. The discharge authorised by this consent shall only occur on the land shown in the map labelled Figure 1 attached.

Conditions 2 to 12 [previously conditions 1 to 11] – unchanged

Management plan

2. Prior to the exercise of the consent, the consent holder shall provide, and subsequently shall maintain, a spray irrigation management plan, to the approval of the Chief Executive, Taranaki Regional Council, outlining the management of the system, which shall demonstrate ability to comply with consent conditions and shall address the following matters:

a) designated application areas;
b) selection of appropriate irrigation methods for different types of terrain;
c) application rate and duration;
d) application frequency;
e) farm management and operator training;
f) soil and herbage management;
g) prevention of runoff and ponding;
h) minimisation and control of odour effects offsite;
i) operational control and maintenance of the spray irrigation system;
j) monitoring of the effluent [physicochemical];
k) monitoring of soils and herbage [physicochemical];
l) monitoring of groundwater beneath the irrigated area [physicochemical];
m) monitoring of drainage water downslope of the irrigated area [physicochemical];
n) monitoring of Inaha Stream and relevant tributaries;
o) remediation measures;
p) liaison with submitters to the consent, and interested parties;
q) reporting monitoring data;
r) procedures for responding to complaints; and
s) notification to the Council of non-compliance with the conditions of this consent.

An objective of the plan shall be to maximise discharges to land and to minimise discharges to surface water under consent 2049.

3. The consent shall be exercised in accordance with the procedures set out in the spray irrigation management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and other matters specified in the management plan, except by the specific agreement of the Chief Executive, Taranaki Regional Council. In case of any contradiction between the management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.

4. The spray irrigation management plan described in special condition 2 of this consent shall be subject to review upon two months notice by either the consent holder or the Taranaki Regional Council. Further, the consent holder shall review the spray irrigation management plan annually and shall provide the reviewed plan to the Chief Executive, Taranaki Regional Council, by 31 May each year.

5. The consent holder shall designate an officer with the necessary qualifications and/or experience to manage the spray irrigation system. The officer shall be regularly trained on the content and implementation of the spray irrigation management plan, and shall be advised immediately of any revision or additions to the spray irrigation management plan.

6. The consent holder shall at all times adopt the best practicable option or options, as defined in Section 2 of the Resource Management Act 1991, to prevent or minimise the adverse effects of the discharges on the environment. This shall include, but not be limited to the minimisation of total nitrogen concentration in the treated effluent.

7. In circumstances where spray irrigation of wastewater is not possible, and where a dilution rate of 1:200 in the Inaha Stream cannot be maintained, the consent holder shall seek the permission of the Chief Executive, Taranaki Regional Council, prior to discharging wastewater to the Inaha Stream.

Odour and spray effects

8. The level of dissolved oxygen within the wastewater pond from which irrigation water is drawn shall be maintained above 1.0 gm^{-3} at all times.

9. There shall be no offensive or objectionable odour as a result of the irrigation of treated wastewater at or beyond the boundary of the property or properties on which spray irrigation is occurring.

10. There shall be no spray drift as a result of the irrigation of treated wastewater at or beyond the boundary of the property or properties on which spray irrigation is occurring.

Land effects

11. The sodium adsorption ratio [SAR] of the wastewater shall not exceed 15.

12. There shall be no ponding of wastewater, and/or any direct discharge to a watercourse due to the exercise of this consent.

Condition 13 [previously condition 12 - changed]

13. The edge of the spray zone shall be at least:

    a) 25 metres from the banks of any watercourse;
    b) 50 metres from any bore, well or spring used for water supply purposes;
    c) 20 metres from any public road, except as detailed in f) and g) of this condition;
    d) 20 metres from any property boundary;
    e) 150 metres from any dwellinghouse or place of public assembly unless the written approval of the occupier has been obtained to allow the discharge at a lesser distance;
    f) 200 metres from Normanby Road adjacent to the property described as Lots 3 & 4, Pt Lot 1 DP 2707, Lot 1 DP 3731, Blk IV, Waimate SD, unless the written approval of the occupier has been obtained to allow the discharge at a lesser distance; and
    g) 50 metres from Ahipaipa Road adjacent to the properties described as Pt Lot 1 and Lot 2 DP 3322, Lot 2 DP12129, Blk IV, Waimate SD.

Conditions 14 to 26 [previously conditions 13 to 25] – unchanged

14. The effluent application rate shall not exceed 300 kg nitrogen/hectare/year except on land described as Pt Sec 154 Blk IV Waimate SD, where the effluent application rate shall not exceed 200 kg/nitrogen/hectare/year.

15. The consent holder shall investigate, and report in writing on, options for upgrading the wastewater treatment system to reduce the concentration of ammonia in the wastewater prior to discharge; the report to be received by the Chief Executive, Taranaki Regional Council, not later than twelve months from the date the consent is granted. Any necessary works associated with the report on reduction of ammonia concentrations shall be completed within twelve months after the receipt of the report.

16. The average application rate shall not exceed 5 mm/hour.

17. The return period between applications shall be at least seven days and the application depth shall not exceed 25 mm at each application.

Monitoring and liaison

18. The consent holder shall site, install and maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, a minimum of nine monitoring bores for the purpose of determining groundwater quality in the vicinity of the discharge. The bores are to be sited in the following locations: upslope of the Kohiti Road and Katotauru Road irrigation areas (2), at the southern boundary of the western Normanby Road irrigation area (2), within the Normanby Road, Kohiti Road and Katotauru Road irrigation areas (3), at the southern boundary of the Katotauru irrigation area, and at the southern boundary of the Ahipaipa Road irrigation area. The spring downslope of the Normanby Road irrigation area, and three bores in the vicinity of Inuawai Road shall also be monitored.

19. The consent holder shall undertake such baseline and operational monitoring of the activities licensed by this consent, as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council.

20. The consent holder and staff of the Regional Council shall meet as appropriate, quarterly or at such other frequency as the parties may agree, with representatives of Ngati Manuhiakai Hapu and other interested submitters to the consent, and any other interested party at the discretion of the Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of the resource consent, in order to facilitate ongoing consultation.

21. The consent holder shall, where practicable, advise the Chief Executive, Taranaki Regional Council, and representatives of Ngati Manuhiakai Hapu, prior to discharge to Inaha Stream under consent 2049.

Mitigation

22. Should monitoring of the discharge under conditions 14 and 18 indicate contamination of local groundwater as a result of the exercise of this consent, the consent holder shall:

    a) undertake appropriate remedial action as soon as practicable as described in the spray irrigation management plan prepared under condition 2, or such action reasonably required by the Chief Executive, Taranaki Regional Council;
    b) shall review the spray irrigation management plan and incorporate such reasonable modifications as are considered necessary by the Chief Executive, Taranaki Regional Council; and
    c) where water supplies are significantly affected, immediately provide alternative supplies as reasonably required by the Chief Executive, Taranaki Regional Council.

Review

23. The consent holder may apply to the Council for a change or cancellation of any of the conditions of this consent in accordance with section 127(1)(a) of the Resource Management Act 1991 to take account of operational requirements or the results of monitoring.

24. The Taranaki Regional Council may review conditions 7 and 14 of this consent within two weeks after the completion of works to be investigated under condition 15 of this consent, for the purpose of evaluating the appropriateness of the required dilution rate and application rate, and the effects of the discharge on the Inaha Stream and soil.

25. The Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, and/or June 2007, for the purpose of assessing the need to increase the land area for wastewater disposal, reduce nitrogen loading to land and/or increase treatment at the wastewater treatment system to reduce the nitrogen concentration of the effluent.

26. The Taranaki Regional Council may, pursuant to section 128 of the Resource Management Act 1991, review any or all of the conditions of this consent by giving notice of review during June 2001, June 2003, June 2005, June 2007, June 2009, June 2011, June 2014 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this consent, which either were not foreseen at the time the application was considered or which it was not appropriate to deal with at that time.

Signed at Stratford on 9 November 2009

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

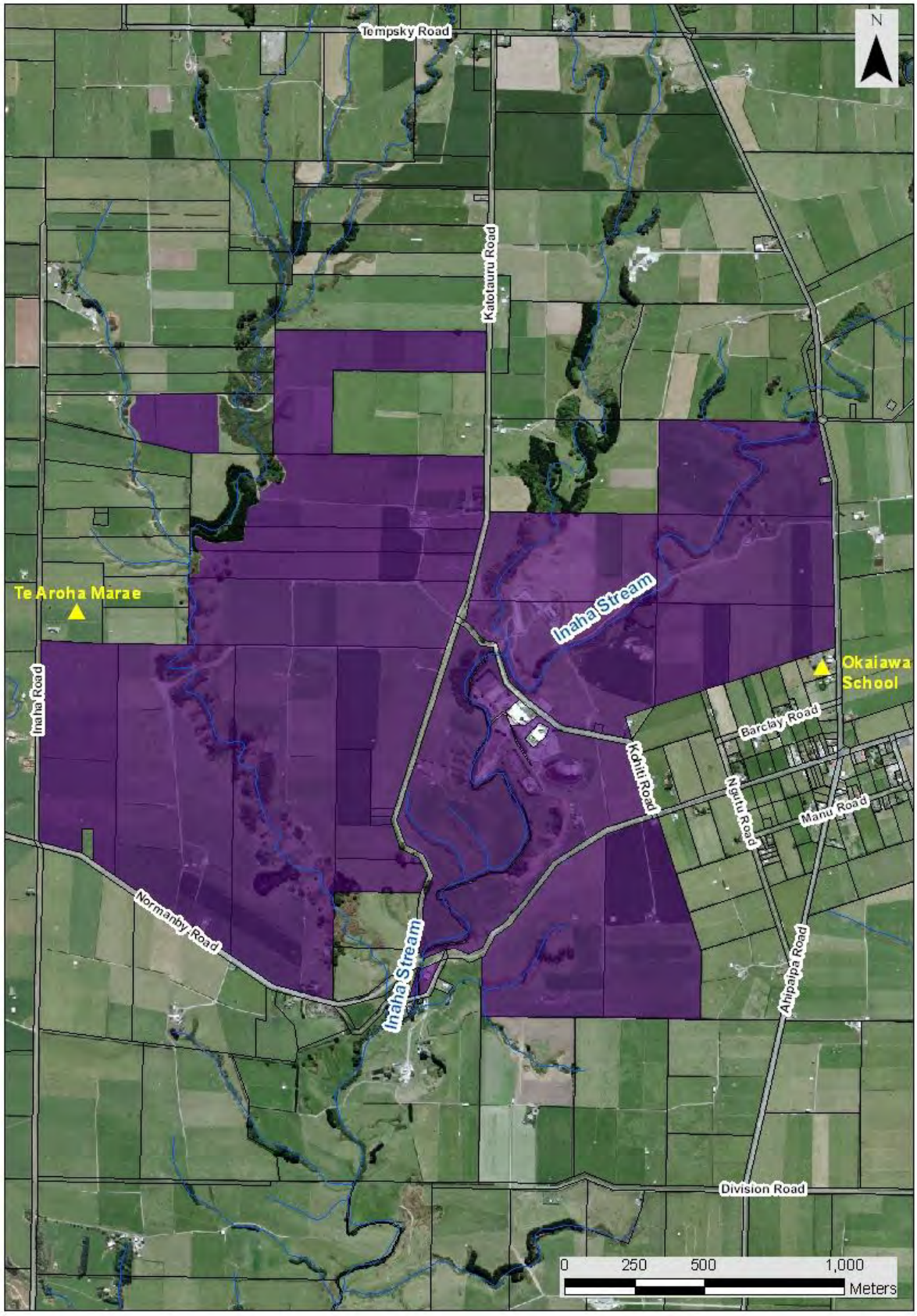

Figure 1 Location of the authorised area to receive wastewater, via spray irrigation, onto and into land

Discharge Permit

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

Name of Consent Holder:	Taranaki By-Products Limited P O Box 172 HAWERA 4640
Decision Date:	11 October 2011
Commencement Date:	11 October 2011

Conditions of Consent

Consent Granted:	To discharge emissions into the air from rendering operations and associated processes including wastewater treatment at or about (NZTM) 1701965E-5624119N and burial of material at or about (NZTM) 1702416E-5624339N
Expiry Date:	1 June 2024
Review Date(s):	June 2013, June 2015, June 2017, June 2019, June 2021, June 2023
Site Location:	Kohiti Road, Okaiawa
Legal Description:	Lot 3 DP 378038 Lot 2 DP 410593 Lots 2-3 DP 6457, Lot 1 DP 6457 Blk IV Waimate SD, Lot 1 DP 410593 [TBE], Lot 1 DP 10174 Lot 1 DP 11864 Sec 88 Pt Sec 90 Blk IV Waimate SD

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

General condition

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

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.

2. The discharge authorised by this consent shall not give rise to an odour at or beyond the boundary of the site that is offensive or objectionable.

   Note: With respect to this condition, the consent holder's site is defined as the areas shown in the map attached.

3. For the purposes of condition 2, an odour shall be deemed to be offensive or objectionable if:

   a. it is held to be so in the opinion of an enforcement officer of the Taranaki Regional Council, having regard to the duration, frequency, intensity and nature of the odour; and/or
   b. an officer of the Taranaki Regional Council observes that an odour is noticeable, and either it lasts longer than two (2) hours continuously, or it occurs frequently during a single period of more than four (4) hours; and/or
   c. no less than two individuals from at least two different properties, each declare in writing that an objectionable or offensive odour was detected beyond the boundary of the site, provided the Council is satisfied that the declarations are not vexatious and that the objectionable or offensive odour was emitted from the site at the frequency and duration specified in (b). Each declaration shall be signed and dated and include:

      1. the individuals' names and addresses;
      2. the date and time the objectionable or offensive odour was detected;
      3. details of the duration, frequency, intensity and nature of the odour that cause it to be considered offensive or objectionable;
      4. the location of the individual when it was detected; and
      5. the prevailing weather conditions during the event.

4. The consent holder shall continue to employ a suitably qualified and experienced person in the role of Environmental Manager, whose responsibilities shall include ensuring compliance with the conditions of this consent.

5. No fish or fish parts shall be received or processed on the premises.

6. By 30 April 2013, and every two years thereafter, the consent holder shall provide certification by a suitably qualified independent person that the works , processes and equipment relevant to all discharges to air from the site are operational in accordance with good engineering practice.

7. Before 2 February 2012, the consent holder shall prepare an Air Discharge Management Plan for the site that, to the satisfaction of the Chief Executive of the Taranaki Regional Council, details how discharges to air from the site will be managed to ensure compliance with conditions of this consent. The plan shall include but not necessarily be limited to;

    a. A description of the air quality objectives sought by the plan;

    b. The identification of key personnel responsible for managing air discharges and implementing the Management Plan;

    c. A description of the activities on the site and the main potential sources of odour emissions;

    d. A description of storage and treatment procedures (including specification of storage times and preservative dosing concentrations) for ensuring that only high quality raw material is processed;

    e. The identification and description of the odour and dust mitigation measures in place;

    f. The identification and description of relevant operating procedures and parameters that need to be controlled to minimise emissions;

    g. A description of contingency procedures for addressing situations, such as equipment failure or spillage of raw material or chemicals, which could result in a discharge to air of odorous emissions that are offensive or objectionable beyond the boundary of the plant;

    h. A description of monitoring and maintenance procedures for managing the odour mitigation measures including record keeping of control parameters and maintenance checks; and

    i. Details of staff training proposed to enable staff to appropriately manage the odour mitigation measures.

8. Operations on site shall be undertaken in accordance with the Air Discharge Management Plan, required by condition 7 above.

9. The Air Discharge Management Plan described in special condition 7 of this consent shall be subject to review upon two months notice by either the consent holder or the Taranaki Regional Council. Further, the consent holder shall review the management plan annually and provide the reviewed plan to the Taranaki Regional Council, by 31 May each year.

10. The discharges authorised by this consent shall not give rise to suspended or deposited dust at or beyond the boundary of the site that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable. For the purpose of this condition, discharges in excess of the following limits are deemed to be offensive or objectionable:

    a. dust deposition rate 0.13 g/m^2/day; and/or

    b. suspended dust level 3 mg/m^3.

11. The consent holder shall consult and inform the local community about activities on the site, specifically those relating to the exercise of this consent, by:

    a. Four times per year, providing a newsletter to all landowners and/or occupiers of properties within 3 kilometres of the site; and

    b. Convening a meeting with the Director - Resource Management, Taranaki Regional Council (or their delegate), and the local community annually or at such other frequency as the parties may agree.

12. 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 2013 and/or every two years thereafter. The purpose of any review would be to ensure 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. When determining if any review is required the Council will take into account any expressed views of the Okaiawa community.

Signed at Stratford on 11 October 2011

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

TRK995426

DISCHARGE PERMIT

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

Name of Consent Holder:	TARANAKI BY-PRODUCTS LIMITED PO BOX 172 HAWERA
Consent Granted Date:	31 May 1999

CONDITIONS OF CONSENT

Consent Granted:	TO DISCHARGE UP TO 1,095 LITRES/SECOND OF STORMWATER FROM AN ANIMAL RENDERING SITE INTO AN UNNAMED TRIBUTARY OF THE INAHA STREAM AT OR ABOUT GR: Q21:119-858, Q21:120-858 AND Q21:121-858
Expiry Date:	1 June 2019
Review Date[s]:	June 2001, June 2003, June 2005, June 2011 and June 2017
Site Location:	KOHITI ROAD OKAIAWA
Legal Description:	LOTS 1 & 2 DP6457 BLK IV WAIMATE SD
Catchment:	INAHA 351.000
Tributary:	UNNAMED TRIBUTARY

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

TRK995426

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 advise the Taranaki Regional Council prior to making any change in the processes undertaken at the site which could significantly alter the nature of the discharge.

2. THAT the discharge shall not exceed the following parameters:

Component	Concentration
pH range	6-9
oil and grease	15 gm^{-3}
suspended solids	100 gm^{-3}

This condition shall apply prior to the entry of the discharge into the receiving water at designated sampling point[s] approved by the General Manager, Taranaki Regional Council.

3. THAT after allowing for reasonable mixing, within a mixing zone extending 45 metres from the confluence of the unnamed tributary with the Inaha Stream, the discharge [in conjunction with any other discharges pertaining to the same property], shall not give rise to any of the following effects in the receiving waters:

(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 freshwater unsuitable for consumption by farm animals;

(e) any significant adverse effects on aquatic life, habitats or ecology; and

(f) any visible bacterial and/or fungal growths.

4. THAT within three months of the granting of this consent, the consent holder shall prepare a contingency plan outlining measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not licensed by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

5. 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 2001, June 2003, June 2005, June 2011 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 31 May 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

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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:	Taranaki By-Products Limited P O Box 172 HAWERA
Change To Conditions Date:	4 August 2000 [Granted: 30 March 2000]

Conditions of Consent

Consent Granted:	To discharge up to 200 tonnes/day of wastes from meat rendering operations by burial into land in the vicinity of the Inaha Stream at or about GR: Q21:121-859
Expiry Date:	1 June 2019
Review Date(s):	June 2001, June 2003, June 2005, June 2011, June 2017
Site Location:	Kohiti Road, Okaiawa
Legal Description:	Lot 1 DP 10174 Lot 1 DP 11864 Sec 88 Pt Sec 90 SO 268 Blk IV Waimate SD
Catchment:	Inaha

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

special condition 1 [amended]

1. THAT by 1 November 2000, the consent holder shall provide a waste burial management plan, to the approval of the General Manager, Taranaki Regional Council, outlining the management of the system, which shall demonstrate ability to comply with consent conditions and shall address the following matters:

a) nature of wastes discharged;
b) discharge control;
c) waste cover;
d) addition of hydrated lime to stabilise the wastes;
e) minimisation and control of odour effects offsite;
f) stormwater control;
g) leachate management;
h) monitoring of groundwater beneath the burial area [physicochemical];
i) site re-instatement and after care (including maintaining the integrity of the cover material);
j) site contouring;
k) reporting monitoring data;
l) procedures for responding to complaints; and
m) notification to the Council of non-compliance with the conditions of this consent.

special conditions 2-5 [unchanged]

2. THAT the consent shall be exercised in accordance with the procedures set out in the waste burial management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and other matters specified in the management plan, except by the specific agreement of the General Manager, Taranaki Regional Council. In case of any contradiction between the management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.

3. THAT the waste burial management plan described in special condition 1 of this consent shall be subject to review upon two months notice by either holder the Taranaki Regional Council.

4. THAT the consent holder shall designate an officer with the necessary qualifications and/or experience to manage the waste burial site. The officer shall be regularly trained on the content and implementation of the burial management plan, and shall be advised immediately of any revision or additions to the burial management plan.

5. THAT the disposal pit[s] shall not intercept shallow groundwater.

special conditions 6 – 7 [amended]

6. THAT the disposal pits shall be constructed when required in general accordance with the information supplied by the applicant in support of application 1084.

7. THAT the consent holder shall notify the Council of the commencement to construct additional disposal pits outside of the disposal area indicated in the map supporting the application.

special condition 8 [unchanged]

8. THAT an officer of the Council is to inspect all constructed disposal pits prior to disposal operations.

special condition 9 [amended]

9. THAT special conditions 1 to 4 shall apply after 1 November 2000 when the disposal pit required by special condition 6 is constructed and also for all subsequent disposal pits.

special conditions 10 – 15 [unchanged]

10. THAT the discharged material shall be covered within a period of four hours or less so as to avoid the generation of offensive offsite odours.

11. THAT at the completion of the disposal operation a low permeability, clean, compacted soil cover with a minimum thickness of 1.0m be placed over the discharged wastes.

12. THAT the cover material and surrounding land shall be contoured such that all stormwater is directed away from the disposal area to the satisfaction of the General Manager, Taranaki Regional Council.

13. THAT the disposal site shall be rehabilitated and pasture re-established to the satisfaction of the General Manager, Taranaki Regional Council.

14. THAT there shall not be any irrigation of effluent under resource consent 3941 or resource consent 2466 onto the disposal area.

15. THAT the exercise of this consent shall not lead, or be liable to lead, to a direct discharge of contaminants to a surface water body.

special condition 16 [amended]

16. THAT the consent holder shall install and maintain, to the satisfaction of the General Manager, Taranaki Regional Council, a minimum of eight monitoring bores for the purpose of determining groundwater quality in the vicinity of the discharge.

special condition 17-18 [unchanged]

17. THAT the consent holder may apply to the Council for a change or cancellation of any of the conditions of this consent in accordance with section 127(1)(a) of the Resource Management Act 1991 to take account of operational requirements or the resources of monitoring.

