Fonterra Kapuni
Air and Water
Monitoring Programme
Annual Report
2018-2019

Technical Report 2019-51

ISSN: 1178-1467 (Online)
Document: 2322737 (Word)
Document: 2409132 (Pdf)

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March 2020

Executive summary

Fonterra Limited (the Company) operates a lactose manufacturing factory and inhalation grade lactose (IGL) plant located on Manaia Road at Kapuni, in the Kaupokonui catchment. The plant processes milk and whey permeate from dairy product manufacture around the North Island. This report for the period July 2018 to June 2019 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

During the year under review the Company held 17 resource consents, which included a total of 155 conditions setting out the requirements that the Company must satisfy. The Company holds two consents to allow it to take and use water, five consents to discharge stormwater and/or cooling water into the Kaupokonui and Motumate Streams, four consents to discharge wastes to land, five land use consents, and one consent to discharge emissions into the air at this site. Two of the consents, to discharge factory wastewater to land, were varied in July 2015 to include dairy shed effluent which previously had been discharged to surface water. Another two of the consents were granted in February 2016 to provide for the discharge of farm dairy solids and pond sludge to land. One of the land use consents was granted in March 2017 for the installation of a dual culvert in the Waiokura Stream to allow the reinstatement of a farm track across the stream. The replacement consent for the use of the weir associated with the water abstraction consent was granted in December 2017. Four of the Company's consents expired in June 2017, with the applications put on hold so that the effects of these activities could be considered in combination with the effects of the seven further activities for which the consents expired in June 2019. Applications to renew these consents were received on 1 February 2019 and were put on hold until 19 December 2019 awaiting further information. There are a total of 11 expired consents where the Company is operating under the expired consents until a decision is made on the renewal, as provided for by Section 124 of the *Resource Management Act 1991* (RMA). The applications indicate that the Company wishes to amalgamate activities under single consents where appropriate.

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

The Council's monitoring programmes for the period under review included 12 inspections, 183 water samples collected for physicochemical analysis, two macroinvertebrate surveys of receiving waters, and five ambient air quality analyses.

Cooling water discharge volume metering had been introduced at the site as per the agreement between the Council and the Company, in relation to assessment of the consumptive nature of the take and future water allocation for the Kaupokonui Stream. Telemetry of abstraction from and discharge to the stream was installed, however, the ongoing transmission and validity of the data have resulted in the full terms of the agreement not being met within the agreed timeframe. The problems with data transmission were addressed during the 2017-2019 year's, however the Council was advised that the location in which the equipment was installed has resulted in the agreed accuracy and validation not being achievable. As the written agreement brought this monitoring within the scope of condition 1 of consent 0919, this was recorded as a consent non-compliance.

Ecological monitoring did not note any problems in regard to the abstraction of water from the Kaupokonui Stream for cooling water and general purposes.

Temperature increase limits on cooling water discharged to the Kaupokonui Stream were complied with throughout the review period. The main cooling system was replaced in August 2015 with the system designed to ensure that the temperature differential and downstream temperature limits would be complied with. During the year under review, the Company ran the cooling system at the maximum cooling capacity from November to the end of the period under review. This resulted in the discharge temperature being

significantly reduced, with a measurable reduction in the instream temperature differential. The reduced discharge temperature would have also minimised the potential for a thermal barrier to fish within the mixing zone.

Irrigation onto the two dairy farms was, in general, well managed, including the new dairy shed effluent. Nitrogen loading on the farms was reduced due to a decrease in loading from factory wastewater. No effect from irrigation was found during inspection, sampling or biological monitoring of the Kaupokonui and Waiokura Streams. A 20 m buffer to the bank of water courses was maintained during irrigation activities observed at inspection.

Effects on the groundwater in the vicinity of the farms were varied, but most showed an impact on both mineral and organic component levels. This had been addressed through extension of the irrigation disposal system in 2007-2008, and by more intensive wastewater and groundwater monitoring. During the year under review, the Company's wastewater and dairy shed effluent (DSE) monitoring of both the component concentrations and volumes irrigated shows that, there was a decrease in the volume irrigated and reduction in estimated total nitrogen loading. It is noted however, that there was an increased variability in the wastewater component strengths during the year under review, so these estimates need to be used cautiously. Due to the increase in the irrigation area utilised, the nitrogen concentrations in the impact bores, although elevated in some bores to above the previous annual median, are showing little, if any, increase overall. This is based on the 2018-2019 annual median being similar to or below the long term historical median. The exceptions to this are in two of the Farm 2 impact bores, which had increased annual median nitrate concentration across the year under review in relation to the long term historical median.

Two of the control bores (Farm 2 and Farm 3 control bores) continued to show significant increases in groundwater nitrate concentrations that are in excess of drinking water standards. This is still to be explained after suitable investigation, with the anticipation that this will be a requirement of the renewed consent.

Stormwater from the site continued to be diverted to containment ponds, with the stormwater batch released after quality checks. Sample results for the discharge samples collected by the Council were within those prescribed by consent conditions.

Particulate deposition from air emissions was, in general, similar to the previous monitoring periods. At the monitoring site west of the plant site the lactose deposition rate was found to be 7% over the guideline value. No complaints were received and visual inspections found no evidence of depositions. Odour surveys did not note any odours off site.

There were two consent non-compliance's recorded during the year under review; self-notification of a 45 minute marginal exceedance of the abstraction rate limit that would have had little, if any adverse effect due to the moderate flow of the stream at the time of the exceedance and the non-compliance with the monitoring condition in relation to the cooling water discharge rate monitoring as outlined above. This matter was resolved in September 2019.

The Company demonstrated a high level of environmental performance and compliance with resource consents as defined in Section 1.1.4.

With respect to the administrative performance, there were still ongoing issues with provision of accurate real time monitoring data that was due by 30 September 2015. A further agreement was made to resolve this issue by 30 September 2019 following the recording of this matter as a consent non-compliance. An improvement was therefore required in the Company's administrative performance during the year under review, as defined in Section 1.1.4.

For reference, in the 2018-2019 year, consent holders were found to achieve a high level of environmental performance and compliance for 83% of the consents monitored through the Taranaki tailored monitoring

programmes, while for another 13% of the consents, a good level of environmental performance and compliance was achieved.

This report includes recommendations for the 2019-2020 year.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2018 to June 2019 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Fonterra Limited (the Company). The Company operates a whey processing facility situated on Manaia Road at Kapuni, in the Kaupokonui catchment, along with two operational dairy farms used for wastewater irrigation (Figure 1).

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to abstractions and discharges of water to land and water within the Kaupokonui, Motumate and Waiokura catchments, and the air discharge permit held by the Company 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 the Company's use of water, land and air, and is the 27th combined report and 30th water related report by the Council for the Company.

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 the Company, for their Kapuni lactose plant;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at the Company's site.

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

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

Section 4 presents recommendations to be implemented in the 2019-2020 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
b. physical effects on the locality, including landscape, amenity and visual effects;
c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;

d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
e. risks to the neighbourhood or environment.

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

1.1.4 Evaluation of environmental and administrative performance

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

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company'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 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 during investigations of incidents reported to the Council by a third party 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 during investigations of incidents reported to the Council by a third party. 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 during investigations of incidents reported to the Council by a third party. 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 2018-2019 year, consent holders were found to achieve a high level of environmental performance and compliance for 83% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 13% of the consents, a good level of environmental performance and compliance was achieved.[1]

1.2 Process description

The manufacturing of lactose is based on the processing of milk and whey permeate, which is the by-product of the production of cheese and casein. Whey permeate contains typically contains 78 to 88% lactose; which is most of the lactose present in the original milk source. At this site the lactose is extracted and purified through a process that includes evaporation and crystallisation. The lactose is then dried and packed into different grades that meet a diverse range of customer needs and requirements.

The lactose process (Figure 2) uses raw water from the Kaupokonui Stream for the evaporator condensers. Once water has passed through the condensers it is returned to the stream via the cooling tower system. In the summer, the increased stream water temperature may not be suitable for cooling the refined and edible crystallisers in the required time, so bore water may be brought into service. The cooling water systems are single pass, which do not require the use of any treatment chemicals. The cooling water from the

[1] The Council has used these compliance grading criteria for 15 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

condensers is discharged to the stream via spray nozzles that reduce the temperature of the condenser cooling water so as to minimise temperature rises in the stream.

Steam used for the lactose process is imported to the plant, via a 3 km pipeline, from the Vector Gas Treatment Plant (Vector) at Kapuni. The first delivery of steam was in December 1997. This has reduced the use of water treatment chemicals at the lactose plant considerably, which has therefore reduced the amount of process waste discharged from the site, and reduced the potential for chemical spillages. Steam condensate is returned to Vector via a pipeline for reprocessing.

Plant washdown and other process wastes are disposed of by a land irrigation system. The wastewater is irrigated onto the Company's two farms, which are located close to the lactose plant site. There is a component of the monitoring programme in place to assess the effects of wastewater from the irrigation on groundwater and on surface water quality.

Emissions of lactose powder into the atmosphere from the driers are mitigated by the use of a wet scrubber. The scrubber removes any fine lactose particles from the exhaust of the driers to prevent product loss to the atmosphere.

Figure 1 shows the location of the Company's Kapuni lactose factory, North, South and (extended) No. 3 farms, and the Kaupokonui, Motumate and Waiokura Streams, which are referred to throughout this report.

In the 2014-2015 dairy season, Farm 2 and Farm 3 were merged into one dairy unit and renamed "Kapuni Farms". The name of the other farm remained "Farm 1". Table 1 summarises the nomenclature that has been used to describe the various farms as the farming activities have changed over the years. Due to the way in which the wastewater irrigation information is provided and analysed, and for consistency, where possible the primary nomenclature used in this report is Farm 1, Farm 2 and Farm 3.