18. 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 2001, June 2003, June 2005, June 2011 and/or June 2017, 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 was 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 4 August 2000

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Consent 5560-1

Discharge Permit

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

Name of Consent Holder:	Taranaki By-Products P O Box 172 HAWERA
Consent Granted Date:	15 October 1999

Conditions of Consent

Consent Granted:	To discharge waste cheese and associated packaging by burial into land and to discharge emissions into air from the removal and disposal operation at or about GR: Q21:116-854	
Expiry Date:	1 February 2000 1 June 2017	[for air discharge] [for land discharge]
Review Date(s):	June 2005, June 2011	[for land discharge]
Site Location:	Katotauru Road, Okaiawa	
Legal Description:	Ngatimanuhiakai 17B2 Block Blk IV Waimate SD	

*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

Air discharge and land discharge

1. THAT the consent holder shall notify the Taranaki Regional Council at least 24 hours prior to commencement of the removal and disposal operations to plan monitoring.

2. THAT the consent holder, at the consent holder's reasonable expense, shall undertake to remove all affected parties from the discharge area for the duration of the removal and disposal operations or to otherwise mitigate the effects, to the satisfaction of the General Manager, Taranaki Regional Council.

3. THAT the consent holder shall ensure that the discharge licensed by this consent takes place in general accordance with the information submitted in support of application 774 and does not exceed 100 tonnes.

4. THAT the consent holder shall allow the Taranaki Regional Council, its employees or agent access to the discharge site at all reasonable times for the purpose of inspecting the site and/or taking samples of water or other material for analytical purposes.

5. THAT the consent holder shall keep a photographic record of the disposal operation and shall forward a copy of the photographic record to the Taranaki Regional Council upon request.

6. THAT the disposal operation shall be completed as far as practicable within one 15 hour period.

7. THAT if Condition 6 is not achieved the discharged wastes shall be covered with at least 0.5 m of clean soil as an interim measure.

8. THAT the discharged material shall be immediately covered upon placement in the disposal pit with hydrated lime and agricultural lime (dolomite) as an interim cover.

9. THAT at the completion of the disposal operation a low permeability compacted clean soil cover with a minimum thickness of 1.0 m shall be placed over the discharged wastes.

10. THAT the site shall not be used for simultaneous disposal, or re-opened for subsequent disposal, of any other wastes.

11. THAT the consent holder shall adopt the best practicable option (as defined in Section 2 of the Resource Management Act, 1991) to prevent or minimise any odour and to remedy or mitigate any actual or potential effects on the environment arising from the discharge.

Air discharge only

12. THAT during transportation all waste material shall be covered.

13. THAT any material discharged during transit shall be recovered immediately.

14. THAT the discharge shall only be undertaken when the prevailing wind is from the southerly quarter (ie. south-east to south-west).

15. THAT there shall be no emission of odours from the removal and disposal operation after 1 February 2000.

Land discharge only

16. THAT the disposal pit shall be constructed with a low permeability compacted soil liner with a minimum thickness of 0.6 m.

17. THAT the disposal pit shall not intercept groundwater (the water table).

18. THAT the cover material and surrounding land shall be contoured such that all stormwater is directed away from the disposal area.

19. THAT the disposal site shall be rehabilitated and pasture re-established.

20. THAT there shall not be any irrigation of effluent from the Taranaki By-Products wastewater disposal system over the disposal area.

21. THAT the integrity of the cover material shall be maintained after the completion of the discharge.

22. THAT the exercise of this consent shall not lead, or be liable to lead, to a direct discharge of contaminants to a surface waterbody.

23. 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 2005 and/or June 2011, 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 either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 15 October 1999

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Consent 6431-1

Land Use Consent

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

Name of Consent Holder:	Taranaki By-Products Limited P O Box 172 HAWERA
Consent Granted Date:	4 October 2004

Conditions of Consent

Consent Granted:	To erect, place and maintain two culverts in the Inaha Stream for farm access purposes at or about GR: Q21:121-860 and Q21:125-863
Expiry Date:	1 June 2023
Review Date(s):	June 2011, June 2017
Site Location:	Kohiti Road, Hawera
Legal Description:	Secs 89 & 90 Blk IV Waimate SD
Catchment:	Inaha

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

   i) the administration, monitoring and supervision of this consent; and
   ii) charges authorised by regulations.

Special conditions

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

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3271. In the case of any contradiction between the documentation submitted in support of application 3271 and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the commencement and upon completion of the initial installation and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the river bed or discharges to water.

4. Once initial work is complete, any further instream works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.

5. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.

6. The consent holder shall ensure the area and volume of riverbed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.

7. The structures authorised by this consent shall be removed and the area reinstated, if and when the structures are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to removal and reinstatement.

8. The structures which are the subject of this consent shall not restrict the passage of fish.

9. The consent holder shall prevent stock at all times from accessing all water bodies, including wetlands, on or bordering the consent holder's property, upstream of Kohete Road bridge, by constructing and maintaining fences or other controls, located to provide for the establishment of riparian margins; such means of prevention to be established within four years of the granting of this consent.

10. The consent holder shall undertake planting and subsequent maintenance of the riparian margins of the water bodies within the fenced or controlled area(s) as required by special condition 9, to the satisfaction of the Chief Executive, Taranaki Regional Council, within four years of the granting of this consent, for the purpose of enhancing water quality and aquatic habitat.

11. The invert of the culverts shall be not less than 50 mm below the bed of the stream. Appropriate headwall structures shall be constructed to protect the intake and outlet of the culverts from erosion.

12. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2011 and / or June 2017, 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 4 October 2004

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Land Use Consent

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

Name of Consent Holder:	Taranaki By-Products Limited P O Box 172 HAWERA
Consent Granted Date:	12 March 2008

Conditions of Consent

Consent Granted:	To realign a section of approximately 350 metres of the Inaha Stream for land improvement purposes at or about 2612637E-6186381N
Expiry Date:	1 June 2023
Review Date(s):	June 2011, June 2017
Site Location:	533 Ahipaipa Road, Okaiawa
Legal Description:	Sec 89 Blk IV Waimate SD Lot 2 DP 10412 Pt Sec 87 Blk IV Waimate SD
Catchment:	Inaha

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 4881. In the case of any contradiction between the documentation submitted in support of application 4881 and the conditions of this consent, the conditions of this consent shall prevail.

2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to the exercise of this consent. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable only if the consent holder does not have access to email.

3. A rock wall consisting of interlocking boulders of an average diameter of at least 1 metre shall be constructed on the outside of the bend at the downstream end of the realignment to protect that bank from erosion. The rock wall and bank over this reach shall be no steeper than 2 horizontal to 1 vertical.

4. Any instream works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.

5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

6. The consent holder shall take all reasonable steps to:

a. minimise the amount of sediment discharged to the stream;
b. minimise the amount of sediment that becomes suspended in the stream; and
c. mitigate the effects of any sediment in the stream.

Undertaking work in accordance with *Guidelines for Earthworks in the Taranaki region,* by the Taranaki Regional Council, will achieve compliance with this condition.

7. Immediately before water is diverted away from the existing stream channel the consent holder shall ensure that fish are removed from the channel to be dewatered and released to a reach with suitable habitat. Fish to be removed shall be captured using electric fishing, or other accepted fish capture techniques that achieve similar results.

8. The stream realignment shall not obstruct fish passage.

9. Any vegetation removed during the realignment shall not be buried within 25 metres of the Inaha Stream.

10. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

11. 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 2011 and/or June 2017, 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 12 March 2008

For and on behalf of
Taranaki Regional Council

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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:	Taranaki By-Products Limited P O Box 172 HAWERA
Consent Granted Date:	30 June 2008

Conditions of Consent

Consent Granted:	To discharge stormwater and sediment from earthworks associated with the re-contouring of land and the re-aligning of a section of the Inaha Stream onto and into land and into the Inaha Stream at or about (NZTM) 1702455E-5624812N
Expiry Date:	1 June 2023
Review Date(s):	June 2011, June 2017
Site Location:	533 Ahipaipa Road, Okaiawa
Legal Description:	Sec 89 & Lot 2 DP 10412 Pt Sec 87 Blk IV Waimate SD
Catchment:	Inaha

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The exercise of this consent shall be undertaken in accordance with the documentation submitted in support of application 6022. If there is any conflict between the documentation submitted in support of application 6022 and the conditions of this consent, the conditions of this consent shall prevail.

2. The discharge shall not derive from an area of soil disturbance greater than 8 hectares.

3. The discharge shall not derive from a volume of soil disturbance greater than 24, 000 cubic metres.

4. While any area of soil is exposed, all run off from that area shall pass through settlement ponds or sediment traps with a minimum total capacity of 200 cubic metres for every hectare of exposed, unless other sediment control measures that achieve an equivalent standard are agreed to by the Chief Executive of the Taranaki Regional Council.

5. The consent holder shall take all reasonable steps to:
   a. minimise the amount of sediment discharged to the stream;
   b. minimise the amount of sediment that becomes suspended in the stream; and
   c. mitigate the effects of any sediment in the stream.

   Subject to condition 2, undertaking work in accordance with *Guidelines for Earthworks in the Taranaki region,* by the Taranaki Regional Council, will achieve compliance with this condition.

6. At least 7 working days prior to the commencement of works the consent holder shall provide the Taranaki Regional Council with a programme for the proposed works, including: a schedule of proposed start dates and an estimation of the duration of the works, and details of the contractor including contact information for the project manager. The programme shall be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable if the consent holder does not have access to email.

7. All earthwork areas shall be stabilised vegetatively or otherwise as soon as is practicable immediately following completion of soil disturbance activities.

8. In the event of any archaeological site or koiwi being encountered during the exercise of this consent, activities in the vicinity of the discovery shall cease. The consent holder shall contact the Chief Executive, Taranaki Regional Council, to obtain details of the relevant iwi authority. The consent holder shall then consult with the relevant local iwi, the New Zealand Historic Places Trust and the New Zealand Police and shall not recommence works in the area of the discovery until the relevant Historic Places Trust approvals or other approvals to damage, destroy or modify such sites have been obtained, where necessary.

9. This consent shall lapse five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

10. 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 2011 and/or June 2017 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 30 June 2008

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Water Permit

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

Name of Consent Holder:	Taranaki By-Products Limited P O Box 172 HAWERA 4640
Decision Date:	3 February 2014
Commencement Date:	3 February 2014

Conditions of Consent

Consent Granted:	To take and use groundwater for industrial water supply purposes
Expiry Date:	1 June 2029
Review Date(s):	June 2017, June 2023
Site Location:	179 Katotauru Road, Okaiawa
Legal Description:	Ngatimanuhiakai 2B (Site of take & use)
Grid Reference (NZTM)	1701636E-5624804N
Catchment:	Inaha

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

General condition

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

Special conditions

1. The total volume of water taken from the 'Bore 3' (GND2380) at a rate not exceeding 22.8 litres per second (1,970 cubic metres per day)

2. The bore shall be easily identifiable by a permanent label, which may be welded or engraved on the casing, or on the equivalent fixed part of the well construction or associated building. The bore shall be labelled with the bore number assigned by Taranaki Regional Council - GND2380.

3. The consent holder shall ensure that there is access into the well that enables the manual measurement of static and pumping water levels.

4. Before exercising this consent the consent holder shall install, and thereafter maintain a water meter and a datalogger at the site of taking (or a nearby site in accordance with Regulation 10 of the *Resource Management (Measurement and Reporting of Water Takes) Regulations 2010*. The water meter and datalogger shall be tamper-proof and shall measure and record the rate and volume of water taken to an accuracy of ± 5%. Records of the date, the time (in New Zealand Standard Time) and the rate and volume of water taken at intervals not exceeding 15 minutes, shall be made available to the Chief Executive, Taranaki Regional Council at all reasonable times.

   Note: Water meters and dataloggers must be installed, and regularly maintained, in accordance with manufacturer's specifications in order to ensure that they meet the required accuracy. Even with proper maintenance water meters and dataloggers have a limited lifespan.

5. The consent holder shall provide the Chief Executive, Taranaki Regional Council with a document from a suitably qualified person certifying that water measuring and recording equipment required by the conditions of this consent ('the equipment'):

   (a) has been installed and/or maintained in accordance with the manufacturer's specifications; and/or

   (b) has been tested and shown to be operating to an accuracy of ± 5%.

   The documentation shall be provided:

   (i) within 30 days of the installation of a water meter or datalogger;

   (ii) at other times when reasonable notice is given and the Chief Executive, Taranaki Regional Council has reasonable evidence that the equipment may not be functioning as required by this consent; and

   (iii) no less frequently than once every five years.

6. Before exercising this consent, the consent holder shall install and subsequently maintain equipment to measure and record the water level within Bore 3 to an accuracy of ± 0.05 metres at intervals not exceeding 15 minutes.

7. The measurements made in accordance with condition 4 and 6 of this consent, shall be transmitted to the Taranaki Regional Council's computer system, in a format to be advised by the Chief Executive, Taranaki Regional Council, to maintain a 'real time' record of the water taken and bore water levels.The records of water taken and the water level within each bore shall:

   (a) be in a format that, in the opinion of the Chief Executive, Taranaki Regional Council, is suitable for auditing; and

   (b) specifically record the water taken as 'zero' when no water is taken.

8. The water meter, level monitoring device and datalogger shall be accessible to Taranaki Regional Council officer's at all reasonable times for inspection and/or data retrieval. The data logger shall be designed and installed so that Council officers can readily verify that it is accurately recording the required information.

9. If any measuring or recording equipment breaks down, or for any reason is not operational, the consent holder shall advise the Chief Executive, Taranaki Regional Council immediately. Any repairs or maintenance to this equipment must be undertaken by a suitably qualified person.

10. At all times the consent holder shall adopt the best practicable option (BPO) to prevent or minimise any actual or likely adverse effect on the environment associated with the abstraction of groundwater, including, but not limited to, the efficient and conservative use of water.

11. This consent shall lapse on 31 March 2019, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

12. 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 2017 and/or June 2023 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 3 February 2014

For and on behalf of
Taranaki Regional Council

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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:	Taranaki By-Products Limited PO Box 172 Hawera 4640
Decision Date:	21 January 2015
Commencement Date:	21 January 2015

Conditions of Consent

Consent Granted:	To discharge emissions into the air from the burning of pallets, paper and cardboard
Expiry Date:	01 June 2029
Review Date(s):	June 2017, June 2023
Site Location:	Kohiti Road, Okaiawa
Legal Description:	Lot 3 DP 378038 Lot 2 DP 410593 Lots 2-3 DP 6457 (Discharge source & site)
Grid Reference (NZTM)	1701917E-5623971N

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

General condition

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

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent and shall include as a minimum:
    - having regard to the prevailing and predicted wind speed and direction at the time of burning in order to minimise offsite effects;
    - allowing the waste material to dry before burning;
    - starting a small fire with the driest material and adding further material once it is blazing, as opposed to igniting a large stack and leaving it unattended.

2. The materials for combustion are restricted to untreated wood or sawdust, paper and cardboard.

3. There shall be no objectionable or offensive odour to the extent that it causes an adverse effect at or beyond the boundary of the site.

    Note: For the purposes of this condition:

    - The site is defined as Lot 3 DP 378038 Lot 2 DP 410593 Lots 2-3 DP 6457; and
    - Assessment under this condition shall be in accordance with the *Good Practice Guide for Assessing and Managing Odour in New Zealand, Air Quality Report 36, Ministry for the Environment, 2003.*

4. The consent holder, or an authorised agent, shall supervise burning at all times.

5. The dust deposition rate beyond the property boundary arising from the discharge shall be less than 0.13 $g/m^2/day$ or 4.0 $g/m^2/30$ days.

6. Any discharge to air from the site shall not give rise to any offensive, objectionable, noxious or toxic levels of dust at or beyond the boundary of the property, and in any case, suspended particulate matter shall not exceed 3 mg/m^3 (measured under ambient conditions) beyond the boundary of the site.

7. The discharges authorised by this consent shall not give rise to a level of a contaminant or contaminants at or beyond the boundary of the site that is noxious or toxic.

8. This consent shall lapse on 31 March 2020, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

9. 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 2017 and/or June 2023, 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 21 January 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
Director - Resource Management

Appendix II

Biomonitoring reports

To Nathan Crook, Job Manager
From Darin Sutherland and Brooke Thomas, Scientific Officers
Report No. BT049
Date January 2016
Doc number 1632128

Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, October 2015

Introduction

Taranaki By-Products Limited holds a number of consents for discharges to land and to water associated with the operation of a rendering plant and a neighbouring farm owned and operated by the Company. The discharge consents most relevant to this biomonitoring survey are summarised in Table 1 below:

Table 1 Summary of discharge consents held by Taranaki By-Products Limited which are of most relevance to this biological survey.

Consent no.	Purpose
2049-4	To discharge up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream
2050-4	To discharge up to 2,160 cubic metres/day of cooling water and backwash water from a rendering operation into an unnamed tributary of the Inaha Stream
3941-2	To discharge up to 1400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries between 1700909E-5625245N, 1700631E-5625092N and 1700921E-5625046N
5426-1	To discharge up 1,095 litres/second of stormwater from an animal rendering site into an unnamed tributary of the Inaha Stream

Biomonitoring has been undertaken at some sites in relation to the discharges from the rendering plant and associated activities since the mid-1980s. Some of the sites used for the biomonitoring of these discharges have changed over time and these changes have been documented in previous reports (Jansma, 2012 a, b, c).

This spring biological survey was the first of two scheduled in the Inaha Stream catchment in the 2015-2016 monitoring year in relation to discharges from the Taranaki By-Products plant. Results from previous surveys are also referred to in this report (see references).

Methods

This biomonitoring survey was undertaken at eight sites on 20 October 2015 (Table 2 and Figure 1). Five of the eight sites surveyed were in the Inaha Stream and the remaining sites were in an unnamed tributary of the Inaha Stream (Figure 1). The locations of sampling sites in relation to the discharges from the rendering plant are discussed below.

Site U (INH000334) was established in the 2003-2004 monitoring period as an appropriate control site on the Inaha Stream above the rendering plant discharges and irrigation areas. Site 1 (INH000400) is located upstream of the wastewater and cooling water discharge points but downstream of part of the treated wastewater irrigation area. Sites 2d and 3

(INH000420 and INH000430) are located downstream of these two discharges and above the confluence with the unnamed tributary of the Inaha Stream which drains land upon which wastewater is irrigated.

The area of land authorised to be irrigated onto under consent 3941-2 has increased on several occasions since the consent was granted in December 1999. Sites UT, MT and DT (INH000433, INH000435 and INH000440) were established to monitor the effects of the expanded irrigation area on an unnamed tributary of the Inaha Stream. Site UT was established as a 'control site' for the expanded irrigation area. Site MT is located within the authorised irrigation area and site DT is situated downstream of the irrigation area but upstream of the unnamed tributary's confluence with the Inaha Stream.

Site 4 (INH000450) on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 2 Biomonitoring sites in the Inaha Stream and in an unnamed tributary relating to the Taranaki By-Products plant.

Stream	Site No.	Site code	Location	Sampling method used
Inaha Stream	U	INH000334	Upstream of irrigation area, near Ahipaipa Road	Streambed kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Streambed kick
	2d	INH000420	500 m downstream of cooling water discharge	Streambed kick
	3	INH000430	Upstream of Normanby Road	Streambed kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Kick-sweep
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Streambed kick
	MT	INH000435	Middle site within the new irrigation area	Kick-sweep
	DT	INH000440	50m upstream Normanby Road	Streambed kick

Two different sampling techniques were used to collect streambed macroinvertebrates in this survey. The Council's standard '400ml kick-sampling' technique was used at sites U, 1, 2d, 3, UT and DT, and a combination of the 'kick-sampling' and 'vegetation sweep' techniques were used at sites 4 and MT (Table 2). The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-bottomed, semi-quantitative) 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 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience.

Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value. A difference of 11 units or more in MCI values is considered significantly different (Stark 1998).

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, therefore $SQMCI_s$ values range from 1 to 10, while MCI values range from 20 to 200.

Where necessary, sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream. Such heterotrophic growths have been recorded on numerous past occasions at sites downstream of the Taranaki By-Products plant as a result of organic nutrient enrichment from the wastewater discharge.

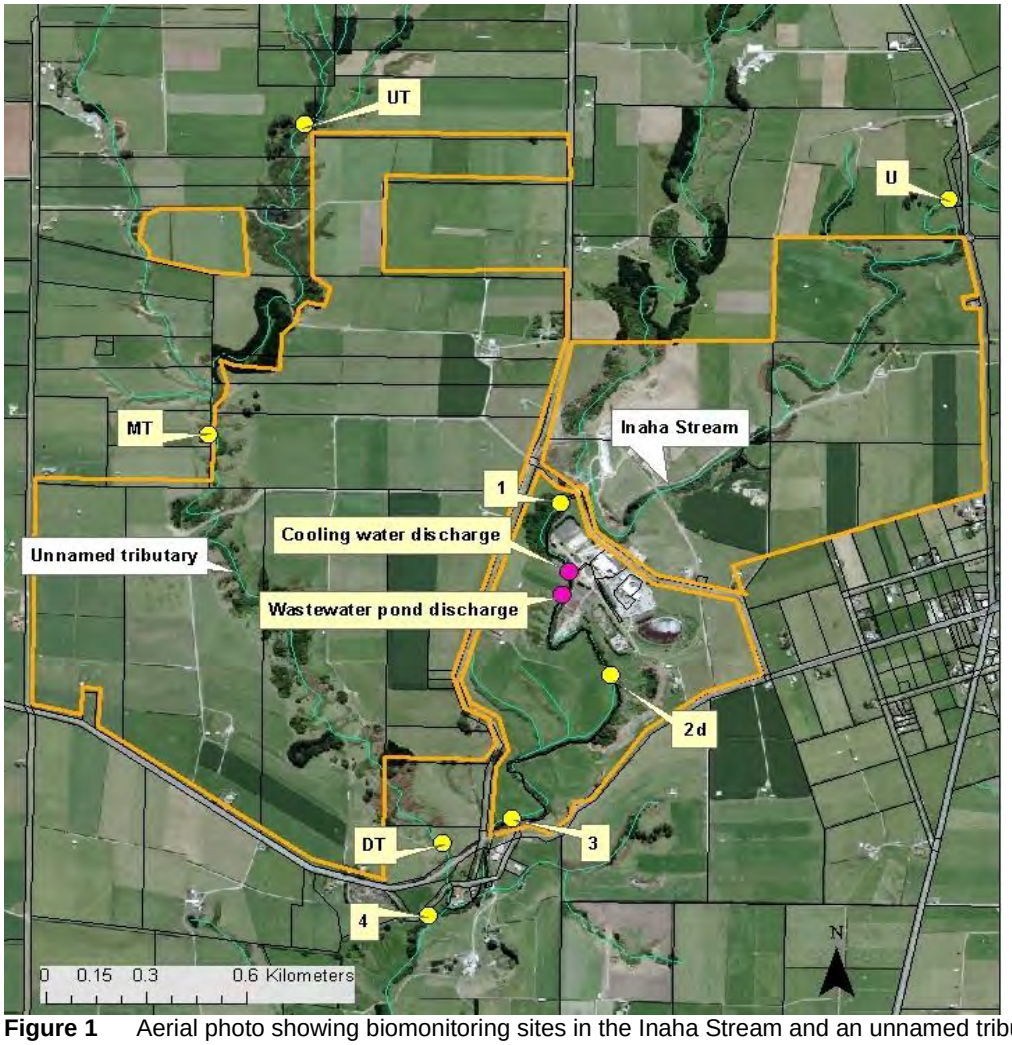

Figure 1 Aerial photo showing biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. The orange line outlines the irrigation areas around the rendering plant.

Results

Site habitat characteristics and hydrology

This October 2015 survey followed a period of 18 days since a fresh in excess of three times median flow in the nearby Waiokura Stream at No. 3 Fairway (the nearest appropriate water level recorder) and 39 days since a fresh in excess of seven times median flow. In the month prior to this survey flow had steadily decreased throughout the month, after a four day period of elevated flow early in the month. An absence of significant freshes would likely result in increased levels of filamentous periphyton and fine sediment accumulating on the streambed.

The Company's records showed that the last discharge of treated wastewater to the Inaha Stream began on the 4 June 2015 and continued without cessation until 14 October 2015 (a period of 128 days). Therefore, there was a short period of 6 days when no discharges occurred prior to this biological survey. Cooling water was discharged to the stream throughout this period. The record shows that the minimum dilution of wastewater of 1:300 that is required under consent 2049-4 was maintained throughout the period. Prior to 4 June 2015, discharge of wastewater was entirely to land over a nine month period, excluding one day only, being 22 September 2014.

At the Inaha Stream sites (U, 1, 2d and 3) the water was brown and cloudy. At site 4, downstream of the tributary confluence, the water was brown and dirty. Flow conditions were moderate and water speeds swift at all the Inaha Stream sites. Water temperatures in the Inaha Stream ranged between 11.7°C and 12.8°C. At the unnamed tributary of the Inaha Stream sites there was a brown, cloudy, moderate and swift flow at sites MT and DT, while the flow at site UT was uncoloured and clear. Stream temperatures ranged from 12.3 °C to 13.2 °C during this survey.

In the Inaha Stream, site U had a substrate which was mostly cobbles and gravels with some silt. Site 1 had a substrate composition of cobbles and gravels while site 2d had a substrate composed of mostly gravels with some cobbles, silt and sand. Site 3 had a substrate composition of predominantly boulders, with cobbles, gravels, sand and some silt. Site 4 had a predominately silt substrate with some sand and small amounts of fine gravel. Substrate at site UT consisted of silt and wood/root while at site MT it consisted almost entirely of silt. At site DT the substrate composition was mostly cobbles and silt with gravels and sand.

No periphyton mats or filaments were recorded at sites 1 and 4 while slippery mats were recorded at sites U and 2d. Slippery mats and patchy filaments were recorded growing at site 3. Only one of the Inaha Stream sites (site 2d) had macrophyte growth, and this was confined to the edges of the stream only. Site 4 was partially shaded, while all other Inaha Stream sites were unshaded. Previously, during the spring survey in October 2014 there were overhanging trees at site 2d but these had been removed before the February 2015 summer survey.

In the unnamed tributary of the Inaha Stream, no periphyton was recorded growing at sites UT and MT, whereas slippery mats and patchy filaments were recorded at the downstream site (DT). No macrophytes were recorded growing at sites UT and DT, while at site MT macrophytes were recorded growing at the edges of the stream. Site UT was partially shaded while sites MT and DT were completely unshaded.

Streambed microflora

A microscopic inspection of material collected from the bed of the Inaha Stream found no evidence of 'heterotrophic growths '(protozoa or fungi) at any of the sites sampled. This was the thirteenth consecutive survey to record a lack of such growths, continuing the improvement following the late summer 2008 and spring 2009 surveys, which both recorded such growths. This is an important result; as such growth is often associated with 'sewage fungus' which is an indication of high levels of organic matter and nutrient enrichment in the stream. Such growths have been recorded on many previous sampling occasions, often in abundance, particularly downstream of the plant discharges at site 2d. The absence of such growths is evidence that the degree of enrichment is not as severe as that recorded previously.

Macroinvertebrate communities

Results of previous macroinvertebrate surveys performed in the Inaha Stream and the unnamed tributary are summarised and presented together with current results in Table 3.

Table 3 Summary of previous numbers of macroinvertebrate taxa and MCI and $SQMCI_S$ values for surveys between September 1987 and February 2015 together with current results recorded in the Inaha Stream and an unnamed tributary in relation to Taranaki By-Products.

	Number of taxa				MCI values			$SQMCI_S$ values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
U	29	18-34	23	20	83-102	94	99	29	4.3-6.9	5.3	6.4
1	69	15-31	22	20	82-104	95	97	45	3.6-6.3	5.1	4.8
2d	57	10-30	22	24	52-106	78	95	46	1.2-6.5	2.0	4.8
3	70	6-35	21	20	43-99	81	96	46	1.3-5.8	2.5	4.8
4	26	17-31	26	25	77-104	90	84	26	2.0-6.6	4.4	2.7
UT	9	13-23	19	15	87-109	98	101	9	3.5-6.3	5.4	5.4
MT	22	12-29	20	15	71-94	82	91	22	3.1-5.7	4.5	4.5
DT	23	12-25	21	14	80-105	89	84	23	3.5-5.3	4.6	4.2

Table 4 provides a summary of various macroinvertebrate indices within a specific altitudinal band for 'control' sites situated in Taranaki ring plain streams arising outside of Egmont National Park. The full results from this current survey are given in Table 5 and Table 6.

Table 4 Range and median number of taxa, MCI values and SQMCIs scores for 'control' sites (Taranaki ring plain rivers/streams with sources outside Egmont National Park) at altitudes 80-124 m asl (TRC, 2015).

	No. of taxa	MCI value	$SQMCI_S$ value
No. Samples	248	248	192
Range	12-34	66-112	1.3-6.9
Median	22	92	5.0

Table 5 Macroinvertebrate fauna of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 20 October 2015.

Taxa List	Site Number	MCI score	U	1	2d	3	4
	Site Code		INH000334	INH000400	INH000420	INH000430	INH000450
	Sample Number		FWB15323	FWB15324	FWB15325	FWB15326	FWB15330
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	-	-	-	R
NEMATODA	Nematoda	3	-	-	R	R	R
ANNELIDA (WORMS)	Oligochaeta	1	C	R	A	A	VA
	Lumbricidae	5	-	R	-	C	-
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	-	R	-
MOLLUSCA	*Potamopyrgus*	4	VA	XA	VA	VA	A
	Sphaeriidae	3	-	-	-	-	R
CRUSTACEA	Ostracoda	1	-	R	R	-	C
	Isopoda	5	-	-	-	-	R
	Paracalliope	5	A	C	R	C	R
	Paraleptamphopidae	5	-	C	-	-	R
	Talitridae	5	-	-	-	-	C
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	A	C	R	C
	Coloburiscus	7	R	-	R	-	-
	Deleatidium	8	XA	A	A	A	-
	Zephlebia group	7	R	R	R	R	A
PLECOPTERA (STONEFLIES)	*Zelandobius*	5	VA	A	A	C	R
COLEOPTERA (BEETLES)	Elmidae	6	A	VA	VA	VA	R
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	C	C	R	R	-
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	R	A	R	R	R
	Costachorema	7	R	C	R	-	-
	Hydrobiosis	5	C	C	A	C	R
	Hudsonema	6	-	-	C	R	R
	Oecetis	4	-	-	-	-	C
	Paroxyethira	2	-	-	-	-	R
	Pycnocentria	7	C	A	C	R	R
	Pycnocentrodes	5	VA	XA	VA	VA	R
DIPTERA (TRUE FLIES)	*Aphrophila*	5	-	-	R	-	-
	Chironomus	1	-	-	-	-	R
	Maoridiamesa	3	A	R	C	C	-
	Orthocladiinae	2	C	R	A	A	-
	Polypedilum	3	C	-	R	-	R
	Tanytarsini	3	A	-	R	R	-
	Muscidae	3	-	R	-	-	-
	Austrosimulium	3	R	-	R	-	C
ACARINA (MITES)	Acarina	5	-	-	-	-	R
		No of taxa	20	20	24	20	25
		MCI	99	97	95	96	84
		SQMCIs	6.4	4.8	4.8	4.8	2.7
		EPT (taxa)	10	9	11	9	9
		%EPT (taxa)	50	45	46	45	36

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Table 5 Macroinvertebrate fauna of the unnamed tributary of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 20 October 2015.

Taxa List	Site Number	MCI score	UT	MT	DT
	Site Code		INH000433	INH000435	INH000440
	Sample Number		FWB15327	FWB15328	FWB15329
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	-	R
ANNELIDA (WORMS)	Oligochaeta	1	C	A	R
	Lumbricidae	5	R	R	-
MOLLUSCA	*Potamopyrgus*	4	VA	XA	XA
CRUSTACEA	*Paracalliope*	5	VA	XA	-
	Paraleptamphopidae	5	A	-	-
	Talitridae	5	R	A	VA
	Paranephrops	5	R	-	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	VA	C	-
	Zephlebia group	7	A	A	A
PLECOPTERA (STONEFLIES)	*Zelandobius*	5	-	R	C
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	R	R	R
	Hydropsyche (Orthopsyche)	9	C	-	R
	Polyplectropus	6	R	R	-
	Oxyethira	2	-	-	R
	Pycnocentria	7	C	-	-
	Triplectides	5	-	R	-
DIPTERA (TRUE FLIES)	Orthocladiinae	2	R	R	A
	Polypedilum	3	-	R	C
	Tanytarsini	3	-	-	R
	Austrosimulium	3	C	C	-
ACARINA (MITES)	Acarina	5	-	R	R
		No of taxa	15	15	14
		MCI	101	91	84
		SQMCIs	5.4	4.5	4.2
		EPT (taxa)	6	6	4
		%EPT (taxa)	40	40	29
'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa			

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Inaha Stream

Site U

A moderate taxa richness of 20 taxa was found at site U ('control' site for the Inaha Stream) at the time of the survey which was three less than the median number recorded for the site (median taxa richness 23; Table 3) and eight less than the previous sample (taxa richness 28; Figure 2).

The MCI score of 99 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 94 units; Table 3) or to the previous survey score (MCI score 92 units; Figure 2). The $SQMCI_s$ score of 6.4 units was markedly higher than the median value calculated from previous surveys at the same site (median $SQMCI_s$ score 5.3 units; Table 3) and that of the previous survey score ($SQMCI_s$ score 4.9 units).

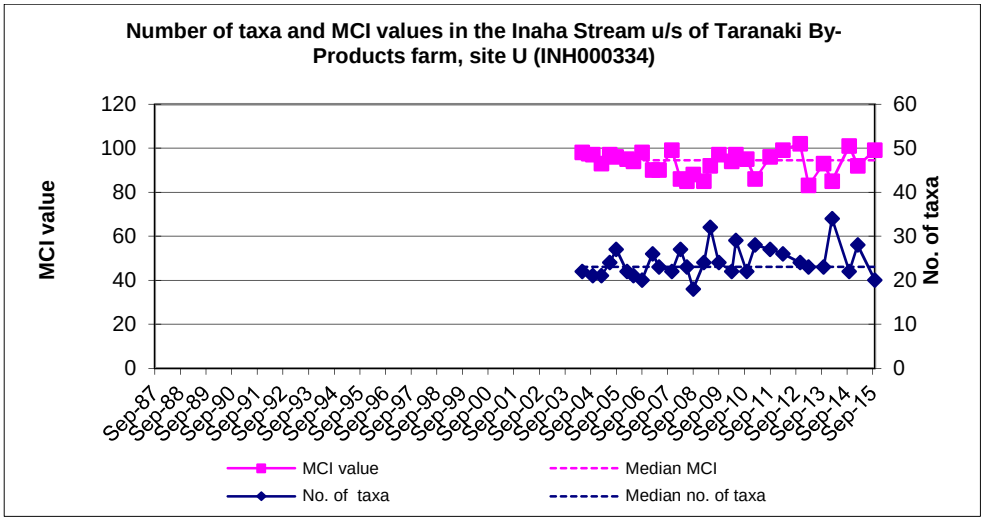

Figure 2 Numbers of macroinvertebrate taxa and MCI values recorded at site U in the Inaha Stream since May 2004.

The community was characterised by three 'tolerant' taxa [snail (*Potamopyrgus*) and midges (*Maoridiamesa*) and (Tanytarsini)], four 'moderately sensitive' taxa [amphipod (*Paracalliope*), elmid beetles, stonefly (*Zelandobius*) and caddisfly (*Pycnocentrodes*)], and one 'highly sensitive' extremely abundant taxon [mayfly (*Deleatidium*)] (Table 5).

Site 1

A moderate taxa richness of 20 taxa was also found at site 1 at the time of the survey which was two taxa less than the median number recorded for the site (median taxa richness 22; Table 3) and nine less than the previous survey (taxa richness 29; Figure 3).

The MCI score of 97 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 95 units; Table 3) or to that of the previous survey score (MCI score 93 units; Figure 3). The $SQMCI_s$ score of 4.8 units was similar to the median value calculated from previous surveys at the same site (median $SQMCI_s$ score 5.1 units; Table 3) but was lower than the previous survey score ($SQMCI_s$ score 5.5 units).

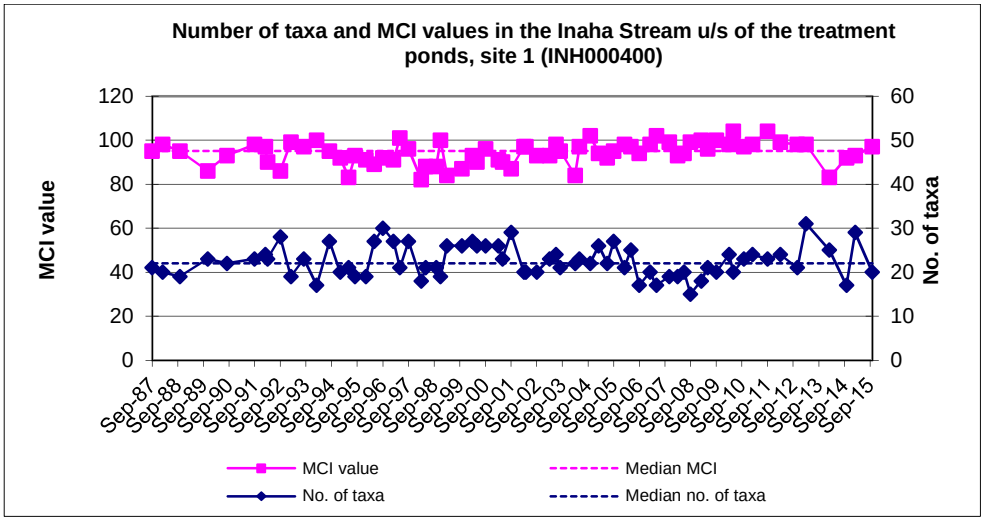

Figure 3 Numbers of macroinvertebrate taxa and MCI values recorded at site 1 in the Inaha Stream since September 1987.

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and caddisfly (*Hydropsyche - Aoteapsyche*)], five 'moderately sensitive' taxa [mayfly (*Austroclima*), stonefly (*Zelandobius*), elmid beetles and caddisflies (*Pycnocentria*) and (*Pycnocentrodes*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 5).

Site 2d

A moderate macroinvertebrate community richness of 24 taxa was found at site 2d at the time of the survey which was two taxa more than the median number recorded for the site (median taxa richness 22; Table 3) and two taxa more than the previous survey (taxa richness 22; Figure 4).

The MCI score of 95 units indicated a community of 'fair' biological health which was significantly (Stark, 1998) higher than the median value calculated from previous surveys at the same site (median MCI score 78 units; Table 3) but not significantly higher than the previous survey score (MCI score 86 units; Figure 4). The $SQMCI_s$ score of 4.8 units was markedly higher than the median value calculated from previous surveys at the same site (median $SQMCI_s$ score 2.0 units; Table 3) and was higher than the previous survey score ($SQMCI_s$ score 4.0 units).

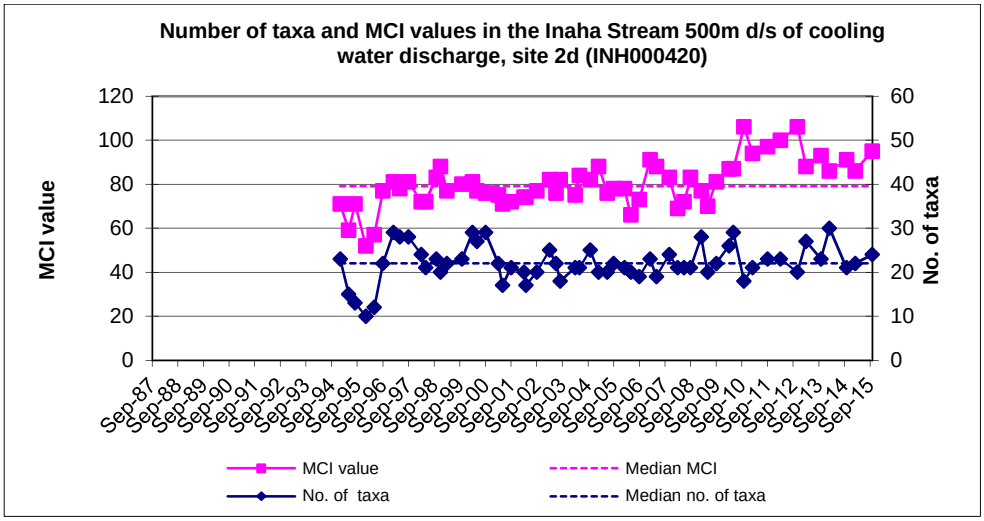

Figure 4 Numbers of taxa and MCI values recorded at site 2d in the Inaha Stream since 1995.

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and orthoclad midges], four 'moderately sensitive' taxa [elmid beetles, and caddisfly (*Hydrobiosis*), stonefly (*Zelandobius*) and caddisfly (*Pycnocentrodes*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 5).

Site 3

A moderate taxa richness of 20 taxa was found at site 3 at the time of the survey which was one taxon less than the median number recorded for the site (median taxa richness 21; Table 3) and 10 taxa less than the previous survey (taxa richness 30; Figure 5).

The MCI score of 96 units indicated a community of 'fair' biological health which was significantly (Stark, 1998) higher than the median value calculated from previous surveys at the same site (median MCI score 81 units; Table 3) and significantly higher (Stark, 1998) than the previous survey score (MCI score 81 units; Figure 5) by 15 MCI units. The $SQMCI_s$ score of 4.8 units was higher than the median value calculated from previous surveys at the same site (median $SQMCI_s$ score 2.5 units; Table 3) and was marginally higher than the previous survey score ($SQMCI_s$ score 3.6 units).

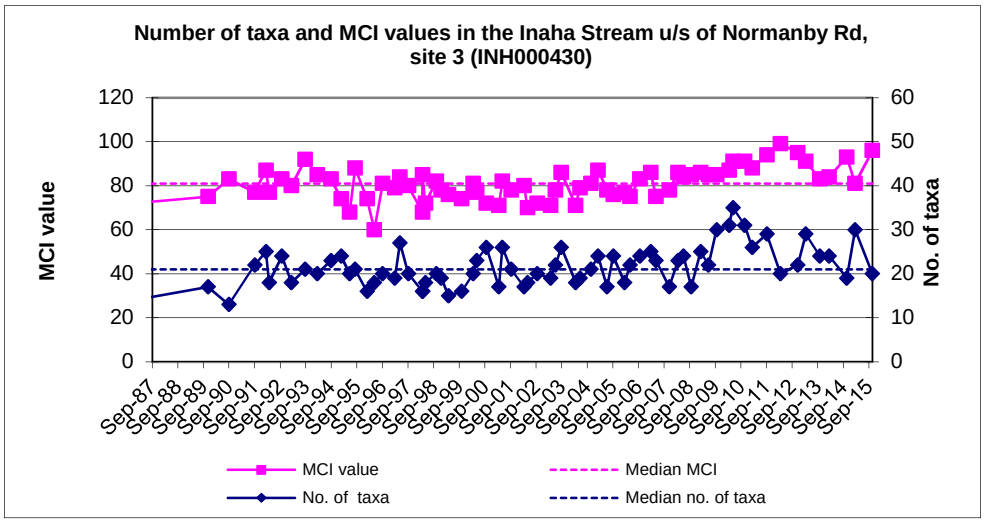

Figure 5 Numbers of taxa and MCI values recorded at site 3 in the Inaha Stream since 1989.

The community was characterised by three 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*) and orthoclad midges], two 'moderately sensitive' taxa [elmid beetles and caddisfly (*Pycnocentrodes*)] and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 5).

Site 4

A moderate macroinvertebrate community richness of 25 taxa was found at site 4 at the time of the survey which was one less than the median number recorded for the site (median taxa richness 26; Table 3) and the same as the previous two surveys (taxa richness 25; Figure 6).

The MCI score of 84 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 90 units; Table 3), although was significantly (Stark, 1998) lower than that recorded by the previous survey (MCI score 97 units; Figure 6). The $SQMCI_s$ score of 2.7 units was markedly lower than the median value calculated from previous surveys at the same site (median $SQMCI_s$ score 4.4 units; Table 3) and markedly lower than the previous survey score ($SQMCI_s$ score 4.5 units).

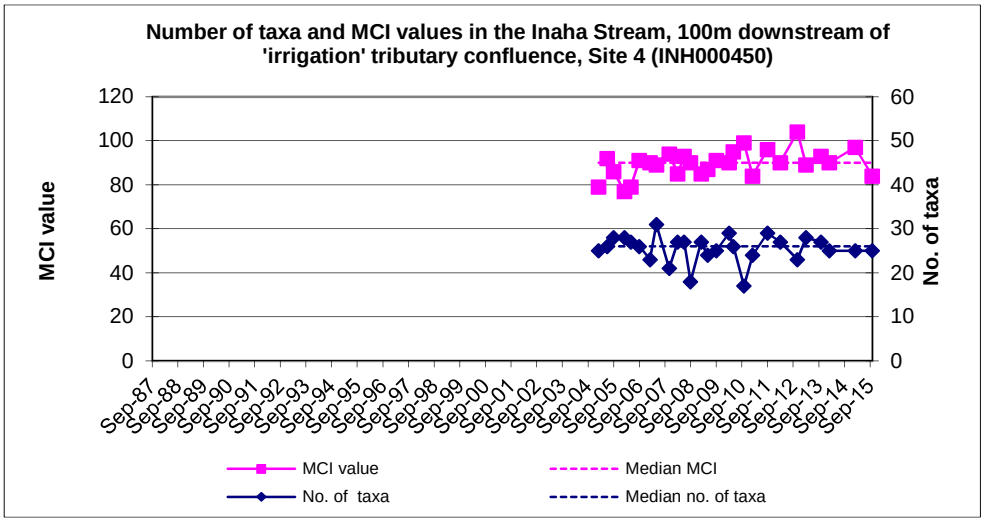

Figure 6 Numbers of taxa and MCI values recorded at site 4 in the Inaha Stream since 1989.