Table 1 Farm nomenclature

Primary nomenclature used in this report	Previous nomenclature	Current Farm names
Farm 1	Northern Farm	Kapuni Farm
Farm 2	Southern Farm	Kapuni Farms
Farm 3	No. 3 Farm	
	No. 3 Extension	

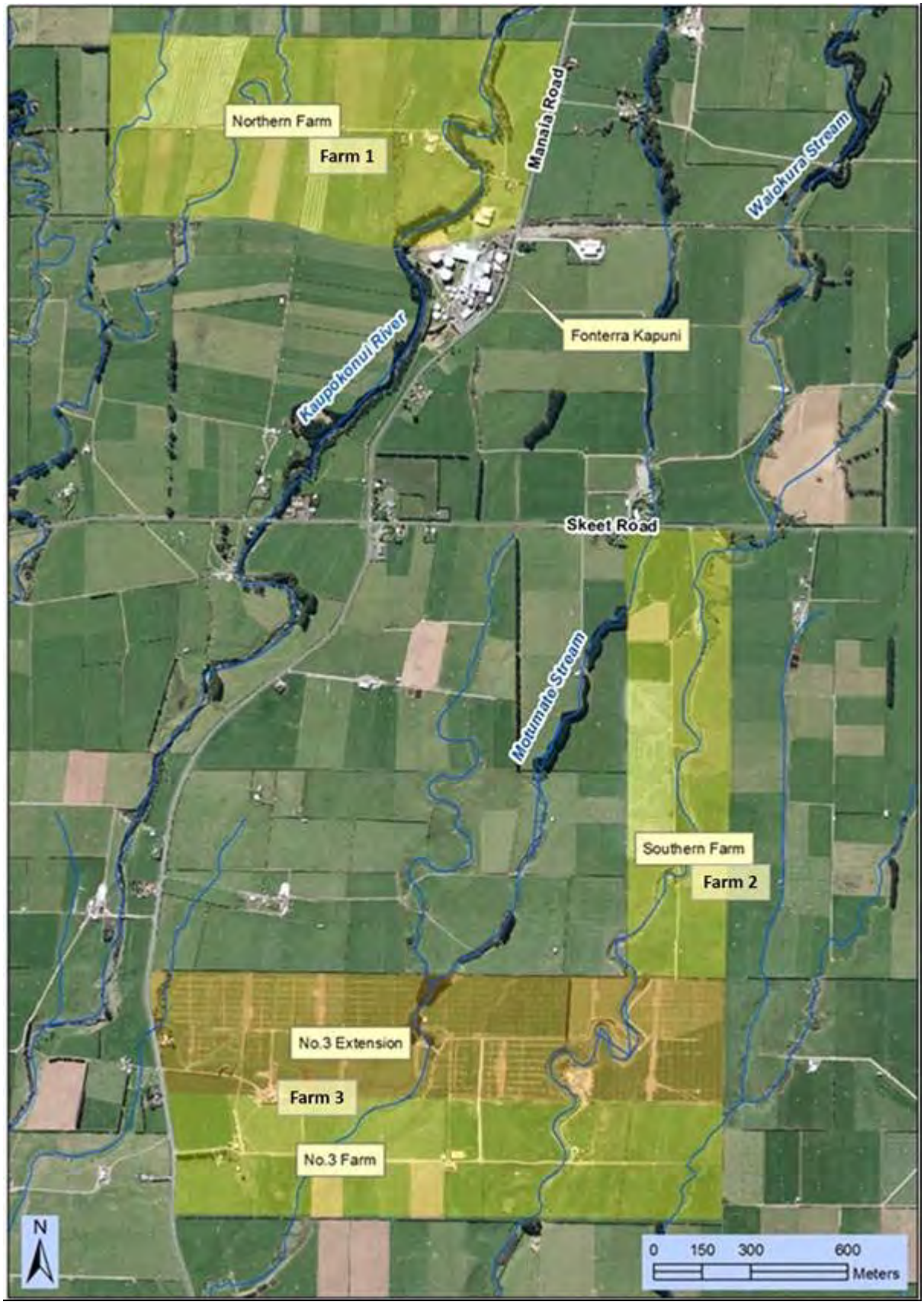

Figure 1 Location of Fonterra Ltd's lactose factory, farms and the Kaupokonui, Motumate and Waiokura Streams

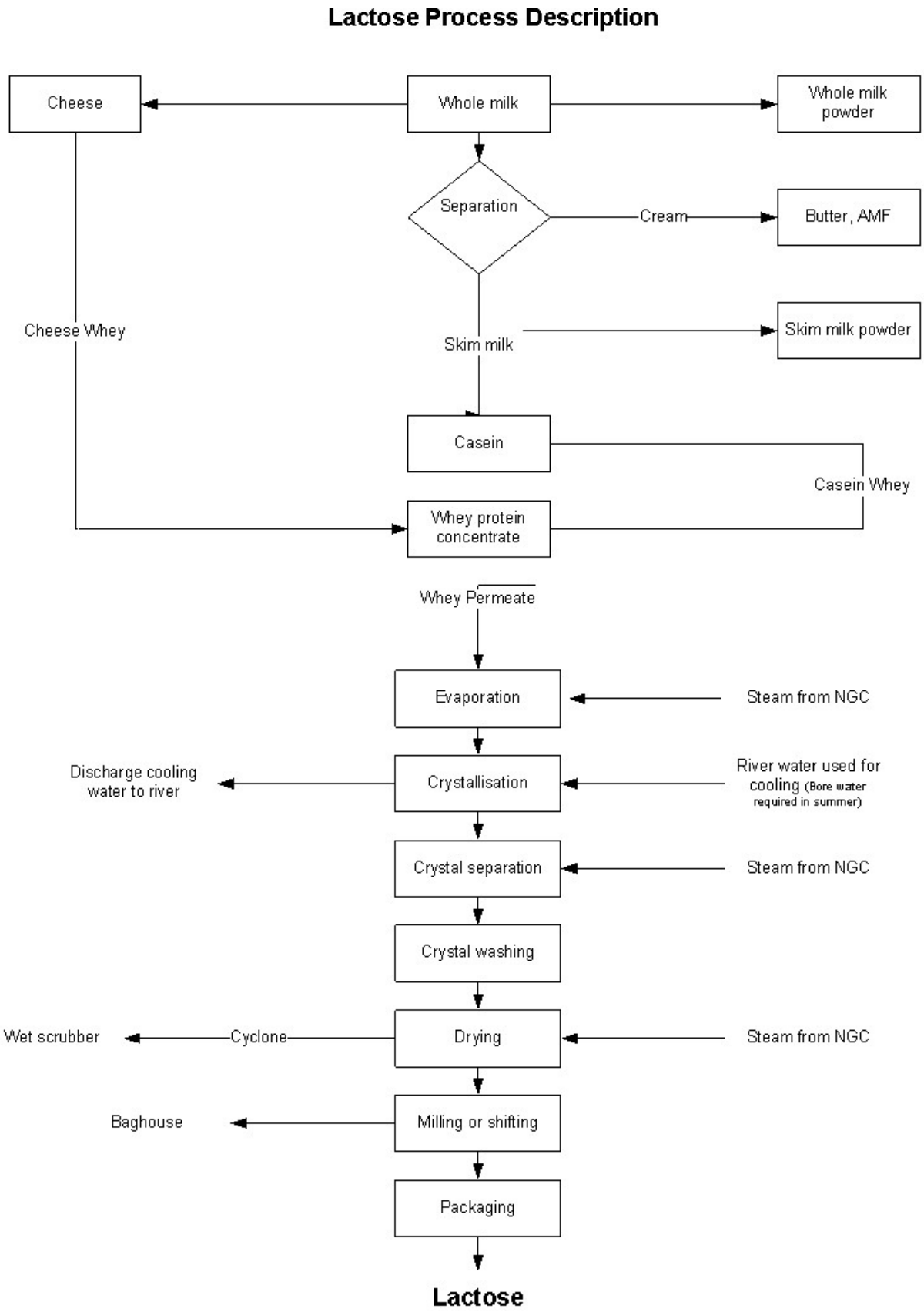

Figure 2 Lactose process diagram

1.3 Resource consents

The Company holds 17 resource consents the details of which, along with relevant consent related activities are summarised in Table 2. Summaries of the conditions attached to each permit are set out in Section 3 of this report, with consent related activities and information that is relevant to the monitoring and compliance assessment for the year under review explained further in this section.

A summary of the various consent types issued by the Council is included Appendix I, as are copies of all permits held by the Company during the period under review.

1.3.1 Status of expired consents - Section 124 protection

Section 124 of the RMA provides for consent holders to continue to operate under the terms and conditions of the existing consent until a decision is made on the renewal. This applies at the Councils discretion where a where an application to renew the consent is made between three and six months prior to its expiry, or as a right when the application is made more than six months prior to expiry.

A number of the Company's consents expired on 1 June 2017. Applications to renew these consents were received on 1 December 2016. These applications were put on hold with the Company's agreement so that the applications for these consents could be decided up on at the same time as the consents that were due to expire on 1 June 2019. This was to allow potential cumulative effects of the activities to be considered and addressed in complimentary consent conditions. The applications to renew the consents expiring in June 2019 were received on 1 February 2019.

The applications were put on hold under Section 92 of the RMA pending the provision of further information. The information requested was:

The further information requested is:

1. Justification/evidence to demonstrate that the existing water take is 10% consumptive;
2. Justification for retaining (and not lowering) the existing consented water take rate of 225 litres/second;

Council staff have recently put together some data which suggests that in the last couple of years, the rate of take was less than ~150 litres/second 95% of the time.

3. A Cultural Impact Assessment;
4. With regards to the assessment of alternatives provided with the application, please provide a cost/benefit analysis of distributing cooling water over a larger area i.e. expanding the length of stream that the spray booms cover (resulting in a spray area that is less concentrated), and reasons why this option is/is not a viable alternative.

The Company asked for the standard 15 working days specified in the RMA to be extended to 19 December 2019 to allow Ngati Tu sufficient time to complete the cultural impact statement. This was agreed.

1.3.2 Abstraction consents 0302-3 and 0920-3 and National Regulations

In addition to the consent requirements, the activity must also comply with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 (the Regulations).

The Regulations require the following:

- all water permits allowing the taking of 5 L/s or more to collect and report records to a set minimum requirement;
- measurement at the point of where the water is taken from the river, lake or groundwater system (unless otherwise approved by the Council to be in another location);

- continuous records of daily volumes to be collected using an appropriate flowmeter with the data transferred to the Council on at least an annual basis;
- the flowmeter to meet an accuracy standard, and should be properly installed and calibrated independently every five years; and
- the consent holder is to be responsible for recording and transferring the data to the Council.

All abstractions captured under the Regulations were required to be compliant by 10 November 2016. The Council retains the authority to apply more stringent requirements on consent holders over and above those set out in the Regulations through the setting of consent conditions.

1.3.3 Notice to review consents 0919-3 and 0924-3

On 27 June 2014, Council invoked the review conditions on consents 0919-3 and 0924-3, which provide for discharge back to Kaupokonui Stream of cooling water taken under consent 0302-3. The reason for review was to impose five new monitoring conditions on both consents to obtain information on the amount of water that is returned to the stream, for water allocation purposes, and for assessment of the effects of the abstraction on the stream. The data gathered was also necessary for the preparation of an assessment of environmental effects in the consents replacement process due to be carried out in 2019.

After consultation, the Company requested that, upon agreement to implement the required monitoring measures by 31 August 2015, Council withdraw the notice of review. The notice of review was withdrawn on basis of the agreement outlined below, with the monitoring being within the scope of condition 1 of both consents.

The agreed monitoring measures related to (1) installation and maintenance of flow recording devices and (2) dataloggers, (3) certification of and (4) access to equipment, and (5) transmission to Council of a real time record of discharge volumes.

Specifically, the agreed monitoring measures are as follows:

1. "By 31 August 2015 the consent holder shall install, and thereafter maintain a flow recording device(s). The device shall be tamper-proof and shall measure and record the rate and volume of cooling water discharge to an accuracy of ±5%.
   Note: flow recording devices 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 flow recording devices have a limited lifespan.
2. By 31 August 2015, the consent holder shall install, and thereafter maintain a datalogger to automatically record discharge volumes from the flow recording devices(s). The datalogger shall be tamper-proof and shall record the date, the time (in New Zealand Standard Time) and the rate and volume of water discharge at intervals not exceeding 15 minutes.
   Note: 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 flow recording devices and dataloggers have a limited lifespan.
3. Within 30 days of the installation of a flow recording device or datalogger, and at other times when reasonable notice is given, the consent holder shall provide the Chief Executive, Taranaki Regional Council with a document from a suitably qualified person certifying that:
   a. water measuring or recording equipment required by the conditions of this consent has been installed and/or maintained in accordance with the manufactures specifications; and/or
   b. water measuring or recording equipment required by the conditions of this consent has been tested and shown to be operating to an accuracy of ±5%.