The community was characterised by two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)] and one 'moderately sensitive' taxon [mayfly (*Zephlebia* group)] (Table 5).

Unnamed tributary of the Inaha Stream

Site UT

A moderately low macroinvertebrate community richness of 15 taxa was found at site UT ('control' site for the unnamed tributary of the Inaha Stream) at the time of the survey which was four less than the median number recorded for the site (median taxa richness 19; Table 3) but the same as the previous survey (taxa richness 15; Figure 7). This site has only been monitored on ten occasions since March 2010 and therefore has a smaller dataset than other sites in this report. Comparisons with median values are therefore not as robust as at other sites.

The MCI score of 101 units indicated a community of 'good' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 98 units; Table 3) or to the previous survey score (MCI score

100 units; Figure 7). The $SQMCI_s$ score of 5.4 units was the same as the median value calculated from previous surveys at the same site (Table 3) and was the same as the previous survey score.

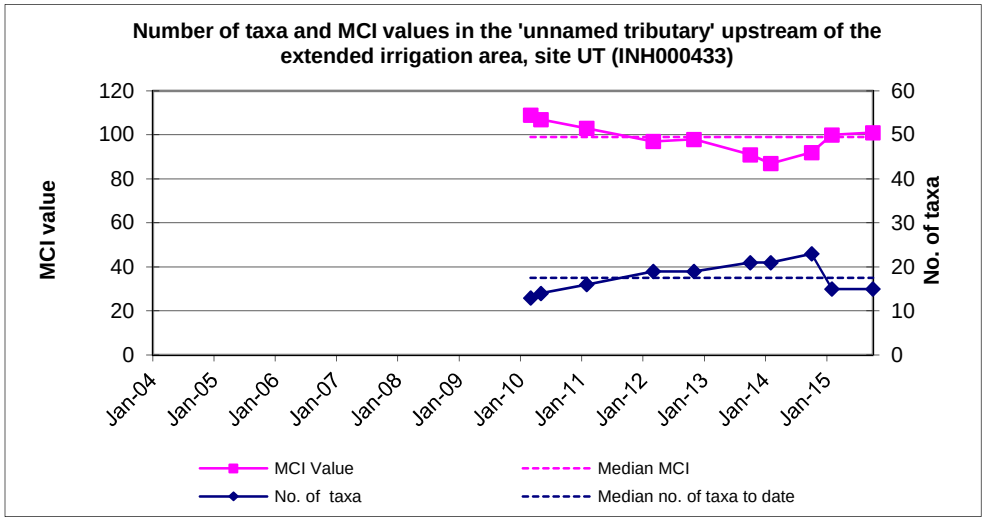

Figure 7 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream.

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)] and four 'moderately sensitive' taxa [amphipods (*Paracalliope*) and Paraleptamphopidae) and mayflies (*Austroclima* and *Zephlebia* group)] (Table 6).

Site MT

A moderately low macroinvertebrate community richness of 15 taxa was found at site MT at the time of the survey which was five taxa less than the median number recorded for the site (median taxa richness 20; Table 3) and six taxa less than the previous survey (taxa richness 21; Figure 8).

The MCI score of 91 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 82 units; Table 3). This MCI score was however significantly (Stark, 1998) higher than the previous survey score (MCI score 80 units; Figure 8). The $SQMCI_s$ score of 4.5 units was the same as the median value calculated from previous surveys at the same site (Table 3) and slightly lower than the previous survey score ($SQMCI_s$ score 4.8 units).

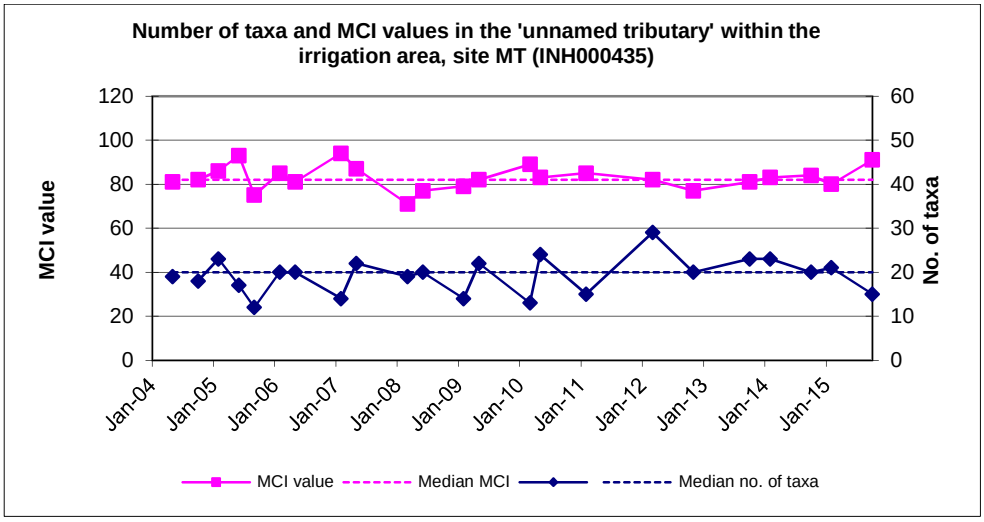

Figure 8 Numbers of taxa and MCI values recorded at site MT in the unnamed tributary of the Inaha Stream since 2004.

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and oligochaete worms] and three 'moderately sensitive' taxa [amphipods (*Paracalliope*) and (Talitridae) and mayfly (*Zephlebia* group)] (Table 6).

Site DT

A moderately low macroinvertebrate community richness of 14 taxa was found at site DT at the time of the survey which was seven taxa less than the median number recorded for the site (median taxa richness 21; Table 3) and six taxa less than recorded by the previous survey (taxa richness 20; Figure 9).

The MCI score of 84 units indicated a community of 'fair' biological health which was slightly less than the median value calculated from previous surveys at the same site (median MCI score 89 units; Table 3) and not significantly different (Stark, 1998) to the previous survey score (MCI score 89 units; Figure 9). The $SQMCI_s$ score of 4.2 units was similar to the median value calculated from previous surveys at the same site (median $SQMCI_s$ score 4.6 units; Table 3) and to the previous survey score ($SQMCI_s$ score 4.9 units).

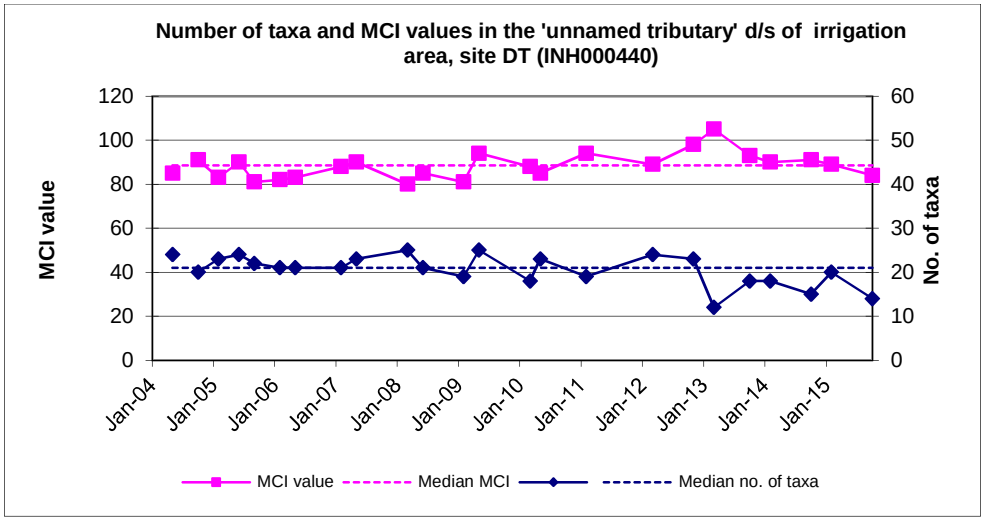

Figure 9 Numbers of taxa and MCI values recorded at site DT in the unnamed tributary of the Inaha Stream since 2004.

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and orthoclad midges] and two 'moderately sensitive' taxa [amphipod (*Talitridae*) and mayfly (*Zephlebia* group)] (Table 6).

Discussion

In the past, heterotrophic growths such as 'sewage fungus' have occurred in the Inaha Stream downstream of the rendering plant which were most likely the result of the discharges from the plant. However, no 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

Inaha Stream

There were no significant differences between site U the 'control' site and site 1 for taxa richness and MCI score, however the $SQMCI_S$ score recorded at site 1 was substantially less than that recorded at site U, mainly due to a significant decrease in one 'highly sensitive' taxon [mayfly (*Deleatidium*)]. This 'highly sensitive' mayfly taxon was however still 'abundant' at site 1. These results indicate that leaching of nutrients into the Inaha Stream from the northeastern block of land under irrigation (Figure 1) was not affecting the health of the macroinvertebrate communities present in the Inaha Stream at the time of the survey.

All three macroinvertebrate indices were similar between site 1, site 2d and site 3, showing an improvement from the previous summer survey where a significant decline in macroinvertebrate health was recorded between sites 1 and 3. In the previous survey it was thought the removal of riparian vegetation at site 2d (which eliminated shading and wood present in the stream), together with higher water temperatures and low flows and subsequent increase in filamentous periphyton growth were major drivers in the decline in macroinvertebrate health (Sutherland, 2015). However it was also suggested that there was some evidence that discharges from Taranaki By-Products, such as possible seepage of nutrient enriched water from the unnamed tributary, may have negatively affected the macroinvertebrate communities present in the Inaha Stream (Sutherland, 2015).

In the previous summer (2015) survey the macroinvertebrate community at site 4 (downstream of the confluence with the unnamed tributary of the Inaha Stream) showed a significant improvement compared with the macroinvertebrate community at site 3, which was thought to be in relation to increased shading at this site (Sutherland, 2015). However in the current survey a significant decrease in both MCI and $SQMCI_S$ score was recorded between site 3 and site 4 (by 12 units and 2.1 units respectively). The MCI score was not significantly different to the historical median for the site, however the $SQMCI_S$ was significantly lower than the historical median (by 1.7 units) and significantly (Stark, 1998) lower than the predicted value for ring plain streams at similar altitudes (by 2.3 units) (Table 4). The decrease in macroinvertebrate health recorded by current survey may be explained by the increased amount of soft sediment recorded at the time of the survey. Substrate comprised predominantly of silt (75%) and was notably soft and thick (>50 cm) in places. In previous surveys higher proportions of hard substrate types have been recorded which in turn support larger numbers of 'sensitive' taxa.

On examination of all of the Inaha Stream sites, the trends suggests improvements began to appear in 2009 (Figure 10 and Figure 11) but in recent surveys large fluctuations in macroinvertebrate indices have occurred. The best result for this type of survey is that MCI scores and $SQMCI_S$ scores in the Inaha Stream are not significantly different to each other within each survey. Occasionally differences in habitat between sites can result in different scores, although this can often be explained when the community assemblage is assessed. The $SQMCI_S$ is more sensitive to changes in habitat, and this is evident in Figure 10. Figure 10 shows some significant differences in $SQMCI_S$ scores between sites, with site 4 recording a score significantly lower than the upstream sites, indicating a potential impact from the rendering plant long-term discharges on the macroinvertebrate communities at this site. Site U also recorded a significantly higher $SQMCI_S$ score in comparison to sites further downstream, although this can be attributed mainly to habitat rather than to impacts caused by the rendering plant.

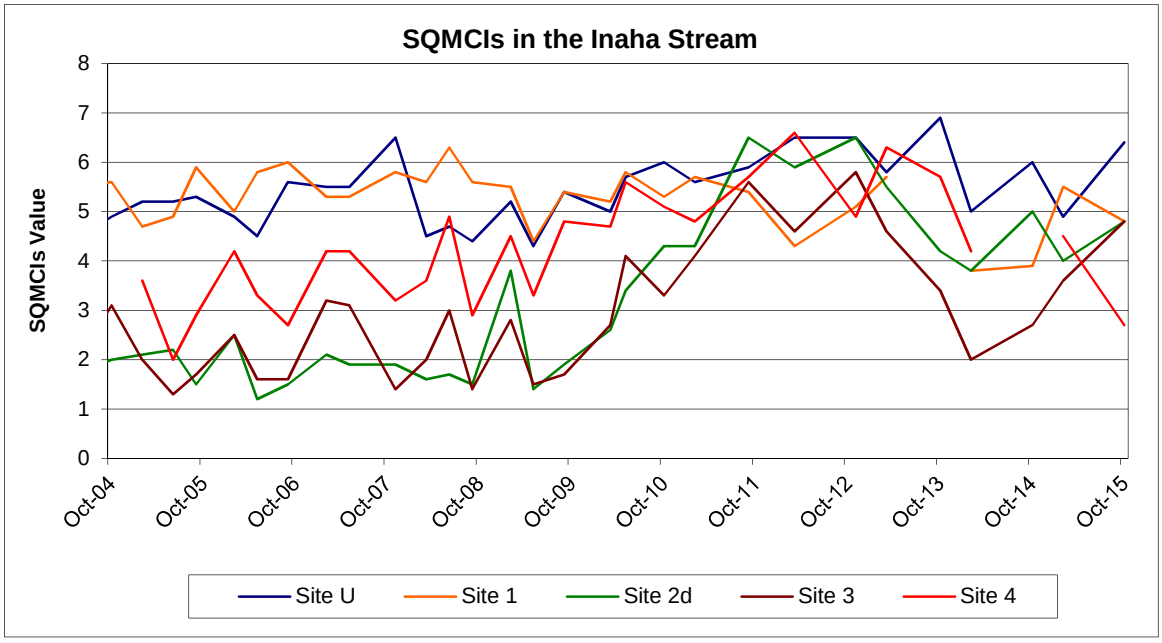

Figure 10 $SQMCI_S$ values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

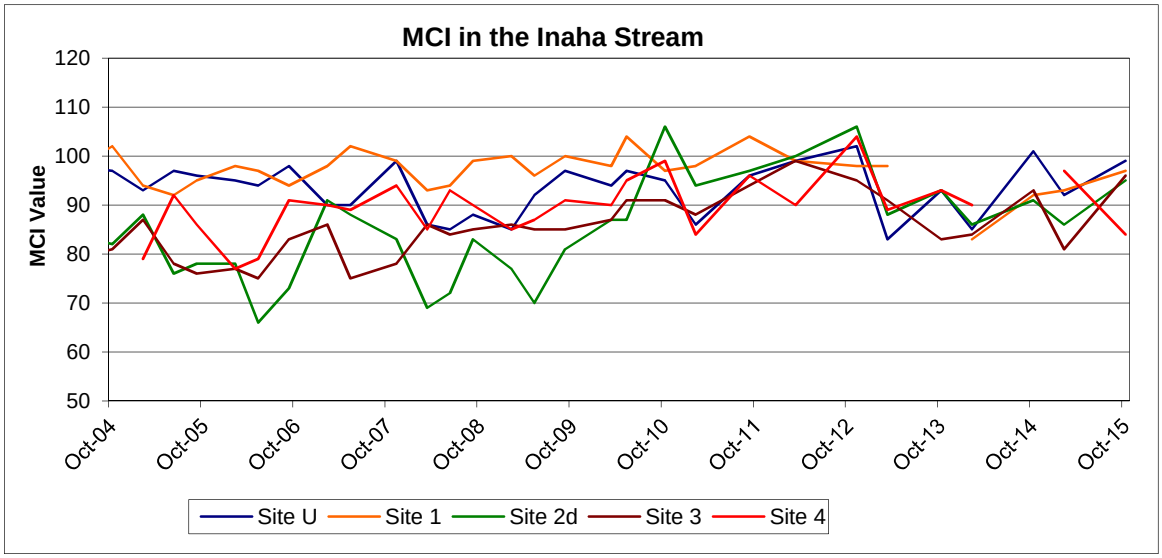

Figure 11 MCI values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

Unnamed tributary of the Inaha Stream

There were significant differences (Stark, 1998) among the three sites sampled in the unnamed tributary of the Inaha Stream in relation to MCI and $SQMCI_S$ scores but not taxa richnesses. Specifically, both the 'potentially impacted' sites (sites MT and DT) had significantly lower $SQMCI_S$ scores than the 'control' site (site UT), with a decline of 1.2 $SQMCI_S$ units occurring between sites UT and MT. In addition site DT had a significantly (Stark, 1998) lower MCI score than site UT (by 17 units). However all three sites had MCI and $SQMCI_S$ scores that were not significantly different to comparative sites in the Taranaki ring plain (Table 4).

The MCI scores recorded at sites MT and DT in the unnamed tributary were indicative of 'fair' health and at site UT 'good' health. Community composition was varying between sites, with two out of eight abundant taxa common to all three sites. *Potamopyrgus* snails were abundant to extremely abundant to all sites, and the mayfly (*Zephlebia* group) was abundant at all sites. The differences in macroinvertebrate community composition between sites reflected differences in the instream habitat, with proportions of roots and/or fine sediment and instream macrophytes varying at all three sites. Habitat variation among sites was probably the cause of the differences in MCI and $SQMCI_S$ scores; however it might be expected the lower site support a higher portion of 'sensitive' taxa due to a higher proportion of hard substrate at this site compared with the two upstream sites. Therefore the significant decrease in MCI and $SQMCI_S$ scores between site UT and DT could also indicate that land under irrigation by Taranaki By-Products may be negatively affecting the macroinvertebrate communities present in the unnamed tributary of the Inaha Stream.

Summary

The Councils 'kick-sampling' technique, or a combination of 'kick-sampling' and 'vegetation sweep', was used at eight sites to collect streambed macroinvertebrates from the Inaha Stream and an unnamed tributary, to assess whether discharges (via point source and irrigation to land) from Taranaki By-Products Limited's rendering plant had had any adverse effects on the macroinvertebrate communities of the streams. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundances as well as sensitivity to pollution. Significant differences in either the MCI or the $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

A spring macroinvertebrate survey was performed at five sites in the Inaha Stream and at three sites in an unnamed tributary of the Inaha Stream in relation to discharges by Taranaki By-Products. Taxa richnesses were generally moderate and slightly lower than that of the median values calculated from all previous surveys.

MCI scores showed that macroinvertebrate communities were generally in 'fair' health in the Inaha Stream. MCI scores were similar between sites U, 1, 2d and 3, however there was a significant decline in macroinvertebrate community health at the furthest downstream site (4). Site 4 had significantly lower MCI and $SQMCI_S$ scores which can largely be attributed to increased sedimentation at this site although may also indicate a potential impact from the rendering plant long term discharges on the macroinvertebrate communities at this site.

Site UT in the unnamed tributary of the Inaha Stream recorded an MCI score reflective of 'good' stream health. Deterioration in macroinvertebrate indices was recorded downstream at sites MT and DT with a significant decrease in MCI recorded at site DT. Site UT also recorded a $SQMCI_S$ score substantially higher than that recorded at site MT and UT, most likely a reflection of a difference in habitat at this site. However it would be expected that the downstream site (DT) would sustain higher proportions of 'sensitive' taxa due to higher levels of hard substrate at this site, thus may indicate land under irrigation by Taranaki By-Products may be negatively affecting the macroinvertebrate communities present in the unnamed tributary of the Inaha Stream at this site.

No 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

Overall, there was some evidence that discharges from Taranaki By-Products had impacted on the freshwater macroinvertebrate communities present in the Inaha Stream. However, changes in habitat and habitat variation between sites make drawing strong conclusions from the data difficult.

References

Colgan, B, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, June 2003. TRC report BC012.

Dunning KJ, 2001: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2001. TRC report KD78.

Dunning KJ, 2002a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2002. TRC report KD108.

Dunning KJ, 2002b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, April 2002. TRC report KD109.

Dunning KJ, 2002c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2002. TRC report KD132.

Fowles CR and Colgan BG, 2004: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, May 2004. TRC report CF339.

Fowles CR and Colgan BG, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, October 2004. TRC report CF352.

Fowles CR and Jansma B, 2008a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, November 2007. TRC report CF468.

Fowles CR and Jansma B, 2008b: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, March 2008. TRC report CF469.

Fowles CR and Jansma B, 2008c: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, June 2008. TRC report CF470.

Fowles CR and Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2008. TRC report CF471.

Fowles CR and Moore SC, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2004. TRC report CF327.

Fowles CR and Stark JD, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant using artificial substrates January to March 2003. TRC report.

Hickey CW and Vickers ML, 1994: Toxicity of ammonia to nine native New Zealand freshwater invertebrate species. Archives of Environmental Contamination and Toxicology 26: 292-298.

Hope KJ, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, June 2005. TRC report KH043.

Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2006. TRC report KH087.

Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2006. TRC report KH088.

Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2006. TRC report BJ033.

Jansma B, 2008: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2007. TRC report BJ034.

Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2009. TRC report BJ086.

Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2009. TRC report BJ087.

Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, September 2009. TRC report BJ094.

Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2010. TRC report BJ095.

Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2010. TRC report BJ096.

Jansma B, 2012 (a): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2010. TRC report BJ168.

Jansma B, 2012(b): Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2011. TRC report BJ169.

Jansma B, 2012(c): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2011. TRC report BJ170.

Jansma B and Smith K, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, November 2012. TRC report BJ211.

Jansma B, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2013. TRC report BJ212.

McWilliam H, 2001a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2000. TRC report HM234.

McWilliam H, 2001b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2001. TRC report HM247.

McWilliam H, 2001c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, May 2001. TRC report HM248.

Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2003. TRC report SM577.

Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, August 2003. TRC report SM588.

Smith K, 2012: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2012. TRC report KS008.

Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil* Miscellaneous Publication No. 87.

Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research 32(1*): 55-66.

Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.

Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.

Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. New Zealand Journal of Marine and Freshwater Research 41(1).

Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.

Sutherland DL and Thomas B, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report DS024.

Sutherland DL, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2015. TRC report DS025.

Thomas B, 2013: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2013. TRC report BT010.

Thomas B, 2014: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2014. TRC report BT042.

TRC, 2015: Some statistics from the Taranaki Regional Council database (Esam) of freshwater macroinvertebrate surveys performed during the period from January 1980 to 30 September 2014. Technical Report 2014-105.

To Nathan Crook, Job Manager
From Brooke Thomas, Scientific Officer
Report No. BT060
Date 07 June 2016
Doc number 1690504

Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2016

Introduction

Taranaki By-Products Limited holds a number of consents for discharges to land and to water associated with the operation of a rendering plant and a neighbouring farm owned and operated by the Company. The discharge consents most relevant to this biomonitoring survey are summarised in Table 1 below:

Table 1 Summary of discharge consents held by Taranaki By-Products Limited which are of most relevance to this biological survey.