4. The flow recording device(s) shall be accessible to Taranaki Regional Council officers at all reasonable times for inspection and/or data retrieval. In addition the data logger shall be designed and installed so that Council officers can readily verify that it is accurately recording the required information.
5. From a date no later than 31 August 2015, the measurements made in accordance with condition 1 of this consent, shall be transmitted to the Taranaki Regional Councils computer system, in a format to be advised by the Chief Executive, Taranaki Regional Council, to maintain 'real time' record of the discharge volumes. The records 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 discharged as 'zero' when no discharge(s) occurs."

In August 2015, the implementation period was extended to 30 September 2015, following delays associated with the installation of a new cooling tower system.

1.3.4 Proposed amalgamation of consents

There have been a number of changes to the site discharge methodologies in recent years namely:

- The diversion of the cooling water previously discharged under consent 0924 to the cooling towers bringing it under the discharges covered by consent 0919; and
- The diversion of the stormwaters covered by consents 4604, 6423 and the stormwater discharged from one of the outfalls covered by consent 0924 to the northern stormwater pond, which has a single outfall.

This leaves the stormwater discharged from the southern stormwater pond as the only stormwater discharge originally authorised under consent 0924.

In the application to renew the consents for the site, it has been requested that all stormwater discharges be authorised by one consent (replacement of 0924-3, 4604-2, and 6423-3 with 6423-4) and that the discharged of wastewater and dairy shed effluents to the two farms also be amalgamated under one consent (replacement of consents 0922-3.2 and 0923-3.3 with 0922-4).

Table 2 Summary of consents held by Fonterra Ltd for the lactose plant at Kapuni

Consent number	Purpose	Commencement	Review	Expiry	Renewal application received	Consent status at 30 Jun 2019
Water abstraction permits						
0302-3	To take and use up to 19,500 cubic metres/day [225 litres/second] of water from the Kaupokonui Stream for cooling water and general purposes associated with lactose manufacturing	9 Jun 1999	-	1 Jun 2019	1 Feb 2019	Expired - S.124 Protection (on hold further information)
0920-3	To take up to 700 cubic metres/day of water from a bore in the Kaupokonui Catchment for factory cooling water using plate heat exchangers	4 Feb 1999	-	1 Jun 2017	1 Dec 2016	Expired - S.124 Protection (on hold further information)
Water discharge permits						
0921-3	To discharge up to 850 cubic metres/day of cooling water from plate heat exchangers and plant cooling system into an unnamed tributary of the Motumate Stream at two different locations	4 Feb 1999	-	1 Jun 2017	1 Dec 2016	Expired - S.124 Protection (on hold further information)
0919-3	To discharge up to 19,500 cubic metres/day of cooling water from a lactose manufacturing plant via an outfall, cooling tower and/or spray system into the Kaupokonui Stream	9 Jun1999	-	1 Jun 2019	1 Feb 2019	Expired - S.124 Protection (on hold further information)
0924-3	To discharge up to 1,440 cubic metres/day of stormwater and cooling water from a lactose manufacturing plant through two outfalls into the Kaupokonui Stream	9 Jun 1999	-	1 Jun 2019	1 Dec 2016. Stormwater discharge activity to be combined under 6423-4	Expired - S.124 Protection (on hold further information)
4604-2	To discharge up to 280 litres/second of stormwater from the factory extension site via a 525 mm diameter pipe into the Kaupokonui Stream	4 Feb 1999	-	1 Jun 2017	1 Dec 2016. Activity to be combined under 6423-4	Expired - S.124 Protection (on hold further information)
6423-1	To discharge stormwater from an inhalation grade lactose plant site into the Kaupokonui Stream	4 Feb 1999	-	1 Jun 2017	1 Dec 2016	Expired - S.124 Protection (on hold further information)

Consent number	Purpose	Commencement	Review	Expiry	Renewal application received	Consent status at 30 Jun 2019
Air discharge permit						
4032-5	To discharge emissions into the air from the manufacture, drying, packaging and storage of lactose and associated processes and from the inhalation grade lactose plant	2 Jun 2004	-	1 Jun 2019	1 Feb 2019	Expired - S.124 Protection (on hold further information)
Discharges of waste to land						
0922-3.2	To discharge combined dairy effluent and factory wastewater (evaporator condensate, washings, processing wastes and stormwater) from a lactose manufacturing plant by spray irrigation onto and into land	15 Jul 2015	-	1 Jun 2019	01 Feb 2019	Expired - S.124 Protection (on hold further information)
0923-3.3	To discharge combined dairy effluent and factory wastewater (evaporator condensate, washings, processing wastes and stormwater) from a lactose manufacturing plant by spray irrigation onto and into land	15 Jul 2015		1 Jun 2019	1 Feb 2019. Activity to be combined under 0922-4	Expired - S.124 Protection (on hold further information)
10214-1.0	To discharge solid farm dairy effluent onto and into land	5 Feb 2016	June 2023	1 Jun 2041	-	Current
10232-1.0	To discharge pond sludge from farm dairy effluent onto and into land	5 Feb 2016	June 2023	1 Jun 2041	-	Current
Land use permits						
4623-3.0	To use a weir in the bed of the Kaupokonui Stream, and to dam water for water supply purposes	15 Dec 2017	-	1 Jun 2019	1 Feb 2019	Expired - S.124 Protection (on hold further information)
6948-1	To erect, place, maintain and use pipeline crossings over the Motumate and Waiokura Streams, for the purposes of conveying irrigation wastewater	18 Sep 2006	-	1 Jun 2023	-	Current
7121-1	To erect, place and maintain a stone lined bank on the left bank of Dunns Creek for erosion control purpose	23 May 2007	-	1 Jun 2023	-	Current
9546-1	To install a dual culvert in the Waiokura Stream, including the associated streambed and reclamation	18 Apr 2013	June 2023	1 Jun 2029	-	Current
10412-1.0	To install a dual culvert in the Waiokura Stream, including the associated disturbance of the stream bed	10 Mar 2017	June 2023	1 Jun 2035	-	Current

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations and seek information from consent holders.

The monitoring programme for the Company's Kapuni site consisted of five 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;
- discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

The Company's site was visited 12 times during the monitoring period. With regard to consents for the abstraction of or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

The Council undertook sampling of both the discharges from the site and the water quality upstream and downstream of the discharge point and mixing zone.

A 24 hour composite or grab sample was collected of the spray cooling wastewater on ten occasions. The samples were analysed for BOD_5 (total and filtered), pH, conductivity and turbidity.

The Kaupokonui Stream was sampled on 12 occasions at three sites. The samples were analysed for temperature, BOD_5 (total and filtered), pH, conductivity, turbidity, dissolved reactive phosphorus, nitrates ammonia-N and total nitrogen. The Motumate Stream was sampled at four sites on 6 occasions. The samples were analysed for temperature, BOD_5, conductivity, dissolved reactive phosphorus, ammoniacal nitrogen, nitrate, pH, turbidity, and anion/cation balance. The Waiokura Stream was sampled at four sites on 6 occasions. The samples were analysed for temperature, BOD_5, conductivity, dissolved reactive phosphorus, ammoniacal nitrogen, nitrate, pH, turbidity and anion/cation balance.

One sample was collected from the northern stormwater pond outfall and four samples were collected from the southern stormwater pond and/or discharge outfall. These samples were analysed for total BOD_5, conductivity, pH, turbidity, suspended solids and oil and grease.

Groundwater from 11 bores on the three farms was sampled on six occasions and the samples were analysed for temperature, COD, conductivity, dissolved reactive phosphorus, ammoniacal nitrogen, nitrate, pH and anion/cation balance.

Deposition gauges were placed at selected sites in the vicinity on one occasion. The collected samples analysed for COD, enabling the lactose deposition rate to be estimated.

1.4.5 Biomonitoring surveys

A biological survey was performed on two occasions in the Kaupokonui Stream to determine whether or not the discharge of stormwater, evaporator condensate, washings, processing and cooling wastes from the site has had a detrimental effect upon the communities of the stream. A biological survey was also performed in the Waiokura Stream to monitor the effects from irrigation of wastewater and stormwater onto land in the Waiokura catchment.

The triennial four site fish survey was last undertaken in the Kaupokonui Stream in June 2017 and is due next in the 2019-2020 monitoring year.

1.4.6 Review of consent holder's data

A large amount of data is supplied by the Company in relation to stream abstraction records, irrigation records, receiving water and coolant temperatures, and wastewater composition. This data is assessed by Council staff to confirm compliance with consent conditions, as well as to assess site performance in relation to the "best practicable option" conditions and to assess if there are any actual or potential environmental effects occurring.

2 Results

2.1 Water

2.1.1 Review of consent holder's data

The Company supplied various data to the Council in the form of monthly environmental reports and electronic data. The data covers information in relation to calibration of the consent holder's instream temperature monitors, stream temperature compliance data, effluent irrigation volumes, effluent production, stream and bore extraction volumes, and cooling water discharge rates. These data were regularly reviewed by Council in terms of compliance with consent conditions and, where necessary, the Company was immediately advised of any necessary follow-up action to be taken. A review of these data follows.

2.1.1.1 Stream abstraction records

The Company holds consent **0302-3** which allows the abstraction of up to 19,500 m^3/day (225 L/s) from the Kaupokonui Stream. Special conditions attached to the consent require the Company to undertake daily monitoring of the water abstracted from the stream, and to forward such monitoring data to the Council. The Company supplies both the daily abstraction volume and the abstraction rate, with the abstraction rate data provided to the Council being a 15 minute average.

Under the *Resource Management (Measurement and Reporting of Water Takes) Regulations 2010*, the Company was required by 10 November 2012 to take continuous measurements and keep daily records of volume taken, and thereafter supply the daily abstraction data by 31 July each year for the preceding 1 July to 30 June period.

Abstraction rate is measured by a magnetic flow meter on the supply line from the stream pumps to the factory that was commissioned on 24 December 2008. Independent verification of the accuracy of the meter was undertaken on 27 August 2014, and is due again in August 2019. Table 3 contains a summary of statistics from the daily abstraction data provided by the Company in a monthly report, and the abstraction rates from the electronic data sent through to Council on a daily basis. Figure 3 and Figure 4 are based on the daily data provided in the monthly reports.

Table 3 Summary of water abstraction volumes from the Kaupokonui Stream

Month	Average daily abstraction[a] (m^3/day)	Minimum daily abstraction[a] (m^3/day)	Maximum daily abstraction[a] (m^3/day)	Number of days per month daily abstraction[a] >19 500 m^3	Average abstraction rate[b] (L/s)	Maximum abstraction rate[b] (L/s)	Total time per month abstraction rate[b]> 225 L/s	Missing records[b]
Jul 2018	1,053	26	5,178	0	13	78	0	2.4 days
Aug 2018	3,000	690	6,495	0	34	143	0	No gaps
Sep 2018	8,238	5,227	11,744	0	95	223	0	30 min
Oct 2018	9,205	6,782	11,277	0	106	233	45 mins	No gaps
Nov 2018	9,878	7,734	13,126	0	114	206	0	No gaps
Dec 2018	7,803	4,209	10,022	0	90	180	0	5.8 hours
Jan 2019	8,099	2,627	9,713	0	95	154	0	45 min
Feb 2019	6,349	2,322	8,295	0	76	144	0	1.3 hours

Month	Average daily abstraction[a] (m^3/day)	Minimum daily abstraction[a] (m^3/day)	Maximum daily abstraction[a] (m^3/day)	Number of days per month daily abstraction[a] >19 500 m^3	Average abstraction rate[b] (L/s)	Maximum abstraction rate[b] (L/s)	Total time per month abstraction rate[b]> 225 L/s	Missing records[b]
Mar 2019	7,675	6,336	10,143	0	89	158	0	No gaps
Apr 2019	6,822	4,904	9,096	0	79	154	0	30 min
May 2019	5,596	2,025	7,978	0	66	128	0	No gaps
Jun 2019	61	0	446	0	<1	32	0	3.0 days

a From the Company's monthly reports

b from the electronic records forwarded to Council

The daily stream abstraction data summaries in Table 3 and Figure 3 illustrate that the Company continued to take a significant volume of water from the stream during the 2018-2019 monitoring period. However, it is noted that the volumes abstracted are significantly lower than the permitted take of 19,500 m^3/day.