Consent no.	Purpose
2049-4	To discharge up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream
2050-4	To discharge up to 2,160 cubic metres/day of cooling water and backwash water from a rendering operation into an unnamed tributary of the Inaha Stream
3941-2	To discharge up to 1400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries between 1700909E-5625245N, 1700631E-5625092N and 1700921E-5625046N
5426-1	To discharge up 1,095 litres/second of stormwater from an animal rendering site into an unnamed tributary of the Inaha Stream

Biomonitoring has been undertaken at some sites in relation to the discharges from the rendering plant and associated activities since the mid-1980s. Some of the sites used for the biomonitoring of these discharges have changed over time and these changes have been documented in previous reports (Jansma, 2012 a, b, c).

This summer biological survey was the second of two scheduled in the Inaha Stream catchment in the 2015-2016 monitoring year in relation to discharges from the Taranaki By-Products plant. Results from previous surveys are also referred to in this report (see references).

Methods

This biomonitoring survey was undertaken at eight sites on 16 February 2016 (Table 2 and Figure 1). Five of the eight sites surveyed were in the Inaha Stream and the remaining sites were in an unnamed tributary of the Inaha Stream (Figure 1). The locations of sampling sites in relation to the discharges from the rendering plant are discussed below.

Site U (INH000334) was established in the 2003-2004 monitoring period as an appropriate control site on the Inaha Stream above the rendering plant discharges and irrigation areas. Site 1 (INH000400) is located upstream of the wastewater and cooling water discharge points but downstream of part of the treated wastewater irrigation area. Sites 2d and 3 (INH000420 and INH000430) are located downstream of these two discharges and above the

confluence with the unnamed tributary of the Inaha Stream which drains land upon which wastewater is irrigated.

The area of land authorised to be irrigated onto under consent 3941-2 has increased on several occasions since the consent was granted in December 1999. Sites UT, MT and DT (INH000433, INH000435 and INH000440) were established to monitor the effects of the expanded irrigation area on an unnamed tributary of the Inaha Stream. Site UT was established as a 'control site' for the expanded irrigation area. Site MT is located within the authorised irrigation area and site DT is situated downstream of the irrigation area but upstream of the unnamed tributary's confluence with the Inaha Stream.

Site 4 (INH000450) on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 2 Biomonitoring sites in the Inaha Stream and in an unnamed tributary relating to the Taranaki By-Products plant.

Stream	Site No.	Site code	Location	Sampling method used
Inaha Stream	U	INH000334	Upstream of irrigation area, near Ahipaipa Road	Streambed kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Streambed kick
	2d	INH000420	500 m downstream of cooling water discharge	Streambed kick
	3	INH000430	Upstream of Normanby Road	Streambed kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Streambed kick
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Vegetation sweep
	MT	INH000435	Middle site within the new irrigation area	Vegetation sweep
	DT	INH000440	50m upstream Normanby Road	Streambed kick

Two different sampling techniques were used to collect streambed macroinvertebrates in this survey. The Council's standard '400ml kick-sampling' technique was used at sites DT, U, 1, 2d 3 and 4 and the 'vegetation sweep' technique was used at sites UT and MT (Table 2). The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-bottomed, semi-quantitative) 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 individuals or more.

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

factor of 20 produces a Macroinvertebrate Community Index (MCI) value. A difference of 11 units or more in MCI values is considered significantly different (Stark 1998).

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, therefore $SQMCI_s$ values range from 1 to 10, while MCI values range from 20 to 200.

Where necessary, sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream. Such heterotrophic growths have been recorded on numerous past occasions at sites downstream of the Taranaki By-Products plant as a result of organic nutrient enrichment from the wastewater discharge.

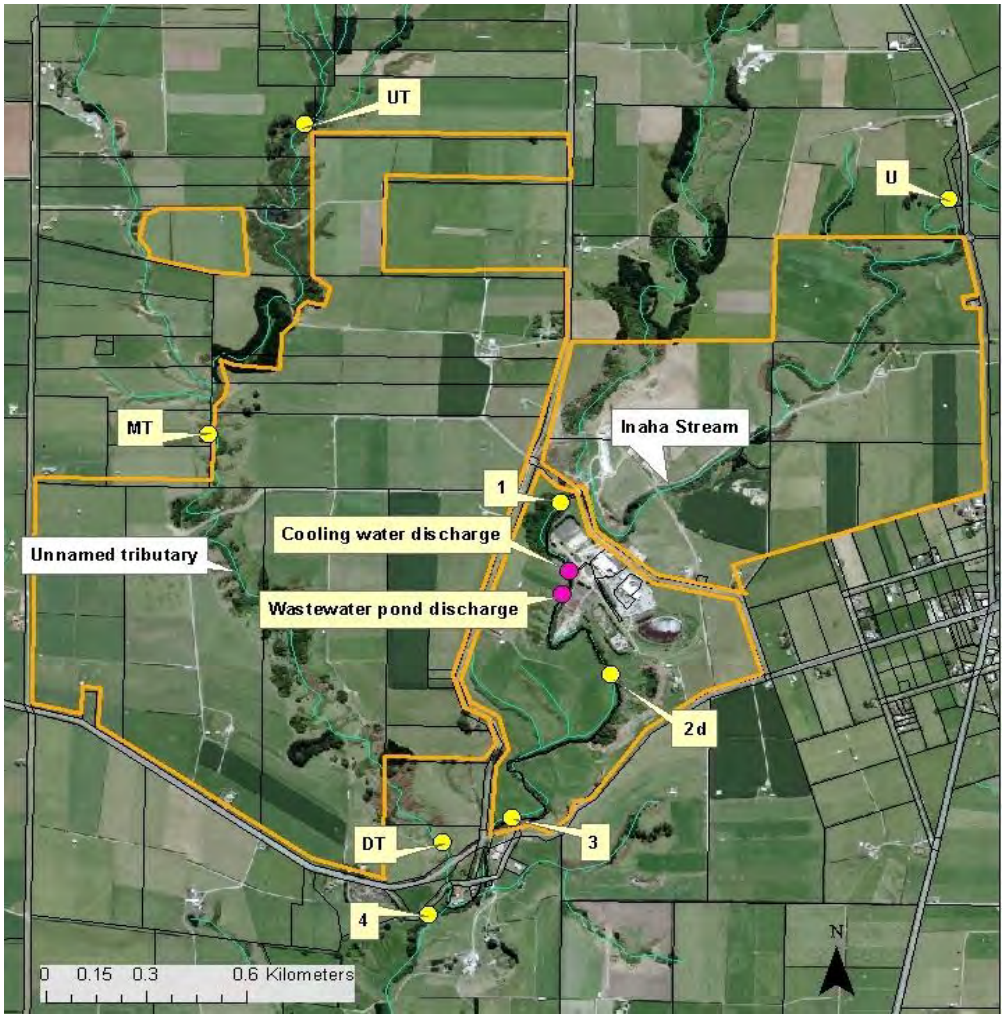

Figure 1 Aerial photo showing biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. The orange line outlines the irrigation areas around the rendering plant.

Results

Site habitat characteristics and hydrology

This February 2016 survey followed a period of 145 days since a fresh in excess of three times median flow in the nearby Waiokura Stream at No. 3 Fairway (the nearest appropriate water level recorder) and 193 days since a fresh in excess of seven times median flow. In the month prior to this survey flow had decreased throughout the month, after a small peak in flow early in the month. An absence of significant freshes would likely result in increased levels of filamentous periphyton and fine sediment accumulating on the streambed.

The Company's records showed that the last discharge of treated wastewater to the Inaha Stream began on the 4 June 2015 and continued without cessation until 14 October 2015 (a period of 128 days). Therefore, there was a long period of 124 days when no discharges occurred prior to this biological survey. Cooling water was discharged to the stream throughout this period. The record shows that the minimum dilution of wastewater of 1:300 that is required under consent 2049-4 was maintained throughout the period.

At all of the Inaha Stream sites (U, 1, 2d, 3 and 4) the water was clear and uncoloured. The water speed was steady at site 3 and slow at sites U, 1, 2d and 4. Flow conditions were low at sites 1, 2d, 3 and 4 and very low at site U. Water temperatures in the Inaha Stream ranged between 18.8°C and 24.2°C. In the unnamed tributary of the Inaha Stream there was an uncoloured, cloudy and very slow flow at sites UT and MT and an uncoloured, clear and slow flow at site DT. Stream temperatures ranged from 18.1 °C to 19.3 °C during this survey.

In the Inaha Stream, sites U and 1 had a substrate which was mostly cobbles, gravels and boulders with some silt and sand. Site 2d had a similar substrate composition; however it had a greater proportion of gravels with no boulders. Site 3 had a substrate composition of predominantly gravels will smaller proportions of cobble, boulder, silt and sand. Site 4 had a predominately cobble and sand substrate with some gravels, silt, cobble and wood/root. Substrate in the unnamed tributary of the Inaha Stream comprised predominantly silt and wood/root at sites UT and MT and predominantly gravels, cobbles, silt and sand at site DT.

Slippery periphyton mats and widespread filaments were recorded at sites 1, 2d and 3 while widespread filaments were recorded at site U and no periphyton was recorded at site 4. Macrophytes were recorded growing at the edges of the stream at sites U, 2d, and 3 and at the edges and on the bed of the stream at site 1. No macrophytes were recorded growing at site 4. Sites U and 4 were partially shaded, while all other Inaha Stream sites were unshaded.

In the unnamed tributary of the Inaha Stream, no periphyton was recorded growing at sites UT and MT, whereas widespread periphyton filaments were recorded downstream at site DT. Macrophytes were recorded growing at the edges of the stream at all sites in the unnamed tributary of the Inaha Stream. Site UT was partially shaded while sites MT and DT were completely unshaded.

Streambed microflora

A microscopic inspection of material collected from the bed of the Inaha Stream found no evidence of 'heterotrophic growths '(protozoa or fungi) at any of the sites sampled. This was the fourteenth consecutive survey to record a lack of such growths, continuing the

improvement following the late summer 2008 and spring 2009 surveys, which both recorded such growths. This is an important result; as such growth is often associated with 'sewage fungus' which is an indication of high levels of organic matter and nutrient enrichment in the stream. Such growths have been recorded on many previous sampling occasions, often in abundance, particularly downstream of the plant discharges at site 2d. The absence of such growths is evidence that the degree of enrichment is not as severe as that recorded previously.

Macroinvertebrate communities

Results of previous macroinvertebrate surveys performed in the Inaha Stream and the unnamed tributary are summarised and presented together with current results in Table 3.

Table 3 Summary of previous numbers of macroinvertebrate taxa and MCI and $SQMCI_S$ values for surveys between September 1987 and October 2015 together with current results recorded in the Inaha Stream and an unnamed tributary in relation to Taranaki By-Products.

	Number of taxa				MCI values			$SQMCI_S$ values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
U	30	18-34	23	32	83-102	95	84	30	4.3-6.9	5.4	5.0
1	70	15-31	22	25	82-104	95	90	46	3.6-6.3	5.1	5.3
2d	58	10-30	22	22	52-106	79	92	47	1.2-6.5	2.0	4.8
3	71	6-35	21	24	43-99	81	83	47	1.3-5.8	2.5	6.4
4	27	17-31	26	25	77-104	90	94	27	2.0-6.6	4.2	5.0
UT	10	13-23	18	19	87-109	99	96	10	3.5-6.3	5.4	5.2
MT	23	12-29	20	21	71-94	82	85	23	3.1-5.7	4.5	4.3
DT	24	12-25	21	22	80-105	89	92	24	3.5-5.3	4.6	4.6

Table 4 provides a summary of various macroinvertebrate indices within a specific altitudinal band for 'control' sites situated in Taranaki ring plain streams arising outside of Egmont National Park. The full results from this current survey are given in Table 5 and Table 6.

Table 4 Range and median number of taxa, MCI values and SQMCIs scores for 'control' sites (Taranaki ring plain rivers/streams with sources outside Egmont National Park) at altitudes 80-124 m asl (TRC, 2015).

	No. of taxa	MCI value	$SQMCI_S$ value
No. Samples	248	248	192
Range	12-34	66-112	1.3-6.9
Median	22	92	5.0

Table 5 Macroinvertebrate fauna of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 16 February 2016.

Taxa List	Site Number	MCI score	U	1	2d	3	4
	Site Code		INH000334	INH000400	INH000420	INH000430	INH000450
	Sample Number		FWB16085	FWB16086	FWB16087	FWB16088	FWB16089
NEMERTEA	Nemertea	3	C	-	-	-	-
ANNELIDA (WORMS)	Oligochaeta	1	A	R	C	C	R
	Lumbricidae	5	R	-	R	R	R
MOLLUSCA	*Latia*	5	-	-	-	-	R
	Physa	3	R	-	C	R	R
	Potamopyrgus	4	A	VA	VA	VA	VA
	Sphaeriidae	3	R	-	R	-	-
CRUSTACEA	Ostracoda	1	A	A	XA	A	A
	Paracalliope	5	XA	C	XA	C	VA
	Paraleptamphopidae	5	-	R	-	-	-
	Talitridae	5	-	-	-	-	C
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	VA	A	A	C	VA
	Coloburiscus	7	R	R	-	-	-
	Deleatidium	8	R	VA	XA	XA	C
	Zephlebia group	7	C	R	R	-	C
PLECOPTERA (STONEFLIES)	*Zelandobius*	5	R	-	-	-	-
ODONATA (DRAGONFLIES)	*Procordulia*	5	-	-	-	-	R
HEMIPTERA (BUGS)	*Microvelia*	3	-	-	-	-	R
	Sigara	3	-	R	R	R	-
COLEOPTERA (BEETLES)	Elmidae	6	VA	VA	VA	VA	A
	Scirtidae	8	-	-	-	-	R
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	A	R	A	C	R
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	VA	A	VA	VA	R
	Costachorema	7	-	-	R	-	-
	Hydrobiosis	5	C	R	C	A	-
	Polyplectropus	6	-	-	-	-	R
	Hudsonema	6	R	A	A	-	R
	Oecetis	4	-	-	-	-	R
	Oxyethira	2	A	R	-	R	-
	Paroxyethira	2	R	-	-	-	-
	Pycnocentria	7	A	R	-	C	-
	Pycnocentrodes	5	A	XA	XA	A	R
	Triplectides	5	-	R	-	-	C
DIPTERA (TRUE FLIES)	*Aphrophila*	5	R	-	-	-	-
	Chironomus	1	R	R	-	-	-
	Maoridiamesa	3	R	-	-	R	-
	Orthocladiinae	2	C	R	R	C	R
	Polypedilum	3	C	-	C	R	C
	Tanypodinae	5	R	-	-	-	-
	Tanytarsini	3	R	R	-	A	-
	Empididae	3	R	-	-	R	-
	Muscidae	3	C	R	-	R	-
	Austrosimulium	3	C	R	-	-	A
	Tanyderidae	4	-	-	R	R	-
ACARINA (MITES)	Acarina	5	-	R	R	R	-
		No of taxa	32	25	22	24	25
		MCI	84	90	92	83	94
		SQMCIs	5.0	5.3	4.8	6.4	5.0
		EPT (taxa)	10	10	8	6	9
		%EPT (taxa)	31	40	36	25	36

'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Table 6 Macroinvertebrate fauna of the unnamed tributary of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 16 February 2016.

Taxa List	Site Number	MCI score	UT	MT	DT
	Site Code		INH000433	INH000435	INH000440
	Sample Number		FWB16082	FWB16083	FWB16084
NEMERTEA	Nemertea	3	R	R	R
ANNELIDA (WORMS)	Oligochaeta	1	A	VA	R
MOLLUSCA	*Physa*	3	-	C	-
	Potamopyrgus	4	A	XA	XA
CRUSTACEA	Copepoda	5	R	-	-
	Ostracoda	1	R	A	R
	Paracalliope	5	A	XA	XA
	Paraleptamphopidae	5	XA	-	-
	Talitridae	5	A	VA	VA
	Paranephrops	5	C	R	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	-	C
	Nesameletus	9	-	-	R
	Zephlebia group	7	VA	A	A
PLECOPTERA (STONEFLIES)	*Zelandobius*	5	-	-	R
ODONATA (DRAGONFLIES)	*Austrolestes*	4	-	R	-
	Xanthocnemis	4	-	C	-
HEMIPTERA (BUGS)	*Microvelia*	3	-	R	-
COLEOPTERA (BEETLES)	Elmidae	6	-	-	R
	Scirtidae	8	-	R	-
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	-	R	-
	Hydropsyche (Orthopsyche)	9	R	-	R
	Polyplectropus	6	C	A	-
	Hudsonema	6	-	-	C
	Oecetis	4	-	-	A
	Oxyethira	2	-	-	R
	Pycnocentria	7	R	-	-
	Pycnocentrodes	5	-	-	C
	Triplectides	5	R	R	R
DIPTERA (TRUE FLIES)	*Chironomus*	1	-	R	R
	Harrisius	6	-	R	-
	Orthocladiinae	2	R	-	-
	Tanypodinae	5	R	-	-
	Paradixa	4	C	-	-
	Muscidae	3	-	-	R
	Austrosimulium	3	-	R	C
	Stratiomyidae	5	-	R	-
ACARINA (MITES)	Acarina	5	R	R	R
		No of taxa	19	21	22
		MCI	96	85	92
		SQMCIs	5.2	4.3	4.6
		EPT (taxa)	6	4	9
		%EPT (taxa)	32	19	41

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Inaha Stream

Site U

A high taxa richness of 32 taxa was found at site U (the 'control' site for the Inaha Stream) at the time of the survey which was nine taxa more than the median number recorded for the site (median taxa richness 23; Table 3) and 12 taxa more than the previous sample (taxa richness 20; Figure 2).

The MCI score of 84 units indicated a community of 'fair' biological health which was significantly lower (Stark, 1998) than the median value calculated from previous surveys at the same site (median MCI score 95 units; Table 3) and significantly lower than the previous survey score (MCI score 99 units; Figure 2). The $SQMCI_S$ score of 5.0 units was slightly lower than the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 5.4 units; Table 3) and substantially lower than the previous survey score ($SQMCI_S$ score 6.4 units).

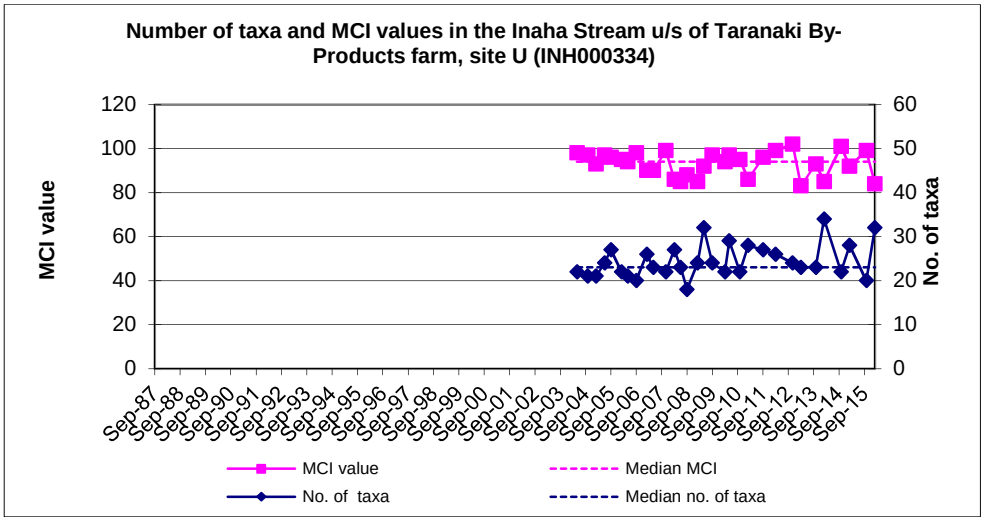

Figure 2 Numbers of macroinvertebrate taxa and MCI values recorded at site U in the Inaha Stream since May 2004.

The community was characterised by five 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), ostracod seed shrimp and caddisflies (*Hydropsyche - Aoteapsyche*) and (*Oxyethira*)], and six 'moderately sensitive' taxa [amphipod (*Paracalliope*), mayfly (*Austroclima*), elmid beetles, dobsonfly (*Archichauliodes*) and caddisflies (*Pycnocentrodes*) and (*Pycnocentria*)] (Table 5)

Site 1

A moderate taxa richness of 25 taxa was found at site 1 at the time of the survey which was three taxa more than the median number recorded for the site (median taxa richness 22; Table 3) and five more than the previous survey (taxa richness 20; Figure 3).

The MCI score of 90 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 95 units; Table 3) or to that of the previous survey score (MCI score 97 units; Figure 3). The $SQMCI_S$ score of 5.3 units was similar to the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 5.1 units; Table 3) and was higher than the previous survey score ($SQMCI_S$ score 4.8 units).

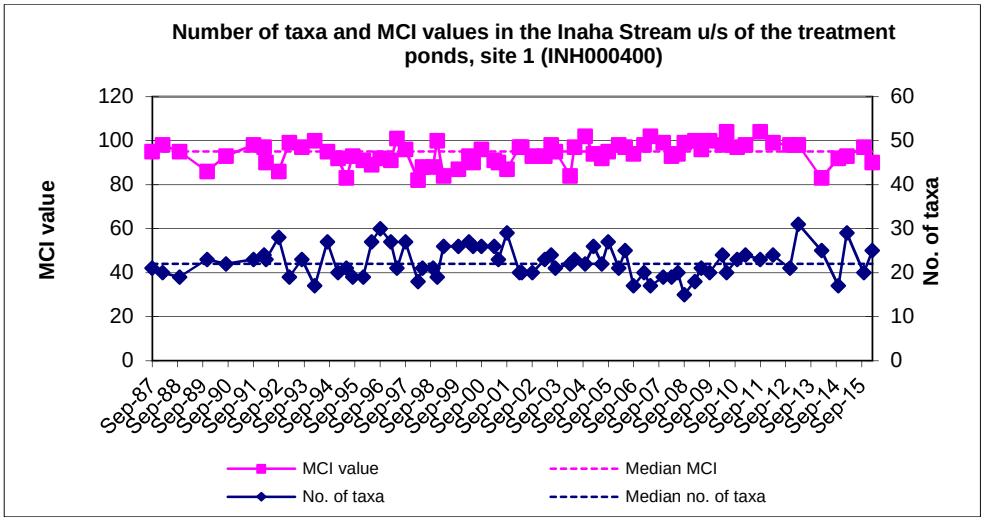

Figure 3 Numbers of macroinvertebrate taxa and MCI values recorded at site 1 in the Inaha Stream since September 1987.