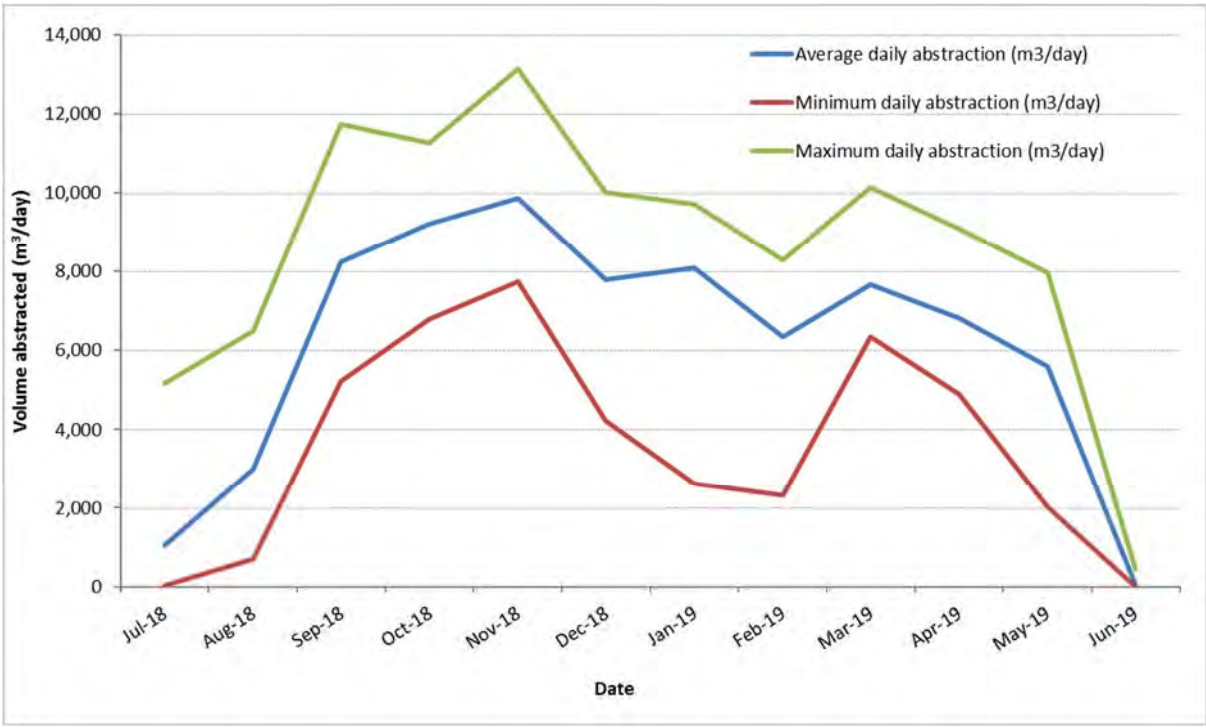

Figure 3 Monthly summary of water abstraction volumes from the Kaupokonui Stream from the Company's monthly reports

The abstraction rate from the daily electronic data showed that the authorised abstraction rate was exceeded for a total of between 15 and 30 minutes during October. However the 8 L/s maximum exceedance is within the allowed ± 5% error of the flow recording device (± 11 L/s), and it was during a period of moderate flows in the Kaupokonui Stream. It is therefore considered that this would not have had any significant adverse effects on the receiving environment.

The Company notified the Council of the exceedance two days after the event and provided an investigation report four days after the event. The outcomes of the investigation are discussed further in Section 2.3.

The total volume of 2,243,162 m^3 abstracted during 2018-2019 was 21% less than the amount taken in 2017-2018, and 22% less than the median annual amount taken during the 2009 to 2018 periods (2,861,796

m^3/year). The daily volume abstracted was maintained well below the 19,500 m^3 daily limit. During 2018-2019, a maximum daily abstraction of 13,126 m^3 was recorded on 13 November 2018, 67% of the consent limit. The changes in the river abstraction volumes since the 2009-2010 year are illustrated in Figure 4.

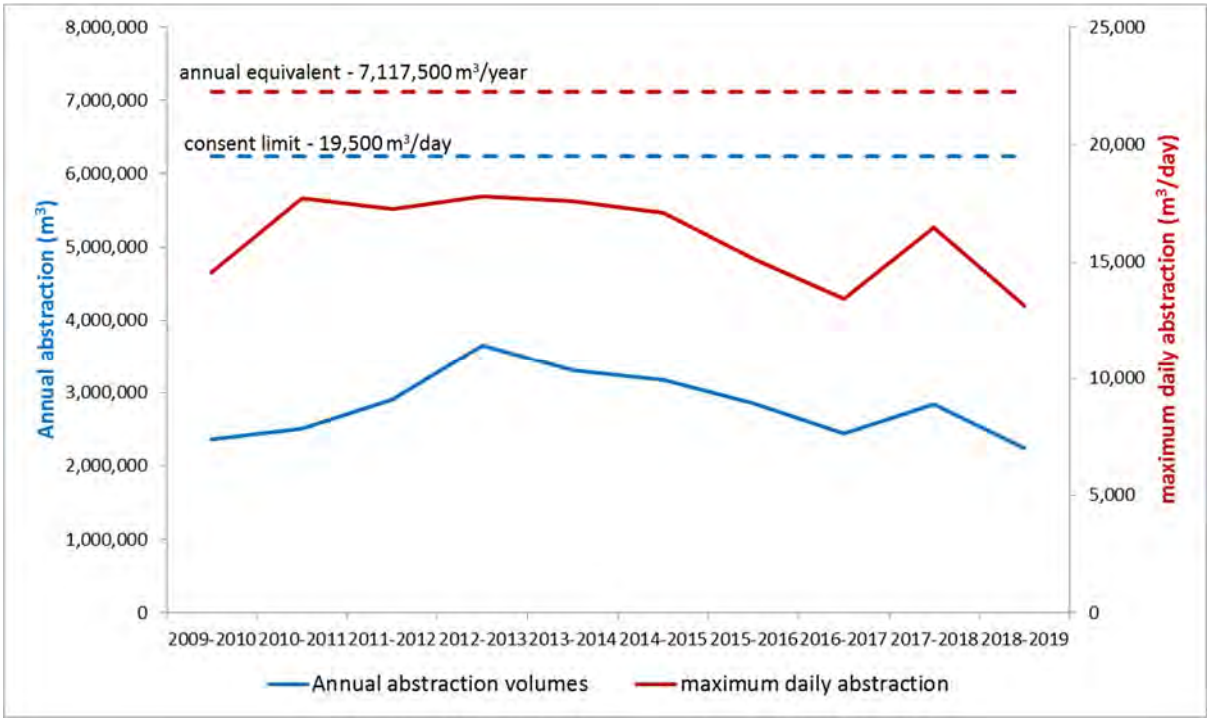

Figure 4 Daily and annual stream abstraction volumes July 2009 to June 2019 from the Company's monthly reports

The Company's abstraction of water from the Kaupokonui Stream was generally undertaken in a satisfactory manner and there was only one short instance where the consent limit was exceeded (Table 3 and Figure 5), however this was of short duration and within the accuracy of the measuring device. The abstraction information supplied by the Company complied with the conditions of consent **0302-1** and the Resource Management Regulations, 2010.

The abstraction rate remained below 160 L/s for 99% of the year, with a total of 3 days and 9 hours of missing records.

In comparison to the daily abstraction volumes provided in the monthly reports, the electronic data record (Figure 6) indicated that the total annual abstraction was 2,243,160 m^3, which is only 2 m^3 less than monthly report record. The maximum daily abstraction volume on the electronic record is 13,126 m^3 on 13 November 2018. These cross checks show that any missing records now evident in the data forwarded to Council are likely to be as a result of infrequent system faults etcetera, where the data isn't recorded, and that reporting discrepancies and data transmission issues observed have been resolved.

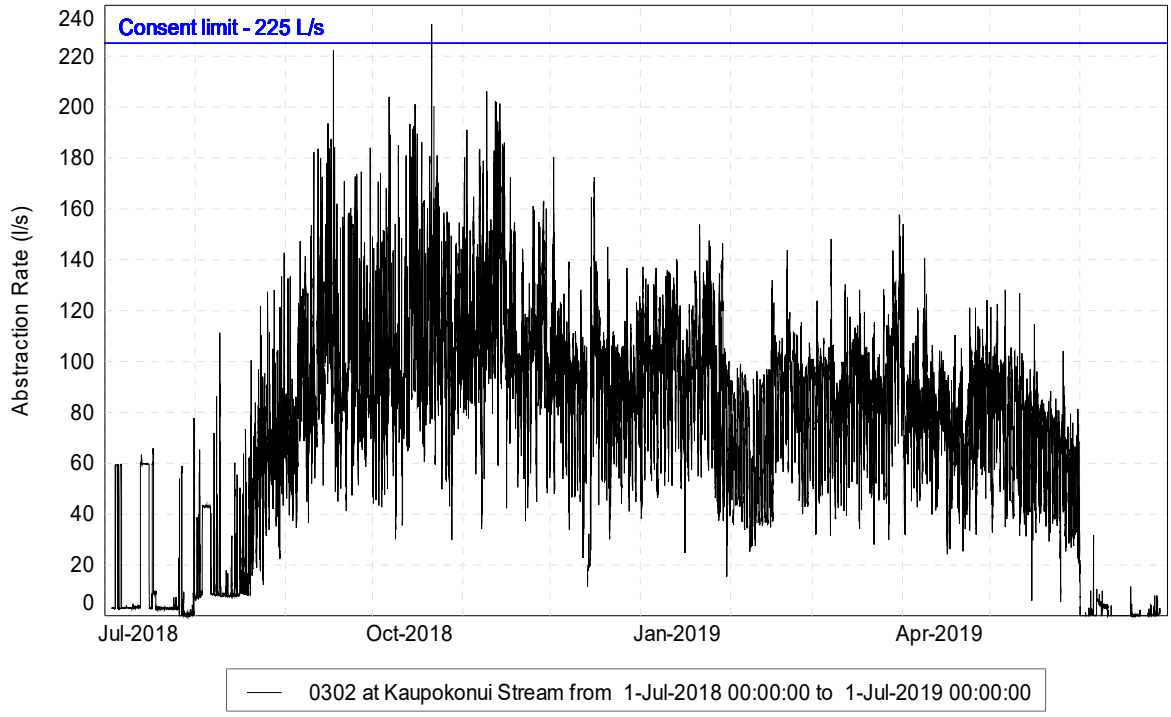

Figure 5 Abstraction rate from the Kaupokonui Stream (consent 0302-3), electronic record