The community was characterised by three 'tolerant' taxa [snail (*Potamopyrgus*), ostracod seed shrimp and caddisfly (*Hydropsyche - Aoteapsyche*)], four 'moderately sensitive' taxa [mayfly (*Austroclima*), elmid beetles and caddisflies (*Hudsonema*) and (*Pycnocentrodes*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 5).

Site 2d

A moderate macroinvertebrate community richness of 22 taxa was found at site 2d at the time of the survey which was the same as the median number recorded for the site (Table 3) and two taxa less than recorded by the previous survey (taxa richness 24; Figure 4).

The MCI score of 92 units indicated a community of 'fair' biological health which was significantly (Stark, 1998) higher than the median value calculated from previous surveys at the same site (median MCI score 79 units; Table 3) but was slightly lower than the previous survey score (MCI score 95 units; Figure 4). The $SQMCI_S$ score of 4.8 units was markedly higher than the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 2.0 units; Table 3) and was the same as the previous survey score.

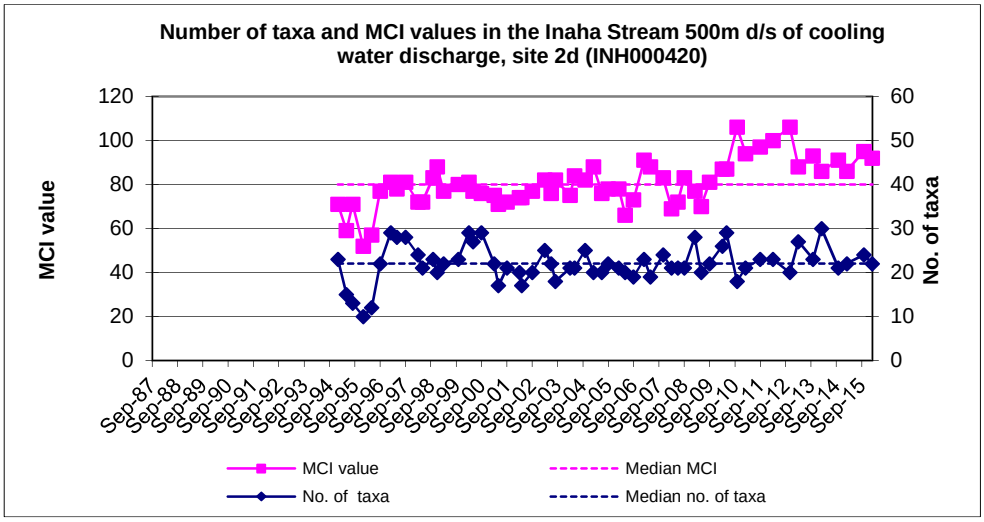

Figure 4 Numbers of taxa and MCI values recorded at site 2d in the Inaha Stream since 1995.

The community was characterised by three 'tolerant' taxa [snail (*Potamopyrgus*), ostracod seed shrimp and caddisfly (*Hydropsyche - Aoteapsyche*)], six 'moderately sensitive' taxa [amphipod (*Paracalliope*), mayfly (*Austroclima*), elmid beetles, dobsonfly (*Archichauliodes*) and caddisflies (*Hudsonema*) and (*Pycnocentrodes*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)](Table 5).

Site 3

A moderate taxa richness of 24 taxa was found at site 3 at the time of the survey which was three taxa more than the median number recorded for the site (median taxa richness 21; Table 3) and four taxa more than the previous survey (taxa richness 20; Figure 5).

The MCI score of 83 units indicated a community of 'fair' biological health which was similar to the median value calculated from previous surveys at the same site (median MCI score 81 units; Table 3) but significantly lower (Stark, 1998) than the previous survey score (MCI score 96 units; Figure 5) by 13 MCI units. The $SQMCI_S$ score of 6.4 units was substantially higher than the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 2.5 units; Table 3) and substantially higher than the previous survey score ($SQMCI_S$ score 4.8 units). It was also the highest $SQMCI_S$ score recorded at this site to date.

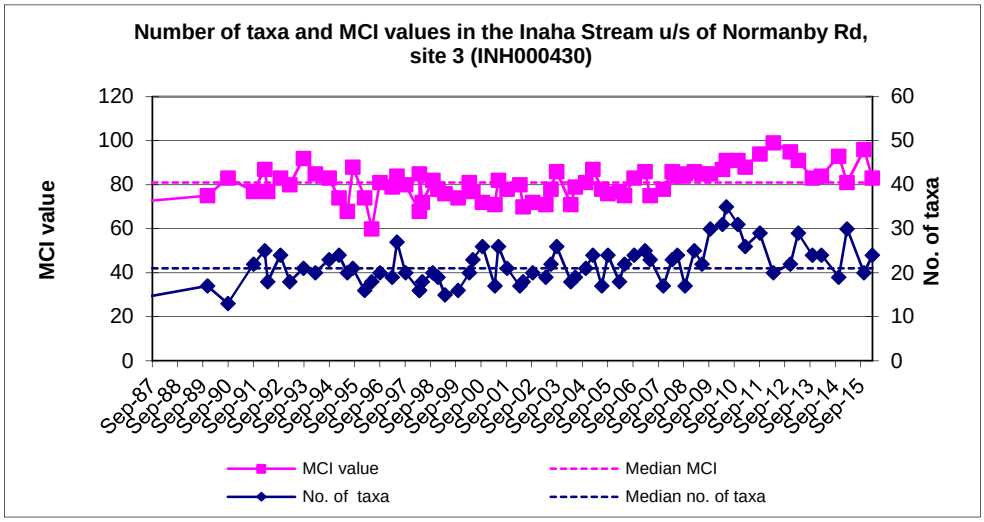

Figure 5 Numbers of taxa and MCI values recorded at site 3 in the Inaha Stream since 1989.

The community was characterised by four 'tolerant' taxa [ostracod seed shrimp, snail (*Potamopyrgus*), chironomid midge (Tanytarsini) and caddisfly (*Hydropsyche - Aoteapsyche*)], three 'moderately sensitive' taxa [elmid beetles and caddisflies (*Pycnocentrodes*) and (*Hydrobiosis*)] and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 5).

Site 4

A moderate macroinvertebrate community richness of 25 taxa was found at site 4 at the time of the survey which was one less than the median number recorded for the site (median taxa richness 26; Table 3) and the same as the previous three surveys (taxa richness 25; Figure 6).

The MCI score of 94 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 90 units; Table 3), although was substantially higher than that recorded by the previous survey (MCI score 84 units; Figure 6). The $SQMCI_S$ score of 5.0

units was slightly higher than the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 4.2 units; Table 3) and markedly higher than the previous survey score ($SQMCI_S$ score 2.7 units).

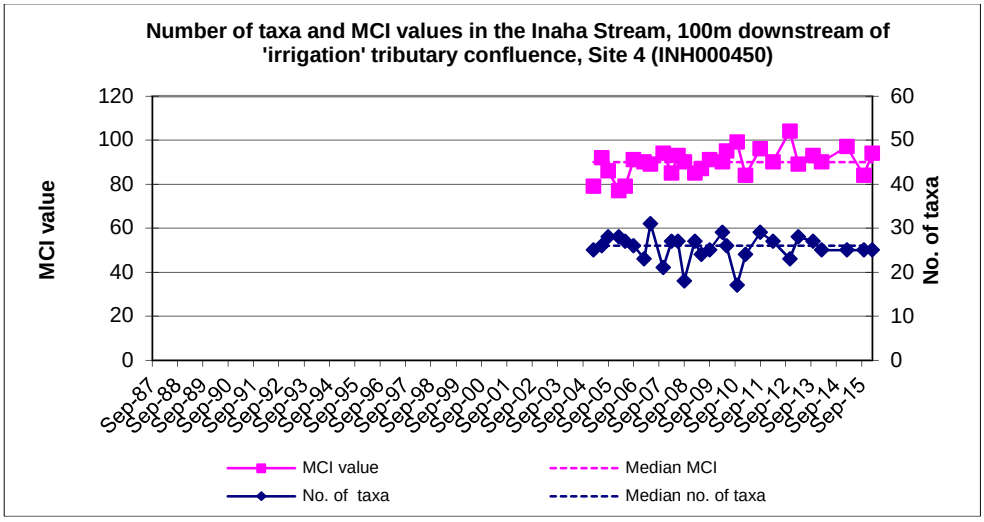

Figure 6 Numbers of taxa and MCI values recorded at site 4 in the Inaha Stream since 1989.

The community was characterised by three 'tolerant' taxa [ostracod seed shrimp, snail (*Potamopyrgus*) and black fly larvae (*Austrosimulium*)] and three 'moderately sensitive' taxa [amphipod (*Paracalliope*), mayfly (*Austroclima*) and elmid beetles] (Table 5).

Unnamed tributary of the Inaha Stream

Site UT

A moderate macroinvertebrate community richness of 19 taxa was found at site UT (the 'control' site for the unnamed tributary of the Inaha Stream) at the time of the survey which was one taxon more than the median number recorded for the site (median taxa richness 18; Table 3) and four taxa more than that recorded by the previous survey (taxa richness 15; Figure 7). This site has been monitored on eleven occasions since March 2010 and therefore has a smaller dataset than other sites in this report. Comparisons with median values are therefore not as robust as at other sites.

The MCI score of 96 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 99 units; Table 3) or to the previous survey score (MCI score 101 units; Figure 7). The $SQMCI_S$ score of 5.2 units was similar to the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 5.4 units; Table 3) and was similar to the previous survey score ($SQMCI_S$ score 5.4 units).

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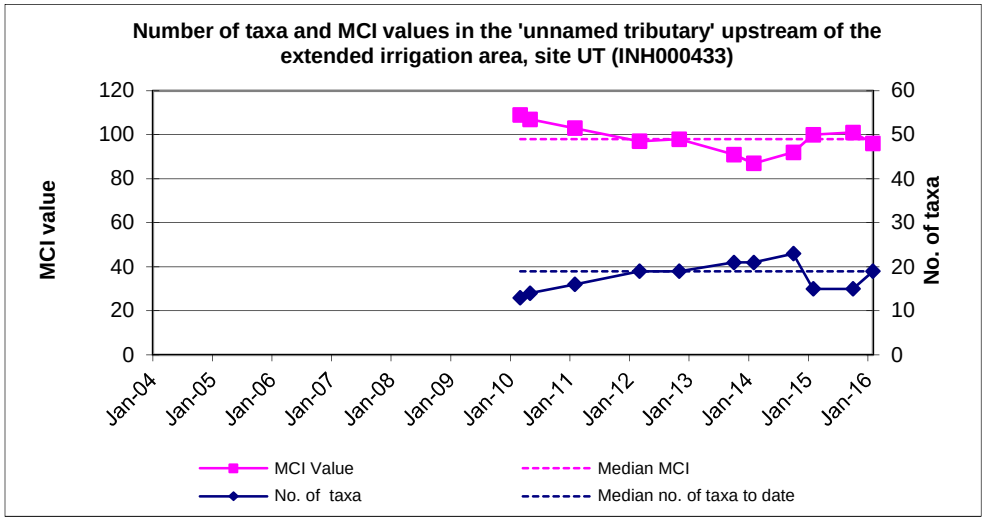

Figure 7 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream.

The community was characterised by two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)] and four 'moderately sensitive' taxa [amphipods (*Paracalliope*), (Paraleptamphopidae) and (Talitridae) and mayfly (*Zephlebia* group)] (Table 6).

Site MT

A moderate macroinvertebrate community richness of 21 taxa was found at site MT at the time of the survey which was very similar to the median number recorded for the site (median taxa richness 20; Table 3) and six taxa more than the previous survey (taxa richness 15; Figure 8).

The MCI score of 85 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 82 units; Table 3). This MCI score was however slightly lower than the previous survey score (MCI score 91 units; Figure 8). The $SQMCI_S$ score of 4.3 units was slightly lower than the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 4.5 units; Table 3) and slightly lower than the previous survey score ($SQMCI_S$ score 4.5 units).

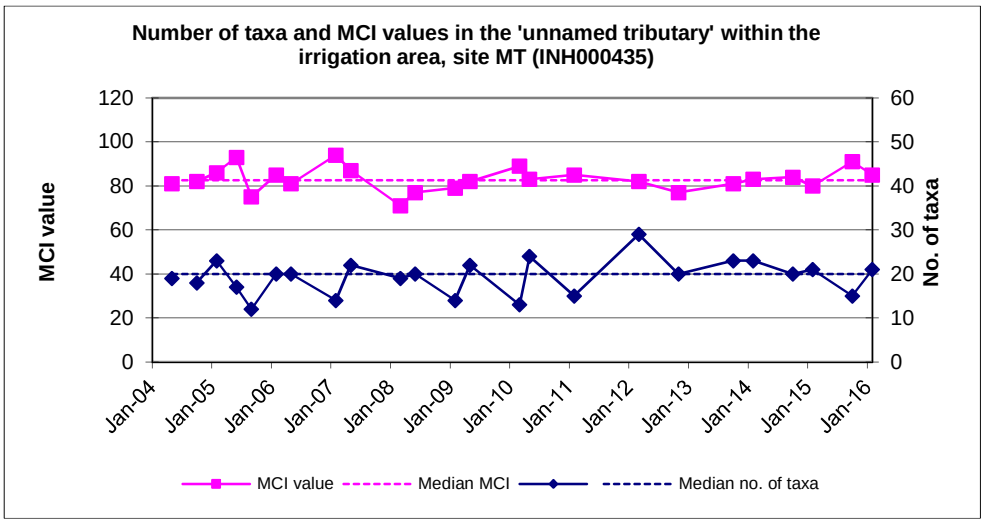

Figure 8 Numbers of taxa and MCI values recorded at site MT in the unnamed tributary of the Inaha Stream since 2004.

The community was characterised by three 'tolerant' taxa [snail (*Potamopyrgus*), ostracod seed shrimp and oligochaete worms] and four 'moderately sensitive' taxa [amphipods (*Paracalliope*) and (Talitridae), mayfly (*Zephlebia* group) and caddisfly (*Polyplectropus*)] (Table 6)

Site DT

A moderate macroinvertebrate community richness of 22 taxa was found at site DT at the time of the survey which was one taxon more than the median number recorded for the site (median taxa richness 21; Table 3) and eight taxa more than that recorded by the previous survey (taxa richness 14; Figure 9).

The MCI score of 92 units indicated a community of 'fair' biological health which was slightly more than the median value calculated from previous surveys at the same site (median MCI score 89 units; Table 3) and not significantly different (Stark, 1998) to the previous survey score (MCI score 84 units; Figure 9). The $SQMCI_S$ score of 4.6 units was the same as the median value calculated from previous surveys at the same site (median $SQMCI_S$ score 4.6 units; Table 3) and slightly higher than the previous survey score ($SQMCI_S$ score 4.2 units).

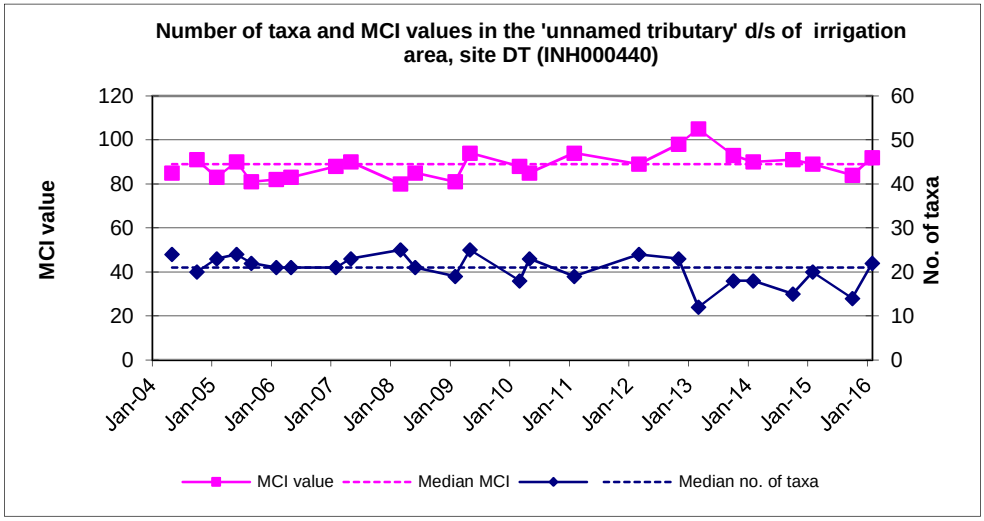

Figure 9 Numbers of taxa and MCI values recorded at site DT in the unnamed tributary of the Inaha Stream since 2004.

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and sandy cased caddis (*Oecetis)*] and three 'moderately sensitive' taxa [amphipods (*Talitridae*) and (*Paracalliope*) and mayfly (*Zephlebia* group)] (Table 6).

Discussion

In the past, heterotrophic growths such as 'sewage fungus' have occurred in the Inaha Stream downstream of the rendering plant which were most likely the result of the discharges from the plant. However, no 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

Inaha Stream

There were no significant differences between site U (the 'control' site) and site 1 for MCI and $SQMCI_S$ scores, however taxa richness was slightly higher at site U. These results may indicate that leaching of nutrients into the Inaha Stream from the northeastern block of land under irrigation (Figure 1) was not affecting the health of the macroinvertebrate communities present in the Inaha Stream at the time of the survey. However it is important to note that the MCI score recorded at the 'control' site was significantly lower than the median for the site and was significantly lower than the previous survey score. In addition, the $SQMCI_S$ score was also lower than the median and previous survey scores. Extensive green filamentous algae was recorded at site U at the time of this survey, which is likely to have contributed to the decline in macroinvertebrate health at this site.

There were no significant differences between sites 1, 2d and 3 for MCI and taxa richness, and no significant differences between sites 1 and 2d for $SQMCI_S$. However the $SQMCI_S$ score recorded at site 3 was significantly higher than that recorded at site 1 and 2d and was the highest $SQMCI_S$ score recorded at this site to date. This result was an improvement from the previous summer (February 2015) survey where a significant decline in macroinvertebrate health was recorded between sites 1 and 3. In the February 2015 survey it was thought the removal of riparian vegetation at site 2d (which eliminated shading and wood present in the stream), together with higher water temperatures and low flows and subsequent increase in filamentous periphyton growth were major drivers in the decline in macroinvertebrate health (Sutherland, 2015). However it was also suggested that there was some evidence that discharges from Taranaki By-Products, such as possible seepage of nutrient enriched water from the unnamed tributary, may have negatively affected the macroinvertebrate communities present in the Inaha Stream (Sutherland, 2015). In comparison to the previous spring survey (October 2015), MCI scores for the current survey at sites 1, 2d and 3 had decreased slightly, likely due to lower flows and higher nuisance periphyton cover at these sites. However taxa richnesses were similar between surveys and $SQMCI_S$ scores either increased (site 1 and 3) or stayed the same (site 2d).

In the previous spring (2015) survey the macroinvertebrate community at site 4 (downstream of the confluence with the unnamed tributary of the Inaha Stream) recorded a significantly lower MCI and $SQMCI_S$ score compared to site 3 (by 12 units and 2.1 units respectively). It was thought the decrease in macroinvertebrate health could be explained by the increased amount of soft sediment recorded at the time of the survey. Substrate comprised predominantly of silt (75%) and was notably soft and thick (>50 cm) in places. In the current survey the substrate was predominantly sand with gravels, cobbles and wood/root, which in turn supported larger numbers of 'sensitive' taxa. Both MCI and $SQMCI_S$ increased from the previous spring survey (by 10 units and 2.3 units respectively). There was a significant (Stark, 1998) increase in MCI score (by 11 units) between site three and four in the current survey, showing some improvement at this site, however the $SQMCI_S$ score recorded at site 4 was substantially lower than that recorded at site 3. The lower MCI score recorded at site three in comparison to site 4 is likely the result of subtle habitat variation; specifically to the increase of nuisance periphyton and lack of shading at this site.

On examination of all of the Inaha Stream sites, the trends suggests improvements began to appear in 2009 (Figure 10 and Figure 11) but since 2012 large fluctuations in macroinvertebrate indices have occurred. The best result for this type of survey is that MCI scores and $SQMCI_S$ scores in the Inaha Stream are not significantly different to each other

within each survey. Occasionally differences in habitat between sites can result in different scores, although this can often be explained when the community assemblage is assessed. The SQMCI$_S$ is more sensitive to changes in habitat, and this is evident in Figure 10. Figure 10 shows SQMCI$_S$ scores were similar between sites, with the exception being site 3 which recorded a SQMCI$_S$ score significantly higher than the remaining Inaha Stream sites.