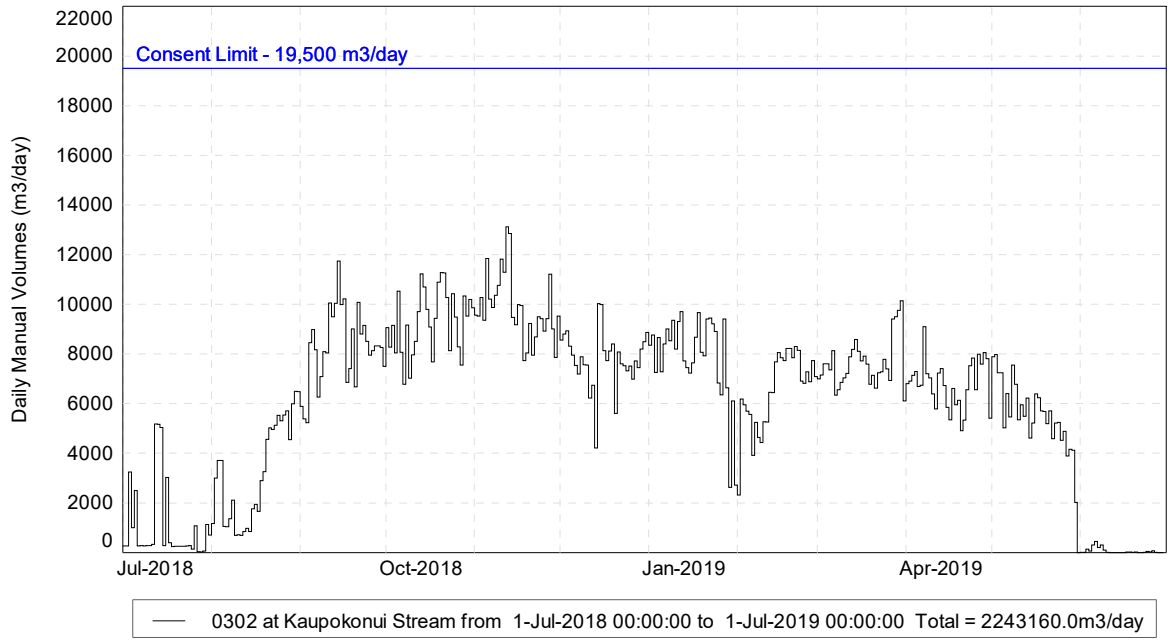

Figure 6 Daily abstraction volumes from the Kaupokonui Stream, electronic record

2.1.1.2 Bore abstraction records

In relation to the exercise of resource consent **0920-3**, the Company supplied the Council, on a monthly basis, monitoring data on the daily volume abstracted from the bore in the Kaupokonui catchment.

During the 2018-2019 monitoring period, the bore was not used.

2.1.1.3 Cooling water discharge rates

In June 2014, Council invoked the review of consent conditions of consents **0919-3** and **0924-3**, which provide for the discharge of the abstracted cooling water back to the Kaupokonui Stream, for water allocation purposes, as discussed in section 1.3.3. The notice of review was withdrawn by Council at the Company's request after an agreement was reached that the necessary monitoring information would be provided voluntarily. As condition 1 of these consents require that *"the consent holder shall, in conjunction with the Taranaki Regional Council, undertake such physicochemical and ecological monitoring of the cooling water wastes, and the receiving waters (Kaupokonui Stream) as deemed necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991"*, this agreed monitoring is within the scope of these conditions.

In summary, the agreement related to the provision of electronic data recording the rate and volume of the cooling water discharges from both outfalls with an accuracy of ± 5%, and this was to be implemented by 31 August 2015. The implementation period was extended to 30 September 2015 following delays associated with the installation of a new cooling tower system.

Provision of an electronic record did not commence until 14 January 2016 following a meeting (3 December 2015) and follow-up correspondence. Since this time there were frequent gaps in the telemetered record, for example about 25% of the time in February 2016. The Company was informed in March 2016 that these were simultaneous across all parameters measured, suggesting a system fault. Although the data was being recorded by the Company and could be back-filled on request, this did not meet the agreed requirement of the data being transmitted to the Council computer system, enabling a "real time" record to be maintained by Council. This was followed up periodically by Council Officers, with the Council advised that the cause of this issue was identified by the Company during the 2017-2018 year. The actions put in place to resolve the issue enabled a substantial reduction in the missing discharge record for the 2017-2018 year, which amounted to a total of approximately 3% of what would be expected for a full dataset. This reduction continued through the 2018-2019 year, with the missing record being only 2.8% of a full year's data.

The more reliable provision of data enabled it to be determined that the consumptive use was being overestimated due to the fouling of the flow meter with solids from the untreated Kaupokonui Stream water. This resulted in the Company cleaning the affected parts on a monthly basis. Due to the agreed requirements around verification, the flow metering should be verified on each occasion, with records provided showing the as found and post maintenance accuracy of the flow measurement. During discussions around this requirement, it was identified that the meter had been installed in a way that would not allow either accurate flow recording or verification. The measuring device (and any verification device) needs to be placed in/on a pipe that is full. The Company's measuring device has been placed in a section of pipe that is not full, and it is therefore not capable of meeting the terms of the agreement. This is discussed further below and in Sections 2.3, 3.1and 3.2.

The discharge rate data provided for the year under review is given in Figure 7, along with the abstraction rate for comparison purposes. However, it is noted that the agreed documentation from a suitably qualified person certifying the installation, maintenance and accuracy of the flow recording device and data logger has not and cannot be provided to Council for the reasons outlined above.

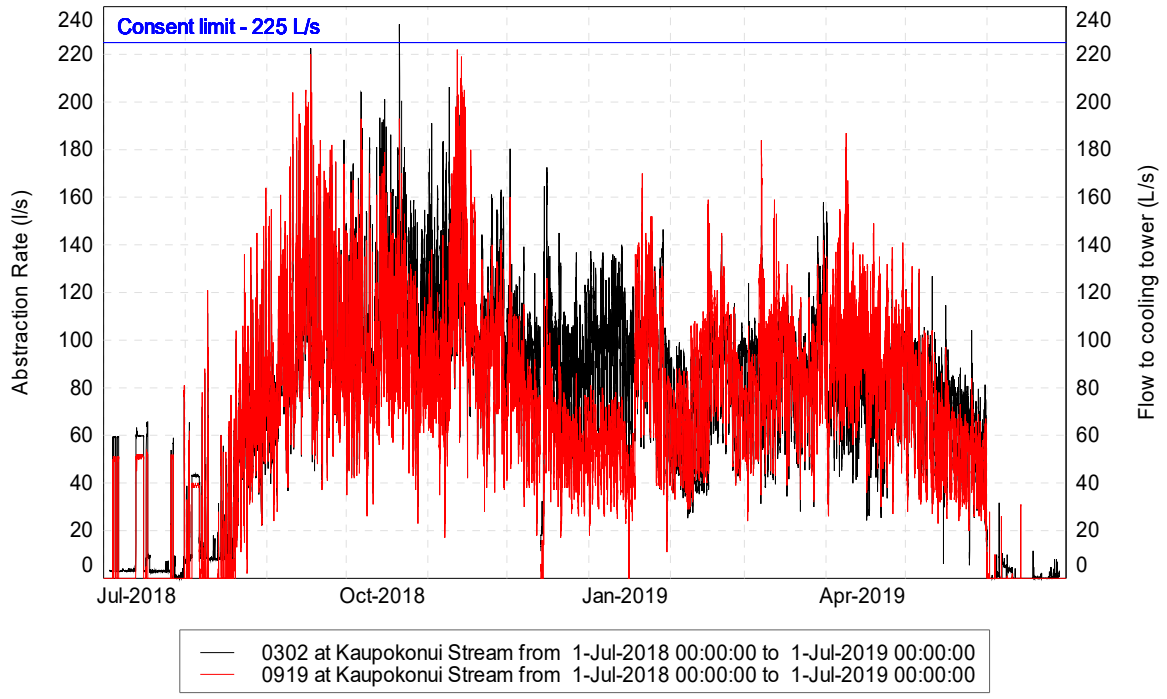

Figure 7 Discharge rates for consent 0919-3, along with the abstraction rate for consent 0302-3, electronic record

Analysis of the more complete data provided for the 2018-2019 year continues to indicates that there are errors occurring that are outside the agreed ± 5% for the measurement of the discharge rate.

On annual basis 2,069,260 m^3 was recorded as having been returned to the cooling tower. Although this is 173,900 m^3 less than the electronically provided abstraction volume, it is also noted that there were, times when return flow to the cooling tower exceeds abstraction volume by more than 10% (± 5% error on each meter). This indicates either periods of greater return or an over estimate of discharge rate as would be expected when measurements are made in a partially filled pipe. However, it is noted that there had been no independent verification of the discharge flow rate.

As previously discussed, the purpose of the review of the consents that were initiated in 2014 were to allow conditions to be put on the consent so that sufficient data could be collected regarding the consumptive use of the abstraction to inform the water allocation decisions that need to be made at the time of the abstraction consent renewal. For the reasons already discussed, the discharge flow measuring system the Company installed to honour that agreement does not provide data suitable for this decision making, as illustrated in Figure 8 and Figure 9. Figure 8 shows the differential between the discharge and the abstraction rates, with negative valued indicating consumptive use and positive values indicating an increase return rate. Figure 9 shows the percentage of the time that the usage or return is at a given rate. The differential is typically in the range of approximately 26 L/s usage to 18 L/s additional return, with a maximum 15 minute average usage of 65 L/s and a maximum additional return of 55 L/s. In addition to the inaccuracies outlined, during the 2018-2019 year, as part of the continuing investigations the Council was advised that the location of the meter will also not take into account the evaporative losses at the cooling tower. Conflicting information has been provided to Council regarding the significance of the losses from this source. It is also noted that any of the evaporative losses and/or wind drift at the spray discharge will also not be accounted for, however these are generally expected to be minor.

During the year under review Council was informed that the Company did not intend to undertake the work necessary to comply with the terms of the agreement made with Council in place of a review of the consent to have these discharge metering requirements included in the conditions. The Company was informed that

this was a contravention of condition 1 of consent 0919 and the matter was logged as a consent non-compliance on Councils incidents register. As outlined in Section 2.3 this was resolved by the Company undertaking to carry out the works by 30 September 2019, which was done.