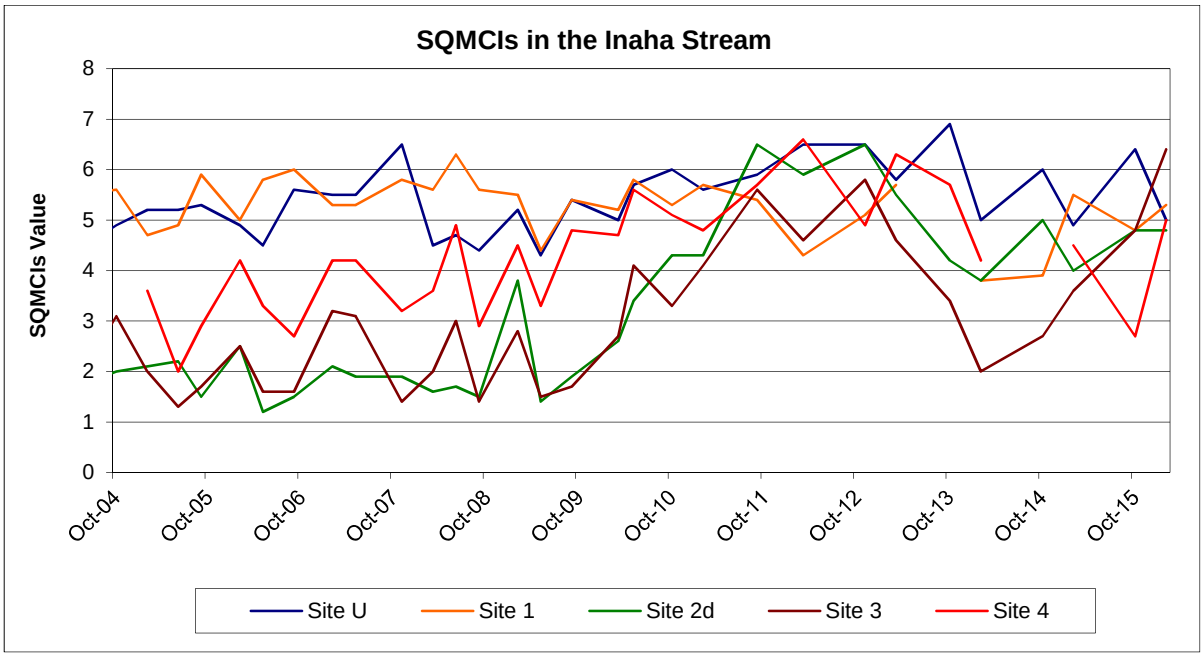

Figure 10 SQMCI$_S$ values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

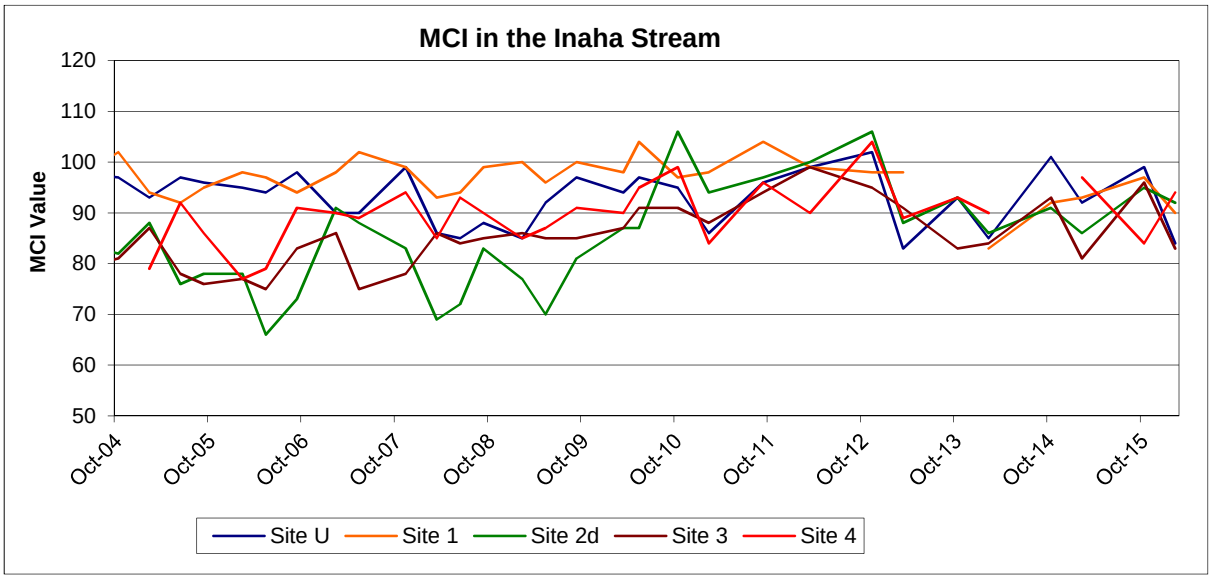

Figure 11 MCI values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

Unnamed tributary of the Inaha Stream

There were some significant differences (Stark, 1998) among the three sites sampled in the unnamed tributary of the Inaha Stream in relation to MCI and SQMCI$_S$ scores but not taxa richnesses. Specifically, the 'potentially impacted' site MT had a substantially lower SQMCI$_S$ score than the 'control' site (site UT), by 0.9 SQMCI$_S$ unit. In addition site MT had a

significantly (Stark, 1998) lower MCI score than site UT (by 11 units). It is important to note that only a small area was surveyed at site MT as access to the site was difficult, which may have affected results. All three sites had MCI and $SQMCI_S$ scores that were not significantly different to comparative sites in the Taranaki ring plain (Table 4).

The MCI scores recorded at all three sites in the unnamed tributary were indicative of 'fair' macroinvertebrate health. Community composition was varying between sites, with four out of nine abundant taxa common to all three sites. Snails (*Potamopyrgus*) and amphipods (*Paracalliope*) were abundant to extremely abundant to all sites, while the mayfly (*Zephlebia* group) and amphipod (Talitridae) were abundant to very abundant at all sites. The differences in macroinvertebrate community composition between sites reflected differences in the instream habitat, with proportions of roots and/or fine sediment and instream macrophytes varying at all three sites. Habitat variation among sites was probably the cause of the differences in MCI and $SQMCI_S$ scores; and it might be expected the lower site (DT) supported a higher portion of 'sensitive' taxa due to a higher proportion of hard substrate at this site compared with the two upstream sites. Overall the MCI and $SQMCI_S$ scores recorded by the unnamed tributary of the Inaha Stream indicated that the land under irrigation by Taranaki By-Products was unlikely to be negatively affecting the macroinvertebrate communities present in the unnamed tributary of the Inaha Stream.

Summary

The Councils 'kick-sampling' and 'vegetation sweep' techniques were used at eight sites to collect streambed macroinvertebrates from the Inaha Stream and an unnamed tributary, to assess whether discharges (via point source and irrigation to land) from Taranaki By-Products Limited's rendering plant had had any adverse effects on the macroinvertebrate communities of the streams. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundances as well as sensitivity to pollution. Significant differences in either the MCI or the $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

A summer macroinvertebrate survey was performed at five sites in the Inaha Stream and at three sites in an unnamed tributary of the Inaha Stream in relation to discharges by Taranaki By-Products. Taxa richnesses were generally similar or higher than that of the median values calculated from all previous surveys.

MCI scores showed that macroinvertebrate communities were in 'fair' health in the Inaha Stream. MCI scores were similar between all sites, with only one significant difference occurring at site 3 which recorded a MCI score significantly lower to that recorded at site 4 (by 11 units). This difference is likely a reflection of habitat differences between the two sites, in particular to the increase nuisance periphyton cover at site 3. In the previous spring survey site 4 had significantly lower MCI and $SQMCI_S$ scores compared to the upstream sites which was largely be attributed to increased sedimentation at this site. The sedimentation recorded in the previous spring survey was not recorded in the current survey.

All sites in the unnamed tributary of the Inaha Stream recorded MCI scores reflective of

'fair' stream health. There was a significant decrease in MCI and SQMCIs scores recorded between the upstream site UT and site MT, which can largely be attributed to habitat variation rather than to impacts caused from irrigation to land by Taranaki By-Products. The decrease may also be attributed to the substantially smaller area surveyed at site MT, due to difficulty getting to this overgrown site. Only a small decrease in MCI and SQMCIs score was recorded between site UT and DT and all scores for the three unnamed tributary sites were similar to historical medians. The current survey results indicate no significant negative impact to the macroinvertebrate communities present in the unnamed tributary of the Inaha Stream from irrigation to land by Taranaki By-Products.

No 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

Overall, there was no evidence that discharges from Taranaki By-Products had impacted on the freshwater macroinvertebrate communities present in the Inaha Stream. However, changes in habitat and habitat variation between sites make drawing strong conclusions from the data difficult.

References

Colgan, B, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, June 2003. TRC report BC012.

Dunning KJ, 2001: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2001. TRC report KD78.

Dunning KJ, 2002a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2002. TRC report KD108.

Dunning KJ, 2002b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, April 2002. TRC report KD109.

Dunning KJ, 2002c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2002. TRC report KD132.

Fowles CR and Colgan BG, 2004: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, May 2004. TRC report CF339.

Fowles CR and Colgan BG, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, October 2004. TRC report CF352.

Fowles CR and Jansma B, 2008a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, November 2007. TRC report CF468.

Fowles CR and Jansma B, 2008b: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, March 2008. TRC report CF469.

Fowles CR and Jansma B, 2008c: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, June 2008. TRC report CF470.

Fowles CR and Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2008. TRC report CF471.

Fowles CR and Moore SC, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2004. TRC report CF327.

Fowles CR and Stark JD, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant using artificial substrates January to March 2003. TRC report.

Hickey CW and Vickers ML, 1994: Toxicity of ammonia to nine native New Zealand freshwater invertebrate species. Archives of Environmental Contamination and Toxicology 26: 292-298.

Hope KJ, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, June 2005. TRC report KH043.

Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2006. TRC report KH087.

Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2006. TRC report KH088.

Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2006. TRC report BJ033.

Jansma B, 2008: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2007. TRC report BJ034.

Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2009. TRC report BJ086.

Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2009. TRC report BJ087.

Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, September 2009. TRC report BJ094.

Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2010. TRC report BJ095.

Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2010. TRC report BJ096.

Jansma B, 2012 (a): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2010. TRC report BJ168.

Jansma B, 2012(b): Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2011. TRC report BJ169.

Jansma B, 2012(c): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2011. TRC report BJ170.

Jansma B and Smith K, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, November 2012. TRC report BJ211.

Jansma B, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2013. TRC report BJ212.

McWilliam H, 2001a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2000. TRC report HM234.

McWilliam H, 2001b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2001. TRC report HM247.

McWilliam H, 2001c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, May 2001. TRC report HM248.

Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2003. TRC report SM577.

Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, August 2003. TRC report SM588.

Smith K, 2012: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2012. TRC report KS008.

Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil* Miscellaneous Publication No. 87.

Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research 32(1*): 55-66.

Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.

Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.

Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. New Zealand Journal of Marine and Freshwater Research 41(1).

Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.

Sutherland DL and Thomas B, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report DS024.

Sutherland DL, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2015. TRC report DS025.

Thomas B, 2013: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2013. TRC report BT010.

Thomas B, 2014: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2014. TRC report BT042.

Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report BT049.

TRC, 2015: Some statistics from the Taranaki Regional Council database (Esam) of freshwater macroinvertebrate surveys performed during the period from January 1980 to 30 September 2014. Technical Report 2014-105.

Appendix III

Golder Air Report

20 July 2015

Project No. 1530864_001_LR_Rev0_TBP Audit Report

Paul Drake
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PO Box 172
Hawera 4640

SITE VISIT REPORT - CONSENT 4058-4 CERTIFICATION

Dear Paul,

This letter[1] provides the results of the audit by Golder Associates (NZ) Limited (Golder) of 'Engineering Practice' with respect to the odour control systems that are operated at the Taranaki By-Products Limited (TBP) and Taranaki Bio-Extracts Limited (TBE) sites at Kohiti Road, Okaiawa. The audit investigations were completed during site visits on the 20, 21 and 22 May 2015 by Golder. The requirement for this audit is specified within special condition 6 of Resource Consent 4058-4. This consent was issued by the Taranaki Regional Council on 11 October 2011.

This letter report contains the following sections:

- Confirmation of scope of services
- Audit approach
- Summary of site processes
- Description of odour control systems
- Description of physical condition of equipment
- Instrumentation review
- Design aspects
- Management aspects.
- Summary of audit findings
- Conclusion & recommendations

Confirmation of Scope of Services

Special Condition 6 of consent 4058-4 defines the scope of work required and states that:

[1] "This letter report is provided subject to the attached limitations.

> *"By the 30 April 2013, and every two years thereafter, the consent holder shall provide certification by a suitably qualified independent person that the works, processes and equipment relevant to all discharges to air from the site are operational in accordance with good engineering practice."*

Please note, Golder considers that an assessment of operational control systems at the site is outside of the scope of a review of 'good engineering practice'.

Audit Approach

The site audit was led by Roger Cudmore (Principal Environmental Engineer, Golder) and supported by Maria Luisa Oliveira de Aguiar (Environmental Engineer, Golder). Roger has the qualification of *B.Eng (Hons) Chemical & Process* and has over 18 years of experience designing, reviewing and overseeing the installation and operation of air extraction and biofilter treatment systems within numerous rendering plants throughout New Zealand. Maria has qualifications of *B.Eng Environmental* and has over 6 years environmental engineering experience in industry and consultancy.

Having reviewed the previous engineering practice audits, also undertaken by Golder (2010, 2013), it was determined that this audit should focus upon the similar aspects that contribute to the status of existing 'engineering practice'. This audit addresses the following aspects of good engineering practice with respect to the odour control systems that are operated by TBP and TBE:

- **Physical condition of equipment:** The state of odour control components, including consideration of materials used for construction.
- **Instrumentation review:** The accuracy of selected instrumentation and the adequacy of instrument for monitoring the odour control system.
- **Design aspects:** The current engineering design with respect to the air extraction, air cooling and biofilter systems.

As part of the audit process, a number of measurements of pressure, temperature and air flows within odour extraction ducts were made using a calibrated pitot tube, differential pressure meter and thermometer. The results of measurements are summarised before the final conclusion and recommendations section.

A summary of site processes and the odour control system is provided below to help provide context for the subsequent sections of this letter. This is followed by our findings with respect to the various aspects of engineering practice listed above.

Site Processes

The rendering processes operated by TBP and TBE are described by Golder (2010). These processes are mostly the same as those currently operated.

Taranaki By-Products

The TBP rendering plant operates the following processes:

- Bovine by-products rendering line (nominally processing 500 tonnes/day raw material) including pre-breaker (for fallen stock), hogger, surge bin, pre-cooker, press, 2 x decanters, tallow recover plant (liquid phase tank and tallow separators), three indirect steam dryers (TST-70, TST-100 and TST150) and dedicated meal processing plant.
- Blood processing line (nominally processing 150 tonnes/day blood) including a steam coagulator, decanter and indirect steam dryer (TST-30) and milling plant.
- A poultry rendering line (nominally 60 to 120 tonnes/day of raw material) including continuous cook, decanter, indirect steam dryer (TST-100), milling line and tallow recovery.
- Pressurised feather hydrolyser co-sharing the poultry line's dryer and milling line.

- Three waste heat evaporators (WHEs) that utilise hot dryer exhaust streams from the chicken, blood processing and bovine rendering lines to evaporate and concentrate the stick liquor streams that are produced from the tallow recovery plants.

Taranaki Bio-Extract

TBE continues to operate an edible (food grade) gelatine bone chip recovery plant that nominally processes 160-180 tonnes/day of bone material.

The TBE bio-extracts plant operates the following process:

- Melting plant (holding 20 tonne of material including recycled stick liquor)
- Solids decanting (pusher-centrifuge) to separate solids and liquor for recycling
- Bone dryer (Duske TDP 3000 gas-fired dryer), product screening and sorting
- Melter tank liquor processing including decanting, screening, liquid phase tank and tallow recovery
- Decanter solids indirect steam heated drying (Dusky drier)
- Final stick liquor waste stream is directed to the TBP wastewater system, or recycled to the melter.

Odour Control Systems

The odour extraction, cooling system and biofilters comprise the main components of the odour control systems that are operated by TBP and TBE. These systems are summarised below.

Air Extraction and Cooling Systems - Taranaki Bio-Extracts

Extraction: The TBE site operates a relatively simple concentrated sources extraction and cooling system that connects to a biofilter. The extraction of process emissions from specific items of equipment is driven by a single fan (TBE concentrated sources fan). The processes extracted by the concentrated sources system include:

- Duskie dryer exhaust
- Melter tank
- Liquor screening (post the liquor decanter)
- Liquid phase tank and
- Final air discharged from the bone air-sieving system.

There is no building air extraction system employed by the TBE plant as the concentrated sources extraction system is sufficient to contain all significant process odour emissions.

The soup stock plant is a small operation for which no odour controls are employed as this process produces only minor odour that is not inherently objectionable or offensive.

Concentrated Sources Cooling: The combined concentrated sources air streams are passed through a water spray scrubber tower that utilises the final wastewater polishing pond for its water supply.

Air Extraction and Cooling Systems - Taranaki By-Products

Extraction: The TBP site also operates a similar concentrated sources extraction and cooling system that targets rendering and tallow recovery process stages as well as all the hot exhaust air streams from the five TST indirect steam dryers.

The TBP concentrated sources extraction and cooling system is shown in Figure 1. The system is more complicated than that operated by TBE, but is also driven by a single concentrated sources fan. In this instance the fan is downstream of the water spray scrubbing air cooling system.

The concentrated sources duct system extends from the two stage scrubber and into the TBL rendering building where it spits into two main sub-manifolds (bovine and chicken sub-manifolds).

The *bovine sub-manifold* is connected to the following processes:

- Pre cooker
- Solids press
- Decanters
- Material transfer conveyors
- Tallow recovery plant (liquid phase tank and separators)

The *chicken line sub-manifold* is connected to the following processes:

- Pre cooker
- Decanter discharge screw and pump
- Decanter discharge conveyor
- Dryer feed conveyors
- Chicken mill and meal bin
- Bovine mill and meal bin

The five TST indirect steam dryers produce hot humid exhaust air streams. These streams are initially extracted by a vacuum created as their vapours are condensed within the WHE plant. The resultant NCG stream that discharged from the WHE plant is subjected to further vacuum as this stream connects to the water spray tower that is ventilated by its connection to the inlet of the TBP concentrated sources fan (located after the two stage water spray scrubber tower).

Building Air Ventilation: TBP also operate two independent building air extraction systems (Factory Air 1 and 2) that extract building air from the TBP plant (including the fallen stock pre-breaker bin).

Concentrated Sources Cooling: The concentrated sources cooling system is shown in Figure 1. This constitutes the waste-heat evaporation system (WHE) and the dual water scrubber tower. The TST steam dryer exhaust flows contain the main heat loading to the cooling system (both latent and sensible energy).

The WHEs provide an important role in condensing vapours and removing most of the latent energy from the dryer exhaust air streams. The result non-condensable gases (NCGs) stream that exits the WHEs is then mixed and further cooled with the concentrated source streams (from rendering and tallow processes) within the two-stage spray water scrubber. This scrubbing system also utilises the final wastewater polishing pond as its water supply as does the TBE scrubber.

By using the thermal energy from the dryer exhausts, the WHE enables the evaporation/concentration of stick liquor streams that can be recovered as product.

Biofilter Systems

There are four biofilter systems including the two factory air biofilters (1 & 2) and two concentrated source biofilters for TBE and TBP respectively. These arrangements are an improvement from the last audit (Golder, 2013), whereby the TBP concentrated sources did not have a dedicated biofilter. The biofilters and associated sources are summarised as follows:

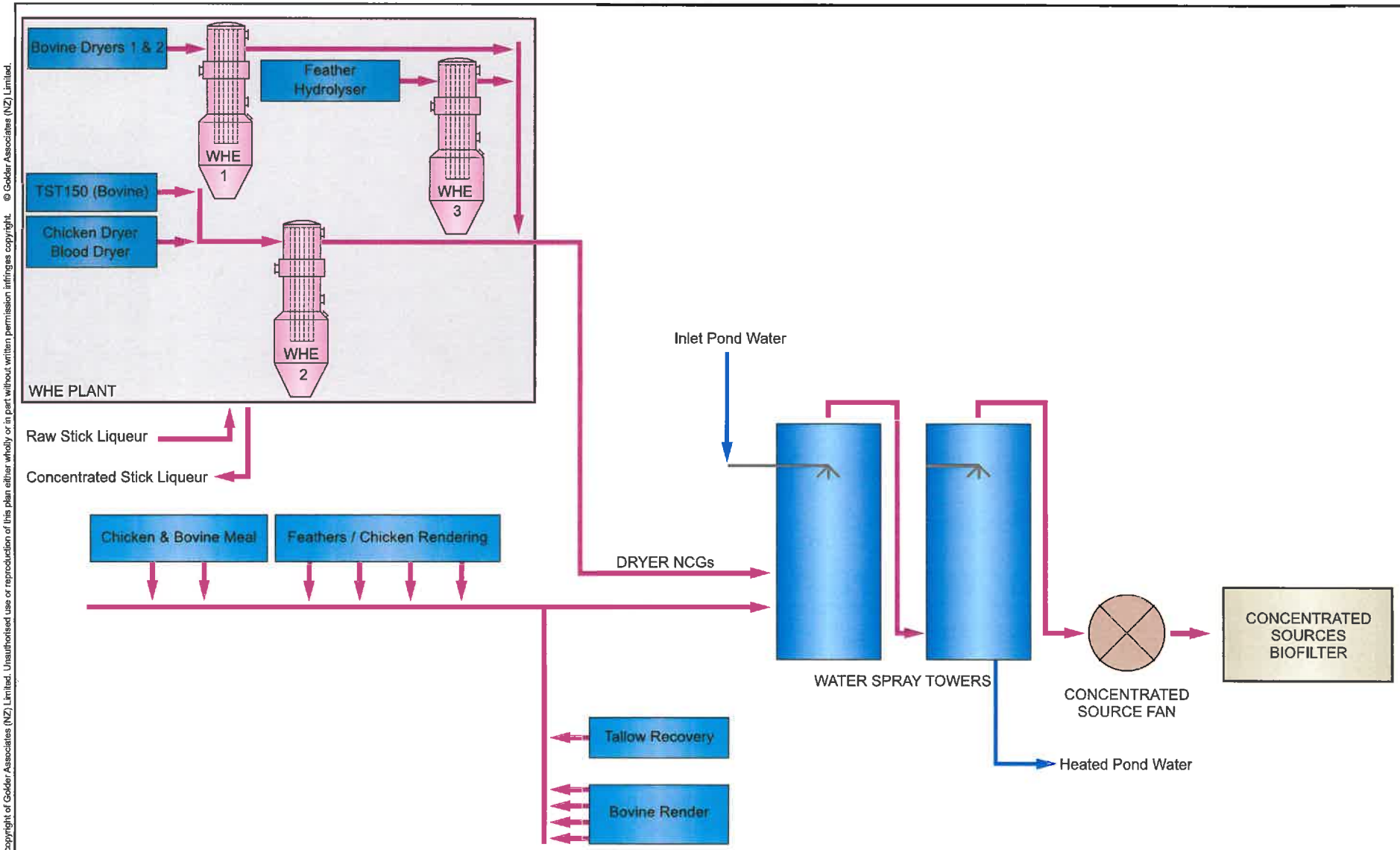
The Factory Air #1: This biofilter consists of a 1.5 m deep bark bed with three areas each of 30 m x 40 m (5,400 m^3 media in total). The Factory Air #1 flow to this bed was measured at 88,000 m^3/hr during the audit. This infers a biofilter bed loading rate of inlet air at 16 $m^3_{air}/hr/m^3_{media}$. This is below our recommended maximum guideline value of 20 $m^3_{air}/hr/m^3_{media}$ for bark-bed biofilters used to treat warm and moist process air streams, and is therefore acceptable. As per our previous recommendation (Golder 2013) this biofilter

had an additional cell installed (i.e. 30 m x 40 m and 1.5 m deep) which has been dedicated to the TBP conc. sources flow (see below).

The Factory Air #2: This biofilter consists of a 1.5 m deep bark bed with a total area of 30 m x 25 m (1,125 m^3 media in total). The Factory Air #2 flow to this bed was measured at 21,000 m^3/hr during the audit. This infers a biofilter bed loading rate of inlet air at 19 $m^3_{air}/hr/m^3_{media}$. As noted from the previous audit (Golder, 2013), this flow was found to heat up from 25°C to 38°C as it passed through the main fan, which is considered to result from the high backpressure this fan works against (discussed later). That aside, be air loading rate to the biofilter media is well within an acceptable range, especially given that building air is involved rather than concentrated sources from the rendering process.

TBP Concentrated Sources (Inedible): This new biofilter consists of a 40 m x 30 m x 1.2 m deep bark bed that was built in 2014 (1,440 m^3 media in total). The TBP concentrated source flow to this bed was measured at 11,000 m^3/hr during the audit. This infers a biofilter bed loading rate of inlet air at 8 $m^3_{air}/hr/m^3_{media}$. For rendering plant concentrated sources air that is cooled down to 40°C, or lower, this equates to a low biofilter bed loading rate.

TBE Concentrated Sources (Edible): This biofilter consists of two 0.7 m deep bark beds that have a significant fines fraction. Each bed had a total area of 20 m x 25 m (700 m^3 media in total). As during the 2013 audit, this bed was only treating the TBE concentrated air flow, which has been the normal mode of operation for the last years – previously this dual bed also treated the concentrated source flow from TBP. The measured flow into the concentrated sources biofilter from the TBE plant was 17,000 m^3/hr, which equates to a media air loading rate of 24 $m^3_{air}/hr/m^3_{media}$. This is above our general guideline of 20 $m^3_{air}/hr/m^3_{media}$ for rendering plant concentrated sources, however is acceptable in this case. This is because the inlet air that is cooled down to 40°C or less and especially because of the low odour content that is inherent within process emissions from the bio-extracts process compared to by-products rendering.



1. Schematic only, not to be interpreted as an engineering design or construction drawing
2. DRAWN BY: ZM REVIEWED BY: RW

Golder Associates

TITLE SCHEMATIC DIAGRAM OF CONCENTRATED SOURCES EXTRACTION AND COOLING SYSTEM - TARANAKI BY-PRODUCTS LTD

JULY 2015
PROJECT 1530864

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Physical Condition of the Odour Control System

All process equipment, extraction ducts, cooling equipment, fans and biofilters were generally found to be in a sound physical and functioning state as previously reported by Golder (2013), although as noted below there are signs of corrosion becoming advanced in some sections of the air ducts. The TBE plant is still in a relatively new condition that the older TBP plant. There are plans for some expansion to the latter plant that will require upgrades to the concentrated sources extraction and cooling systems. Components of the system are discussed as follows.

Extraction & Discharge Ducts

The extraction stainless steel ducts within the TBP plant are relatively old, but remain in a good engineering condition and showing no significant corrosion effects. By comparison the TBE stainless steel extraction ducts are in a relatively new and very good condition. The TBP factory air ducts exhibit corrosion in some isolated locations. These are not resulting in leaks at this stage but are noted below and recommended for closer inspection and scheduled maintenance, as necessary.

- The point of connection between the corrugated iron duct to the stainless steel cowling on the discharge side of the Factory Air 2 fan is under significant pressure and is starting to significantly rust. This could become a significant point of air/odour leakage in the next year or less.
- The Factory Air 1 discharge duct also exhibits some corrosion around a duct join that is immediately downstream of the manual and online temperature instrumentation (i.e. opposite the sump beside the Factory Air 2 Biofilter).
- The sump opposite the Factory Air 2 fan discharges odorous vapours which could be a result of an air leakage from the TBP concentrated sources duct – the source was in a confined space and could not be confirmed during the site visit. This is not a significant source but it is recommended the sump and ducts are inspected.
- Significant emissions from the bovine mill area were observed and indicates that air extraction ducts that are hydraulically connected to the TBP concentrated source duct could be blocked. These emissions are into a building that appears to have effective air extraction via the Factory Air 1 and 2 fans.

Fans

Fans that are operated to extract concentrated sources from TBE and TBP, as well as large factory air fans used by the TBP plant were all operating during the audit and appeared to be well maintained. They exhibited no excessive vibration, bearing noise or any significant leakages around fan seals, and therefore appear to be operating without any malfunction.

Cooling Equipment

All air stream cooling systems at TBE and TBP (i.e., scrubbers, WHEs, heat-exchangers) were in good physical condition and appear well maintained. They also exhibited no leaks or malfunctions were achieving a concentrated sources discharge temperature below 40°C (i.e. 39°C and 36°C for the TBE and TBP discharge ducts respectively). This is an improvement the previous audit findings by Golder (2013), whereby both cooling system were not achieving sufficiently low temperatures.

Increased cooling duty via the water spray scrubbing towers had been achieved by improving the quality of final pond wastewater that is supplied to the TBE and TBP scrubber systems. Additionally, a new evaporative cooling plant has been installed by TBP to provide additional capacity for cooling exhaust vapours from the WHE plant. It is not clear if this system directly benefits the cooling of NCGs from the WHE and therefore reducing their heat loading to the water spray scrubbers.

It is noted that TBP plan to install to replace a TST-70 dryer in the bovine line with a larger dryer (TST-100), move a TST-70 dryer to the blood room and move the blood room's TST-30 dryer to the chicken line. To manage the addition dryer exhaust cooling duty (in the order of 30%), an additional WHE plant is being considered for the two chicken dryer exhaust streams. It also likely that the TBP water spray scrubbers system could need an increased water supply rate, or some other provision is made available for adequate cooling of the net increase in NCG flow and additional rendering line. This additional line would be installed

opposite the exiting bovine rendering line (in the old boiler location) and would include additional pre-cooking, decanting and press equipment.

Biofilters

There are effectively four biofilter systems operated at the site (compared to three in 2013). The TBP concentrated sources biofilter is an independent 30 m x 40 m bed that has been added to the end of the Factory Air 1 biofilter. All these biofilters except for Factory Air No. 2 biofilter have concrete pipe manifolds with Novaflo drainage pipe for air distribution laterals. Factory Air No. 2 biofilter has corrugated iron manifolds which may need replacement in the year or two as corrosion effects could be significant after five years of life.

All beds appear to have good air distribution. However, the TBE concentrated sources biofilter is showing signs of leakage where the laterals connect to the main concrete manifold within the bed (see Figure 2). This leakage is not causing significant odours but the associated flow channelling is likely to increase over time. At some stage in the future (when the bed in partially replaced), it would be an opportune time to reseal the Novaflo lateral connections to the concrete manifold.

All biofilter bed media appear in a good condition except for the TBP concentrated sources media that has excessive moisture in the lower sections of the bed. Consequently the bed back pressure level is high at approximately 1800 Pa.

The back pressure of air supplied to the Factory Air 2 biofilter (FA2 biofilter) is also very high at 4000 Pa and is attributed to the lateral system being blocked by dust discharged from within the blood room. The subsequent building air that extracted via the Factory Air 2 system transports this dust to the FA2 biofilter. One option to reduce the dust loading to the FA2, is to install a spray scrubber tower near the blood room that enables its building air to be scrubbed before being discharged to the FA2 biofilter. This scrubber could also be used for cooling NCGs from the new chicken dryer WHE system that is proposed.

Figure 2: TBE concentrated. sources biofilter bed, with vapour leaking above one of the main ducts.

Instrument Review

The instrument review consisted of checking temperature gauges within the process air extraction system, which was also undertaken by Golder (2013). Temperature gauges and vacuum gauges were compared to pre-calibrated instruments used for the audit – that is the (Fluke 50D) thermometer and the Dwyer digital

manometer (Model AQTI-WDPM-005). The Fluke meter's temperature span was assessed by Golder to have an absolute accuracy within ± 1 °C for 0 °C and 100 °C. This accuracy was checked using ice and boiling water. The Dwyer digital manometer has factory calibration and was on check onsite against water tube manometer readings that indicated an absolute accuracy of within 5%, or less.

Temperature gauges on the TBP concentrated sources system were within 1°C of the Fluke meter. The pressure gauge on the TBE concentrated sources duct (post the scrubber) was within 1% of the Dwyer manometer. No other pressure gauges are on the TBE or the TBP odour extraction system. Installation of vacuum gauges on the odour extraction system is discussed and recommended below.

Recommendations regarding on-line monitoring within parts of the odour control system are the same as those made by Golder (2013) for the key suggestion are listed as follows:

- Install industrial grade pressure/vacuum gauges near the terminus of each main air extraction duct, including concentrated sources and factory air ducts. These gauges should be situated approximately one metre back from the final opening of the factory air ducts (including the pre-breaker hood) and a similar distance for the vacuum gauge installed within concentrated source duct where they connect to first process plant item.
- Install industrial grade pressure/vacuum gauges at the inlet and discharge side of all concentrated source and factory air fans.
- Install robust water manometer or industrial grade pressure gauges on each biofilter inlet pipe within close proximity to the biofiler bed.
- Install industrial grade temperature gauges on the inlet of the biofilters that treat concentrated source air from TBE and TBP.
- Install industrial grade temperature gauges on the inlets and outlets of the water spray scrubbers that cool the TBE and TBP concentrated source air flows, as well as on the inlet cooling water supply and discharge line.
- For overhead air extraction manifolds that are difficult to access, run steel tubing down walls to mounted gauges that can be readily accessed and viewed from floor level.

Design Aspects

The key design features of the odour control system's extraction ducts, air cooling and odour treatment have been set in place for a number of years and have been driven by requirements of resource consent conditions. These aspects are discussed below.

Odour Extraction System

Taranaki By-Products: The TBP odour extraction system relies heavily upon the two building air ducts and associated fans (Factory Air 1 and 2). The concentrated sources extraction system targets point sources of process odour before they escape into the rendering process building. This system is not able to effectively contain hot process emissions from rendering equipment ahead the dryers. With expansion of the TBP rendering plant over the years, the concentrated source extraction system is increasingly less able to contain process emissions. Consequently the building air extraction system, that extracts almost 100,000 m^3/hr of air from near the apex of the TBP rendering building, is relied upon to capture and treat process odour emissions. This system is well designed and is essential for controlling odour emissions and limiting the potential for off-site effects.

As discussed by Golder (2013), modern rendering plants in New Zealand have employed the use of more effective concentrated source odour extraction systems. For these plants, the building air extraction and treatment provides additional odour control redundancy. These systems rely less, or not at all, upon the extraction and treatment of large volumes of building air.

Golder (2013) concluded that there is scope to upgrade the concentrated source system and further increasing its efficiency. This could be undertaken when designing a new concentrated source sub manifold

system for the proposed new bovine rendering line. The options are to install a single new concentrated sources manifold that targets the existing and new bovine rendering equipment including the decanters, transfer conveyors, pre-cookers, and presses.

Finally it is recommended that there be a duct cleaning programme put in place for any upgraded concentrated sources system and the existing chicken rendering line and meal processing (bovine and chicken lines) air extraction systems. The existing system is showing signs of partial blockages and is difficult to access. For the upgraded system recommended for bovine rendering the design should provide for routine access and cleaning of ducts.

Taranaki Bio-Extracts: The TBE plant has an effective concentrated sources system for containing process odours, and does not have, or require a building air extraction system. This is partly because the material processed at TBE is inherently less odorous than at TBP, but also because the TBE concentrated sources system is significantly more effective at containing process odours compared to the equivalent system operated at TBP. The design of the odour system at TBE represents good design practice, as its concentrated sources system is the sole engineered system that is installed to limit the potential for off-site odours.

Cooling Systems

The data summarised in Table 2 indicates the degree of cooling imparted on the concentrated sources from TBE and TBP has improved in comparison with 2013. During the 2015 audit, all inlet biofilter temperatures were found to be below 40°C, which is considered good engineering practice (a target of achieving temperatures below this level for at least 99 % of time is recommended). In the previous audit carried out by Golder (2013), the media temperature of the concentrated sources biofilter was around 50°C. However, the daily inlet biofilter temperature recorded by TBP from 15th to 21st May 2015 show that, with exception of Factory Air #1, which was consistently around 38°C, the other biofilter inlets were mostly between 40 to 44°C.

The limitations on cooling water supply for TBP is likely to be an ongoing issue given the proposed new bovine line and increased dryer capacity at the site. Improvements in the final waste treatment pond water quality and/or the use of evaporative cooling have appeared to have effectively dealt with issues raised by the previous audit by Golder (2013). Similar approaches and equipment are likely to be necessary to maintain the currently level performance following the proposed upgraded and expansion in processing capacity from around 500 tonnes/day to 850 tonnes/day of raw material.

Biofilters

The connections of air streams to the various biofilters at the site have been altered since the last audit (Golder 2013). Specifically, the two large factory air flows are now respectively dedicated to their own biofilter beds, Factory Air #1 and Factory Air #2. On occasions the Factory Air #1 biofilter bed may also receive TBP concentrated sources flow, when the latter's biofilter requires maintenance.

The current dedication of a biofilter bed to each TBP and TBE concentrated source systems is consistent with good engineering practice. The design aspects and the associated air loading rates to the various biofilters are discussed below.

Factory Air #1: This biofilter currently receives only Factory Air #1alone. During this audit this flow was measured at 88,000 m^3/hr. This a significant improvement on the flow of 75,600 m^3/hr (that included the TBP conc. source flow) that was measured by Golder (2013).

TBP Concentrated Sources: This fourth cell was installed with a 40 m x 30 m x 1.5 m deep bark bed, and is dedicated to the TBP concentrated sources stream. The current flow rate of concentrated sources air (i.e. 11,000 m^3/hr) is not able to effectively contain TBP concentrated sources air. However at the current flow rate, the TBP concentrated sources biofilter is only loaded at 8 $m^3_{air}/hr/m^3_{media}$. Therefore given the water logging issues can be resolved (these are leading to high back pressures of 1800 Pa gauge), this bed is able to receive approximately twice or more the current flow and still provide effective odour treatment. In other words there is biofilter capacity available to receive and treat an significant increased concentrated sources air flow. The issues will be to extract this flow, adequately cool it and rectify the high moisture levels in this relatively new biofilter bed.

Factory Air #2: This biofilter treats only Factory Air #2 air stream, which was measured at only 21,000 m^3/hr during the audit. This is results in an acceptable air loading rate and indicates there is some spare capacity (up to 35%). However the high backpressure within the inlet duct that supplies building air to the FA2 biofilter (i.e., around 4000 Pa) due to blocking of distribution system need to be rectified in time. The solution will require blood room dust being removed/clean from the extracted building air as well as water blasting or replacing the existing corrugated iron/novaflo air distribution system. Replacement of the latter with a concrete duct system would represent good engineering practice. Also given this bed receives loading of blood meal dust, then the installation of laterals that can be routinely water blasted and enable effective drainage would be good practice and is recommended. The current novaflo lateral design does not allow for this routine cleaning and unblocking of the air distribution system.

TBE Concentrated Sources: This biofilter treats pre-cooled TBE concentrated sources. The media loading rate of warm air at 24 $m^3_{air}/hr/m^3_{media}$ was established from flow measurements (see data summary section). The inlet air temperature measured during the audit was at 39°C, however the daily temperature records from 15th to 21st May 2015 provided by TBP show this temperature varied from 41 to 44°C. It is recommended this is reduced to 40°C or less during normal operation. As noted above, the bed is effectively removing odour from the extracted TBE concentrated sources stream, however channelling around the main concrete manifolds within the two beds will increased over time and require maintenance the next time the bed is replaced and sooner if necessary.

Management Aspects

Golder (2013) provided an assessment of the management systems that support the on-going maintenance and operation of equipment and instrumentation. The key recommendations from this audit are mostly still relevant in 2015 and are summarised below. Additional recommendations regarding the management of the WHE plant are provided as its effective operation is considered paramount for containing odours associated with meal dryer exhausts – that is the most significant potential source of objectionable odour from rendering. The site maintains formally documented management systems for the control of site processes, which include the following site process documents:

- Process control and description.
- Calibration of measuring device schedule.
- Site repairs and maintenance programme.
- System auditing.

Process Control and Description: The process control description document provides instructions to plant operators on the management and monitoring of process stages including raw material receipt through to the meal room procedures. The document provides instructions with respect to the following:

1) Key operating steps for the operator to implement.
2) Key actions/steps to implement.
3) Key monitoring targets/set-points and methods for recording.

These generic instructions are provided for all process stages and associated plant and for each raw material type. Therefore, key items such as pre-cookers, feather hydrolyser, meal dryers and the waste heat evaporators as well as other plant have specific instructions.

Ensuring that the WHE plant extracts and cools dryer exhaust effectively is one of most important aspects of the concentrated source odour control system. To this end, the following three WHE operational parameters are considered important to control:

- Evaporator vacuum (stick liquor side)
- Stickwater level within the evaporator

- Final stickwater concentration

The first two parameters above are continuously monitored and the second controlled by the plants operating conditions. The stickwater concentration can be manually monitored and the concentrate discharge pump rate adjusted to achieve a desired value. Maintaining the above three operational parameters within normal operating ranges allows for the steady extraction and cooling of dryer exhaust – therefore minimising odorous fugitive emissions into the rendering building.

There are other operational parameters, if monitored and displayed to operators can provide a warning of abnormal or deteriorating WHE operation. Parameters below that are not already monitoring and displayed by the TBL SCADA system are suggested for as future upgrades to the existing WHE monitoring/management system:

- **Stick liquor recirculation pump amps** (high levels warn of possible pump issues or excessive concentration of stick liquor)
- **Condenser hot water outlet temperature** (low levels warn of poor heat transfer in condenser or the WHE)
- **Condenser cold water inlet temperature** (high levels on hot days warn of reduced condensing capacity)
- **Non condensable gas (NCG) temperature** (high values indicate poor heat transfer in the WHE)
- **Stick liquor temperature in WHE** (low values indicate poor heat transfer in the WHE)
- **WHE vapour temperature** (low values indicate poor heat transfer in the WHE)

Calibration of Measuring Device Schedule: The calibration of measuring devices document details standard procedures for calibration, monitoring and verification of measuring devices, as well as procedures for taking corrective actions and associated record keeping. It recommended that this includes measuring devices associated with the odour extraction, cooling and biofilter systems.

Auditing of Management Systems: The management systems at the site, including those discussed above, are themselves subject to an internal audit procedure (SP190). Reviews of different management systems are scheduled throughout the year and undertaken by the Plant Manager on an annual basis. The aim of the audit is to up-date the systems and to check upon their effectiveness. Additionally, other site managers (plant engineering, environmental and operations) are required to undertake weekly reality checks (i.e., effectiveness reviews) of checklists that relate to their responsibilities.

The monitoring of the internal auditing is also undertaken by the plant manager and has the responsibility for ensuring corrective actions are implemented and records are maintained. Monitoring via an external audit by NZFSA is undertaken at a frequency determined by performance history.

This internal and external auditing system represents good practice.

Summary of Data

This section summarises measured temperatures, pressures, relative humidity and flow rates obtained from this audit and compared to values measured by Golder (2013). This includes the inlet air flows to the site biofilters (Table 1), air stream parameters (Table 2) and biofilter parameters (Table 3).

Table 1: Biofilter Inlet Air Flows, 2015 with 2013 in brackets

Biofilter	Source(s)	Flow rate (m^3/hr)
TBE Conc. Source	Concentrated sources, dryer exhaust	17,000 (14,500)
TBP Conc. Source	Conc. sources, mills and dryer NCGs	11,000 (no data)
TBP Factory Air 1	Rendering Building Air	88,000 (75,600)
TBP Factory Air 2	Rendering and Blood Building Air	21,000 (25,000)

Table 2: Air Stream Parameters 2015 with 2013 in brackets

Location	Gauge Pressure (Pa)	Temperature (°C)	Humidity %RH
TBP conc. sources Scrubber – Inlet Duct	-680	52 (59)	100
TBP conc. sources Fan - Inlet Duct	-1250	30 (NR)	100
TBP conc. sources Fan – Outlet Duct	> +1800	36 (51)	100
TBP conc. sources Fan – Outlet Duct (Opposite Sump)	+1800	30 (41)	100
Factory Air 1 Fan – Inlet Duct	-1600	30 (33)	~52
Factory Air 1 Fan – Outlet Duct (Opposite Sump)	+2600	33[#] (41)	~52
Factory Air 2 Fan – Inlet Duct (Opposite Sump)	-680	25 (43)	~58
Factory Air 2 Fan – Outlet Duct (Opposite Sump)	+4000	38[##] (43)[+]	~58
TBE conc. sources Fan – Outlet Duct (River Crossing)	320	39 (49)	100
TBE conc. sources – Scrubber Inlet	990	~60	100

[#] Site measurements previous week indicate 5 °C higher i.e. averaging 38 °C
[##] Site measurements previous week indicate 3 °C higher i.e. averaging 41 °C
[+] Temperature rise of 13°C across Factory Air 2 Fan (i.e. 25 °C to 38°C)

Table 3: Biofilter Parameters 2015 with 2013 in brackets

Biofilter	Inlet Duct Pressure (Pa)	Inlet Air Temperature (°C)	Media Temperature @ 900 mm depth
TBE Conc. Source	160 (250)	39 (50)	35 (50)
TBP Conc. Source	1800 (NR)	36 (51)	~35
Factory Air 1	2,600 (2,300)	33 (41)	< 30 (33,34)
Factory Air 2	4,000 (3,330)	38 (43)	23,25 (31,28)

Conclusions & Recommendation

Following Golder's audit of the TBP and TBE odour control system, it is concluded that the associated equipment, including ducts, fans, cooling system and biofilters, appear to be maintained and operated in a sound engineering state.

The existing cooling systems are generally achieving inlet airstreams to the biofilters are normally 40°C or lower, which represents good practice. Future upgrades to the cooling systems, and a new WHE plant (as being considered by TBP) is likely to be necessary given the expansion to the bovine rendering systems.

It is concluded that an increased level of temperature and pressure gauge monitoring at various positions along the extraction, cooling and biofilter system would ensure standard engineering practice is achieved. Currently regular manual measurements are undertaken.

The existing biofilters and extraction systems are generally working effectively however most will require some maintenance or remedial actions as follows:

- The Factory Air 2 Biofilter requires a new air distribution and lateral system that can be cleaned.
- The Factory Air 2 air extraction from the blood room requires pre-cleaning of this air stream to remove blood dust and blocking up of the biofilter.
- The TBP concentrated sources biofilter has excessive water levels and the source and remediation measures need to further investigation.
- The TBE concentrated sources biofilter has signs of air channelling around its central concrete manifolds that will in time require remediation by re-sealing its connections to the Novaflo laterals.

The site has comprehensively documented management systems for ensuring reliable operation of process equipment and achieving processing goals. An expansion of the documentation to odour control system temperatures and pressures as well as some additional WHE operational information is recommended.

Finally it is recommended that the TBP concentrated source system is reviewed and upgraded in conjunction with the design and installation of a system that targets an expanded bovine rendering line. The opportunity exists for installing a system that manages emissions from both the new and existing bovine rendering equipment.

Please contact the undersigned if you have any queries regarding this report.

Yours sincerely

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Attachments: Report Limitations

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References

Golder 2010. Evaluation of the Air Discharge Control Operations. Letter report prepared by Golder Associates (NZ) Limited for Taranaki By-Products Limited. Document No. 1078104236. 19 July 2010.

Golder 2013. Site Visit Report - Consent 4058-4 Certification. Letter report prepared by Golder Associates (NZ) Limited for Taranaki By-Products Limited. Document No. 1378104138_002_LR_Rev0. 2 July 2013.

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