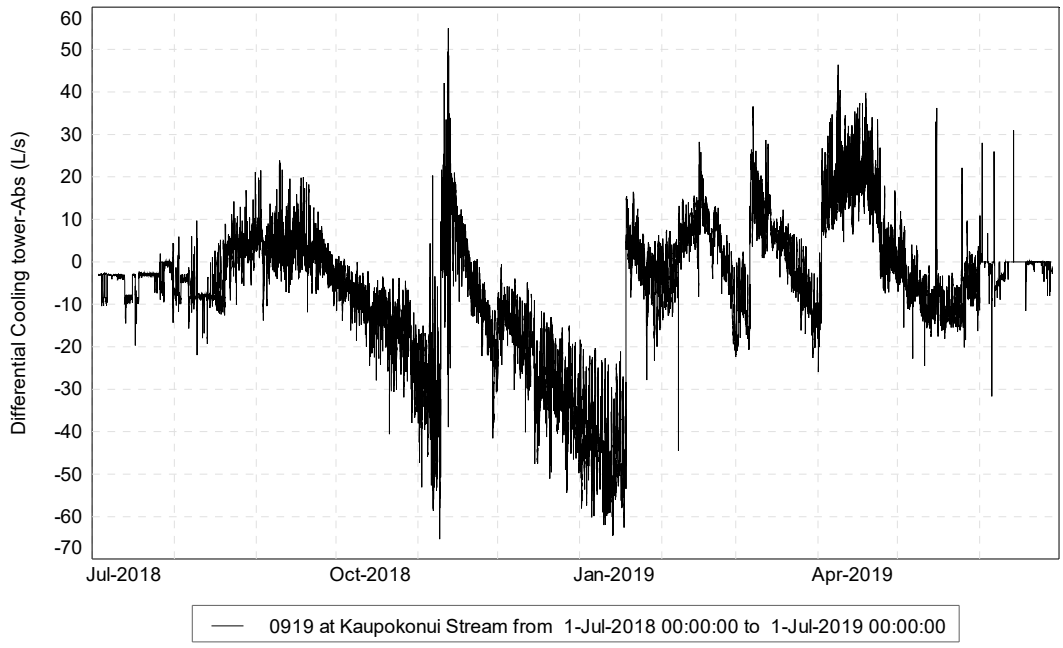

Figure 8 Differential between the rate of discharge to the cooling tower and the abstraction rate

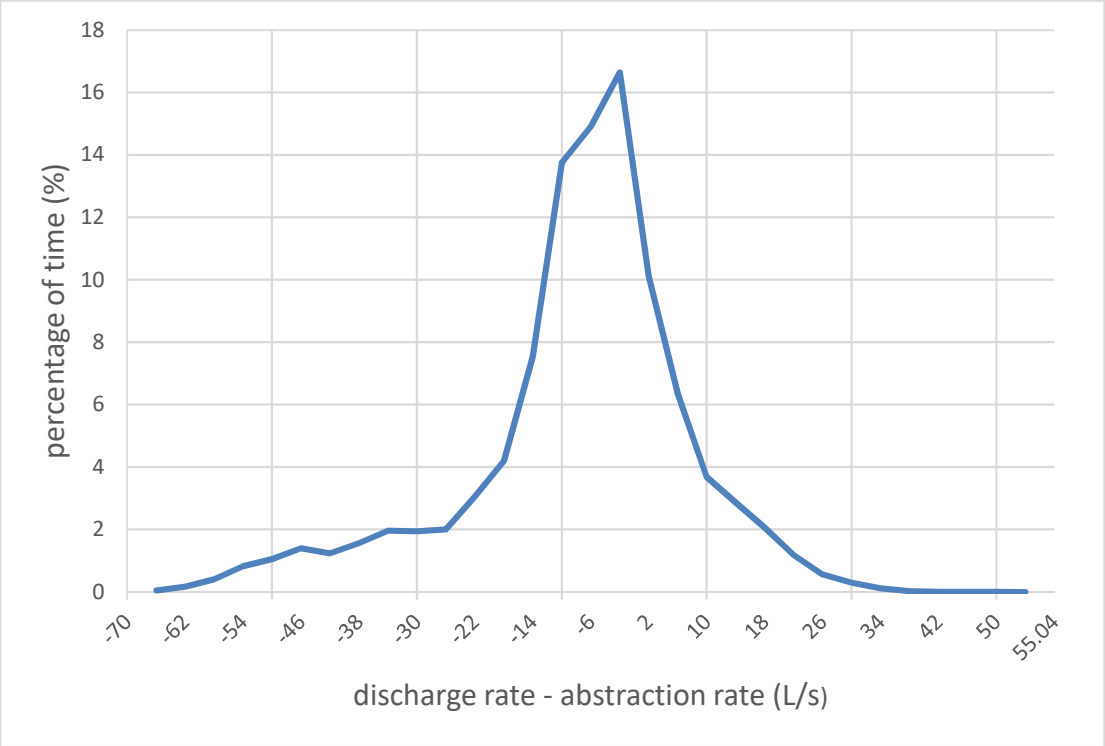

Figure 9 Probability density for the difference between the rate of discharge to the cooling tower and the abstraction rate

2.1.1.4 Cooling water discharge temperature

In addition to providing the new cooling water discharge rate monitoring data, the Company also started to voluntarily monitor the temperature of the cooling water discharged under consent 0919-3 downstream of the cooling water tower, upstream of the sprayers. This monitoring is likely to be required by the renewed consent, and in the meantime informed the assessment of effects prepared by the Company for the renewal of the consent.

This data has been provided to Council electronically on a daily basis for the year under review (Figure 10). The data provided is 15 minute averages. In the 2019-2020 year, 1 minute data provision has commenced and this is being sent through to Council every 2 hours. Compliance will still be determined based on a 15 minute average as per the conditions of the consent.

The median monthly discharge temperatures are given in Table 4.

Table 4 Cooling water temperature monthly statistical summary

Month	Monthly minimum (˚C)	Monthly maximum (˚C)	Monthly median (˚C)	Missing records
Jul 2018	3.1	23.0	9.0	2 days 8.5 hours
Aug 2018	6.4	50.6	13.2	no gaps
Sep 2018	17.0	46.6	36.7	no gaps
Oct 2018	14.6	44.9	28.1	no gaps
Nov 2018	12.6	43.2	25.3	no gaps
Dec 2018	14.8	43.3	24.5	5 hours 45 min
Jan 2019	14.4	42.6	25.0	no gaps
Feb 2019	14.7	30.6	23.4	no gaps
Mar 2019	11.7	31.2	25.3	no gaps
Apr 2019	13.3	27.3	22.4	no gaps
May 2019	11.3	25.1	20.5	no gaps
Jun 2019	3.6	21.2	10.3	no gaps

As already indicated, this data is not specifically required either by the current consents or the agreement made with the Company in lieu of the consent review. However, it will be useful to compare with the stream temperatures when evaluating potential environmental effects, the Company's implementation of the "best practicable option" to minimise effects, and the requirement that the discharge does not present a thermal barrier to fish passage within the mixing zone.

The monitoring shows that the median monthly discharge temperature, as measured downstream of the cooling towers, has been is generally in the range of 23 to 25.5˚C during the warmer, lower stream flow months of the year (Table 4). This is a significant reduction when compared to the 2017-2018 year (and previous years) when the temperature has generally been in the range 30-37˚C during this period. It must also be borne in mind that the discharge method itself (spray discharge) will provide further cooling prior to the cooling waters entry into the stream.

In November 2018, the Company identified that there was a time lag in the control system for the utilisation options available for running the cooling tower efficiently based on the upstream downstream temperature differentials to take effect. The options related to the proportion of cooling water that was passed through the cooling tower versus passing through a bypass line and in the operation of the fans on the cooling tower. The time lag was due to the response time between the activation of the change and the

time it takes for the change to have an effect on the cooling water discharge temperature. A decision was made to manually override the control systems such that all cooling water was directed through the cooling tower and that the cooling tower would be run at 100% capacity at all times, irrespective of the instream temperature differential. The changes in operational management of the cooling tower system in November 2018 resulted significant reduction in the temperature of the cooling water discharge, as can be seen by the reduced variability and lower maximum temperatures recorded (Figure 10).

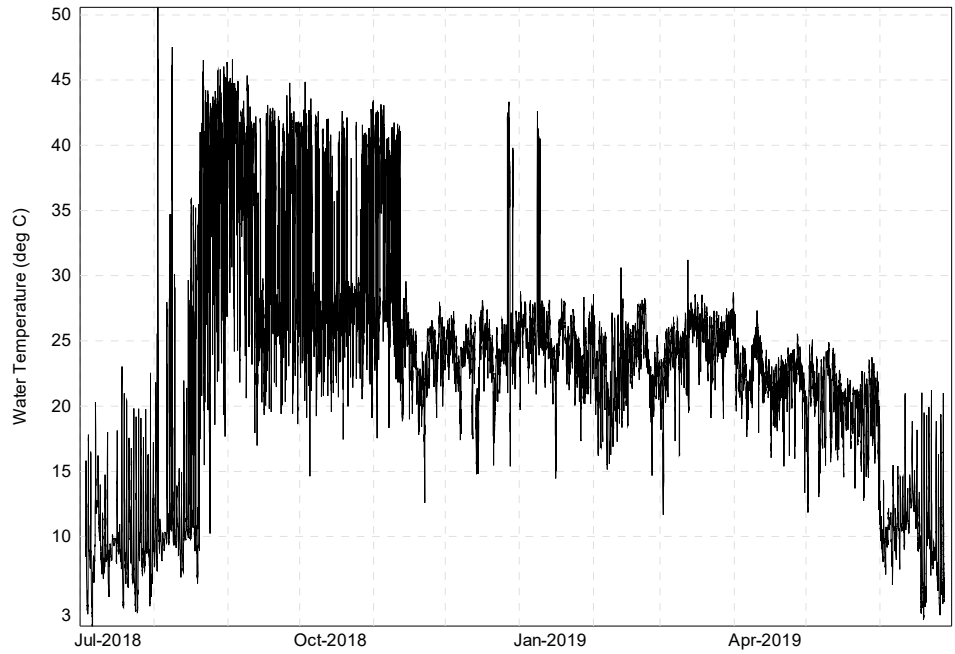

Figure 10 Temperature of the cooling water discharge permitted by consent 0919-3, electronic record

Further analysis and comparison of cooling water tower and operational performance is illustrated in Figure 11 and Figure 12. Cumulatively during the year under review the cooling water discharge is at or above 40˚C for 5% of the time, with most occasions being prior to the operational changes made in November 2018. This is in comparison to 6% of the time in the 2017-2018 year.

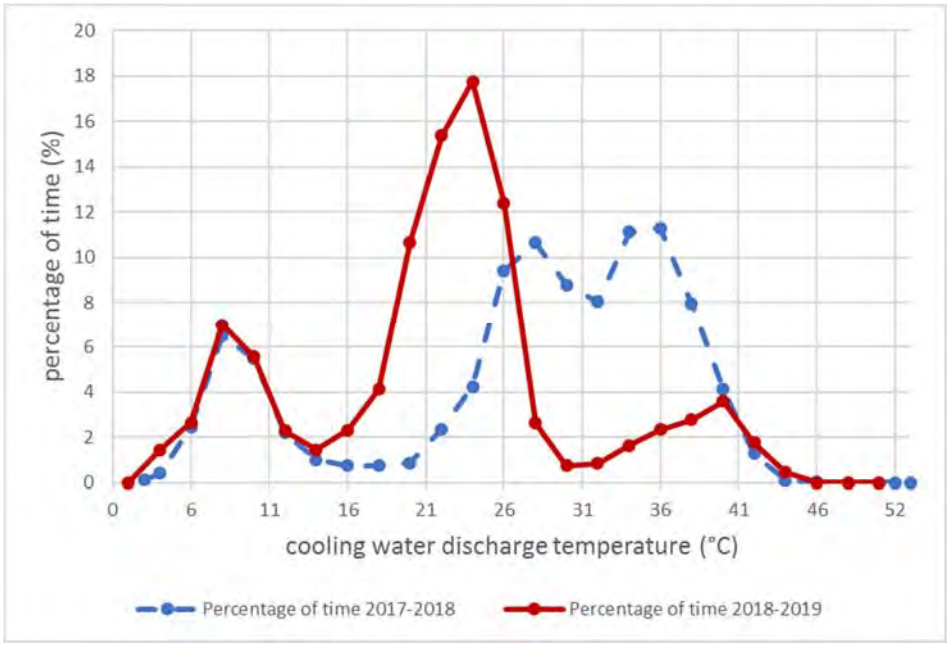

Figure 11 Cooling water tower discharge temperature probability density during the 2017 to 2019 years from 1 July - 30 June

During the period 1 December to 30 March, the time of year when typically the stream flow is low and the water temperature is higher, the cooling water temperature is at or above 33˚C only 1.4% of the time, and is at or over 40˚C for only 0.1% of the time. This in comparison to the 2017-2018 year when the proportions of the time above these temperatures were 48% and 11% of the time respectively. This is a significant reduction in the heat load on the receiving environment. The benefits observed in the receiving waters as a result in this improvement in operational management of the cooling tower are discussed in Section 2.1.1.6.2.

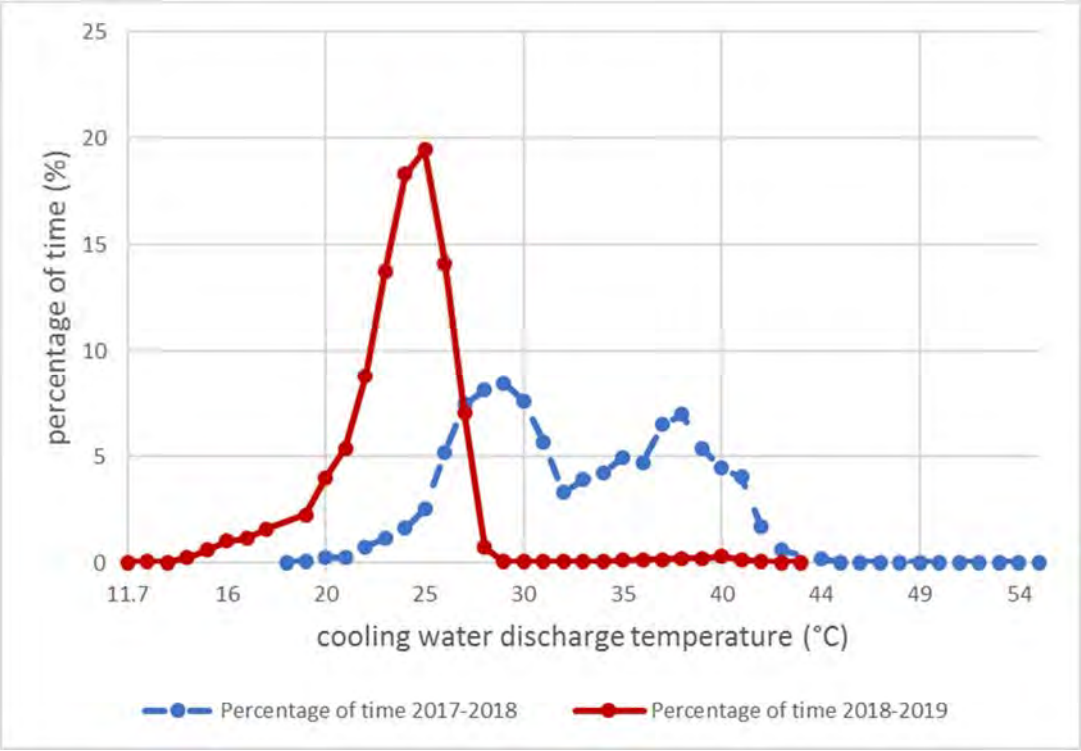

Figure 12 Cooling water tower discharge temperature probability density during the 2017 to 2019 years, 1 December – 31 March

2.1.1.5 Irrigation records

In relation to the Company's spray irrigation of wastewater onto land (that is, the exercise of consents **0922-3** and **0923-3**) the Company supplied the Council with monitoring data relating to the daily volume of factory and dairy shed effluent (DSE) spray irrigated. This information is summarised in Table 5.

Table 5 Wastes irrigation records supplied by Fonterra Ltd

Month	Kapuni Farm 1							Farms 2 & 3						
	Factory			DSE			Total	Factory			DSE			Total
	Days	Volume, m^3/d		Days	Volume, m^3/d		Days 2-day volume >2630	Days	Volume, m^3/d		Days	Volume, m^3/d		Days 2-day volume >3834
		Av.	Max		Av.	Max.			Av.	Max.		Av.	Max.	
Jul 2018	5	107	333	1	30	30	0	14	136	467	2	61	91	0
Aug 2018	15	310	780	10	85	118	0	31	668	1,368	0	0	0	0
Sep 2018	30	414	723	17	86	118	0	30	1,274	1,510	23	102	167	0
Oct 2018	31	512	901	15	114	116	0	31	1,267	1,669	28	120	167	0

Month	Kapuni Farm 1							Farms 2 & 3						
	Factory			DSE			Total	Factory			DSE			Total
	Days	Volume, m^3/d		Days	Volume, m^3/d		Days 2-day volume >2630	Days	Volume, m^3/d		Days	Volume, m^3/d		Days 2-day volume >3834
		Av.	Max		Av.	Max.			Av.	Max.		Av.	Max.	
Nov 2018	30	504	799	13	84	116	0	30	1,280	1,651	4	95	100	0
Dec 2018	31	431	956	25	74	116	0	31	1,127	1,561	20	122	167	0
Jan 2019	29	376	652	21	88	119	0	31	1,217	1,758	7	134	167	0
Feb 2019	27	372	859	11	52	110	0	28	1,033	1,660	4	89	167	0
Mar 2019	30	485	1,000	10	84	116	0	31	1,257	1,818	4	101	113	0
Apr 2019	30	499	146	8	94	119	0	30	1,224	1,612	8	138	167	0
May 2019	29	219	526	19	53	105	0	31	937	1,484	10	77	119	0
Jun 2019	1	101	101	1	25	25	0	22	153	604	14	76	167	0

Note: Average daily volume irrigated is calculated from days when irrigation occurred

The Company continued to irrigate a large volume of wastewater during the year under review. Consents **0922** and **0923** permit a maximum volume of 2,630 m^3 (Farm1) and 3,834 m^3 (Farms 2 and 3) of factory effluent and dairy effluent combined to be spray irrigated per two consecutive days, with a maximum daily volume for dairy shed effluent of 120 and 168 m^3, respectively.

Irrigation of factory effluent occurred almost daily during the monitoring year. A total factory effluent volume of 469,461 m^3 was irrigated during the 2018-2019 year, with a distribution between farms of 26%, 16% and 58% for Farm 1, Farm 2 and Farm 3, respectively. This was a decrease of 18.5% from the volume of 576,183 m^3 irrigated in the 2017-2018 year. The factory wastewater irrigation distribution between the farms during the year under review was similar to the previous year (25%, 17% and 58%).

Disposal of dairy shed effluent from the Farm 3 dairy shed to land via the factory effluent spray irrigation system was established in 2015-2016, replacing the oxidation pond treatment systems which had previously discharged to Kaupokonui and Motumate Streams. On Farms 2 and 3 irrigation commenced for the season on 19 July 2018 (although regular irrigation did not commence until early September). A total volume of 13,276 m^3 was discharged on these farms during the year. On Farm 1, where irrigation also commenced on 19 July 2018, a total volume of 12,034 m^3 was discharged.

The record shows that the volume limits on both consents were complied with throughout the 2018-2019 monitoring period.

2.1.1.6 Receiving water temperatures

The Company maintained continuous records of Kaupokonui Stream water temperatures (upstream of the spray coolant discharge zone and at the downstream end of the designated mixing zone), and water temperature exiting the cooling tower (discussed in section 2.1.1.4). Since 19 March 2014, the upstream and downstream temperature data have been sent directly to Council by telemetry on a daily basis. During the year under review, the data predominantly consisted of 15 minute average values at all three monitoring points. At the end of the monitoring period (26 June 2019), the Company began sending 1 minute averaged data every two hours. It is however noted that, as per the consent conditions, compliance will continue to be assessed based on 15 minute averages. The consent holder undertakes regular checking of the recording system to ensure that compliance is achieved in terms of continuity and accuracy of the record, particularly in relation to the 3˚C maximum stream temperature increase permitted by consent

conditions, and a requirement for the temperature increase not to exceed 2˚C for more than 10% of the discharge period (on an annual basis).

Calibration was performed at monthly intervals by Company personnel, and checks were made by Council staff during monthly receiving water sampling surveys. Although Council had previously been advised that the accuracy of the temperature probes was ± 0.1˚C, calibration records forwarded to Council for the year under review showed off-sets of up to 0.5˚C that were not being corrected for.

During the year under review, the Company ensured that temperature measurement equipment verification and calibration met the requirements of the Water Temperature National Environmental Monitoring Standard (NEMS) standard. This involved verification of the instruments on an at-least monthly frequency by Company personnel. The allowable (NEMS) deviation of up to 0.5˚C was applied. Deviations from the reference thermometer of greater than ± 0.5 ˚C required immediate re-calibration of the instrument as required by the standard. Equipment used by the Company to check instrument accuracy is calibrated against a traceable reference thermometer. The procedures and documentation requirements the NEMS Standard are also adopted by Taranaki Regional Council for managing calibration of their temperature monitoring equipment, however any off-sets of greater than ± 0.3˚C are actioned.

From October 2018, the Company introduced a reduced tolerance for allowable deviations from the reference thermometer during verifications. The allowed deviation was reduced from ± 0.5 ˚C to ± 0.2 ˚C. Up until this point, based on the maximum permitted off-sets given in NEMS, there was potential for error up to ± 0.8˚C deviation at each monitoring location (± 0.5˚C, with an additional off-set of ± 0.3˚C allowed for due to errors on the thermometer used to perform the calibration), and a potential error of up to ± 1.6˚C on any calculated temperature differentials overall. Following implementation of the lower deviation tolerance, the potential error reduces to between ± 0.2˚C and ± 0.5˚C at each monitoring location and a temperature differential accuracy of between ± 0.4˚C and ± 1.0˚C depending on the accuracy of the thermometer used to perform the calibration.

2.1.1.6.1 Parallel temperature monitoring (one month)

Where there are cooling water discharges to waterways, it is Council policy to have continuous water temperature monitoring in place to confirm compliance with consent conditions relating to permitted instream temperature changes. The majority of this monitoring is undertaken by the Council with the installation of one upstream site and at least one downstream site. In the case of the lactose plant, this temperature information is required by the Company, as it is used to control cooling water system operating parameters. The Company is responsible for all aspects of the monitoring of the receiving water temperatures immediately upstream and downstream of their site, with any maintenance, validations and calibrations carried out internally.

The data, including any requested calibration records, are provided to the Council. It is therefore considered the accuracy of the data that the accuracy of the data and consent compliance can be confirmed by periodic parallel temperature monitoring, rather than a full duplication of effort, as would be the case if Council were to undertake monitoring of a similar scale to that which is in place for other consent holders.

A Council temperature logger was installed alongside the Company's temperature probe at the downstream monitoring site from 21 February to 21 March 2019. A comparison of the temperatures recorded by the loggers are shown in Figure 13. The temperature records show that there was very good agreement between the two temperature recorders, with the two graphs overlapping. For the most part the temperature differential between the two loggers was 0.1˚C or less, with the Company monitoring recording the slightly lower temperature. There were no exceedances in the 25˚C downstream temperature limit.

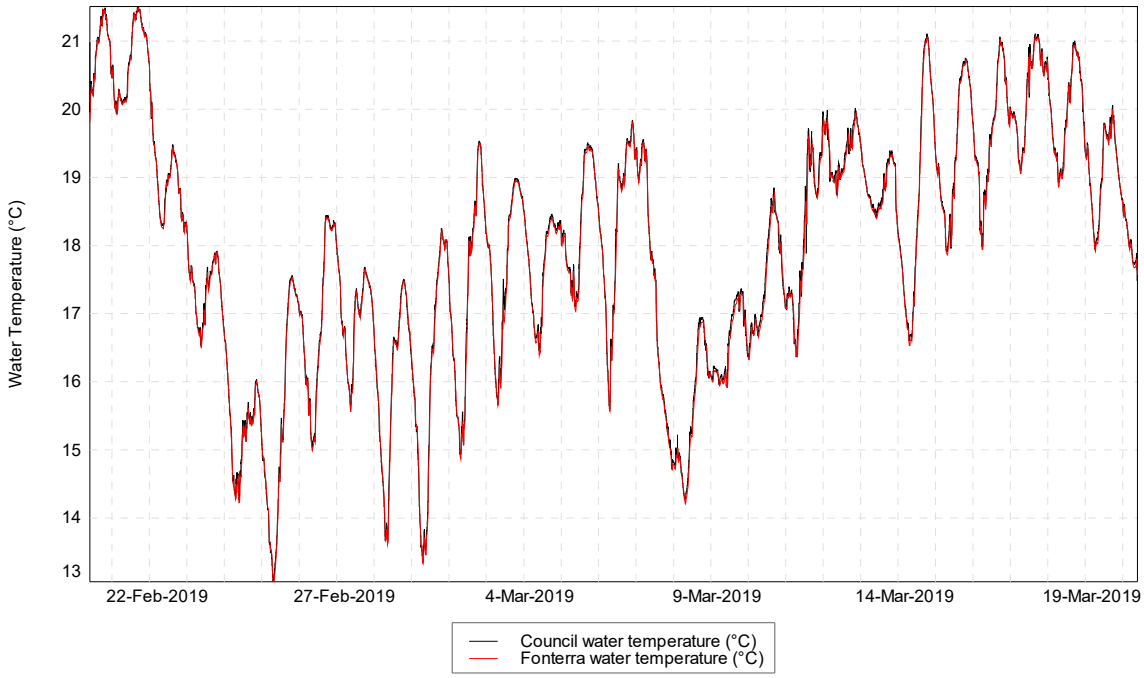

Figure 13 Results of parallel temperature monitoring in the Kaupokonui Stream

2.1.1.6.2 Annual consent holder data

The temperature record over the 2018-2019 reporting period for the Kaupokonui Stream upstream and downstream of the lactose plant discharge is presented in Figure 14 and Figure 15. The change in temperature is given in Figure 16.

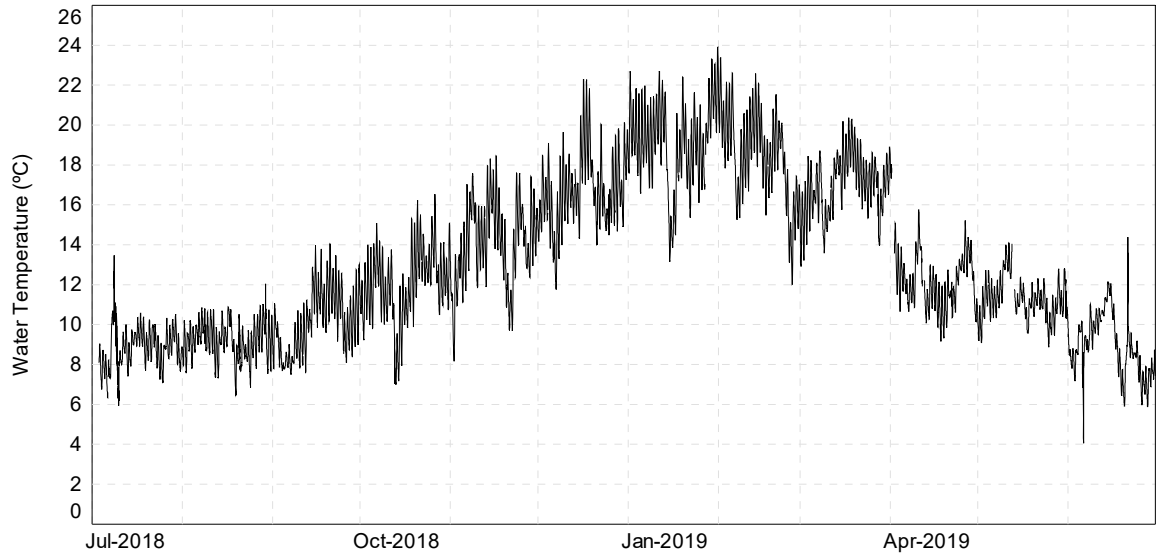

Figure 14 Water temperature (°C) records for the Kaupokonui Stream upstream of the lactose plant, electronic data

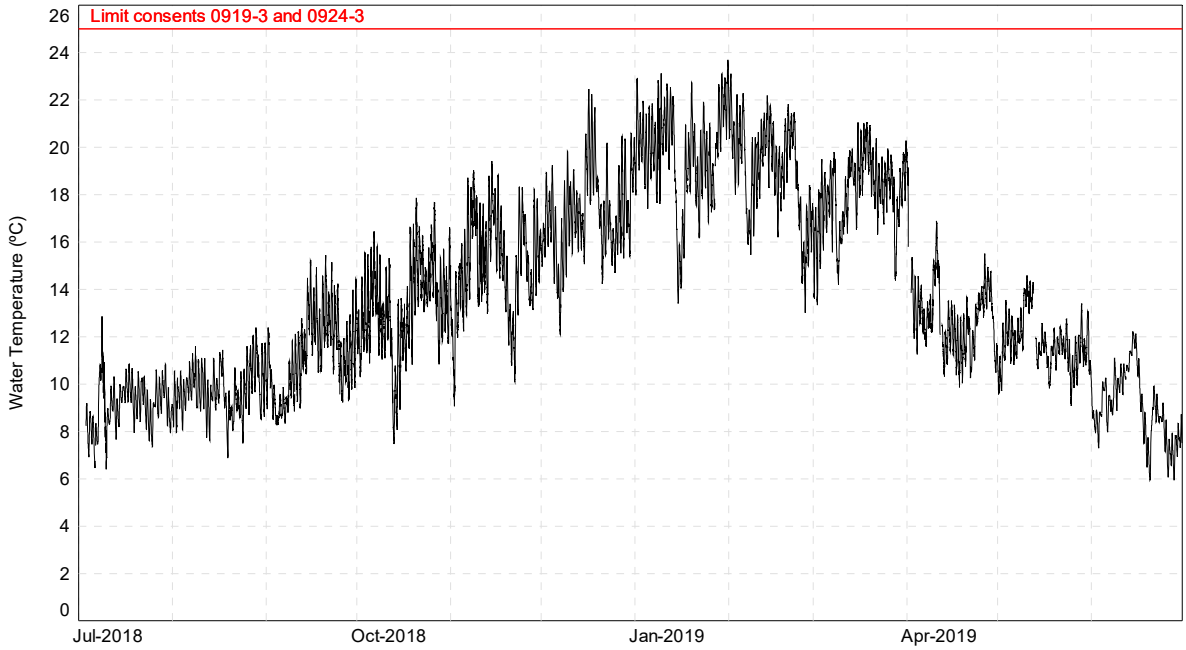

Figure 15 Water temperature (°C) records for the Kaupokonui Stream downstream of the lactose plant, electronic data

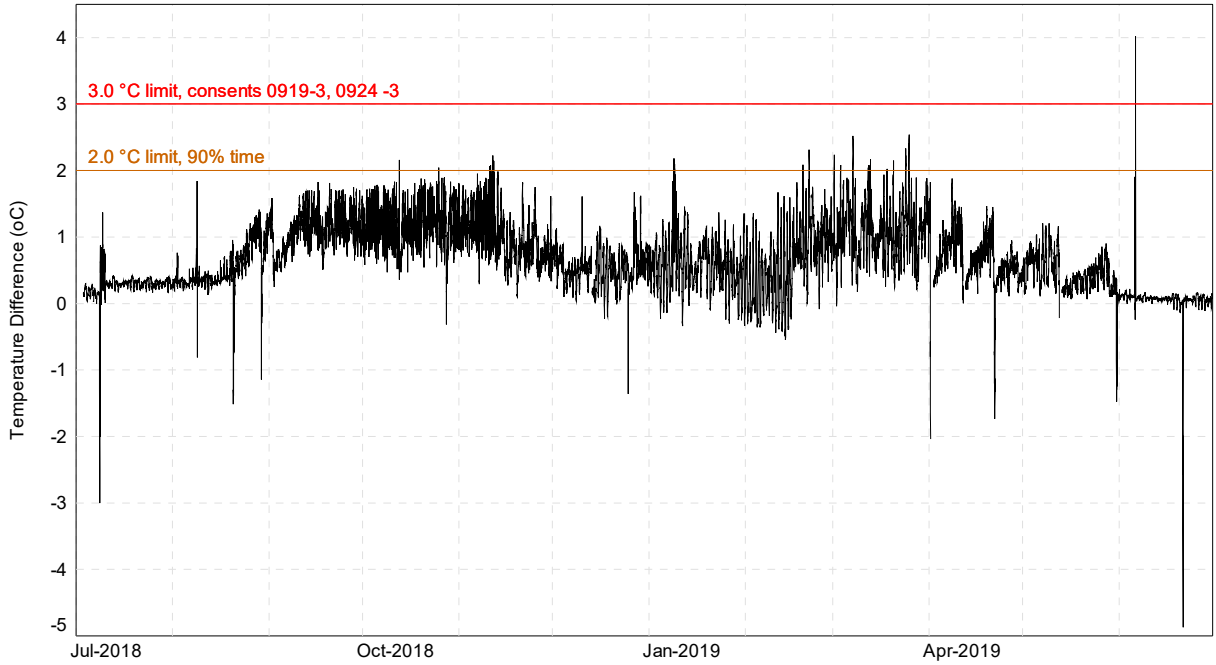

Figure 16 Kaupokonui Stream temperature change below the lactose plant, calculated from electronic data

A summary of the reported temperature change and maximum temperature data for 2018-2019 (15 minute data) is given in Table 6. On a monthly basis, the recorded percentage of time the change was below 0°C, above 2.0°C, 2.5°C and 3.0°C is given, together with the minimum and maximum reported change and the maximum downstream temperature.

Table 6 Summary of Fonterra Ltd's continuous water temperature records (°C) from two monitoring probes in the Kaupokonui Stream

Month	Temperature change% Time*				Downstream temperature				
	<0˚C	>2˚C	>2.5˚C	>3˚C	Min reported change (d/s-u/s) (˚C)	Max reported change (d/s-u/s) (˚C)	Days in excess of 3˚C	Max downstream temp	Days in excess of 25˚C
Jul 2018	0.6	0	0	0	-3.0	1.4	0	12.9	0
Aug 2018	1.1	0	0	0	-1.5	1.8	0	12.4	0
Sep 2018	0	0	0	0	0.25	1.8	0	15.5	0
Oct 2018	0.07	0	0	0	-0.3	2.1	0	17.9	0
Nov 2018	0	0.07	0	0	0.1	2.2	0	19.4	0
Dec 2018	1.3	0	0	0	-1.4	1.7	0	22.5	0
Jan 2019	6.0	0.07	0	0	-0.3	2.1	0	23.7	0
Feb 2019	18	0.4	0	0	-0.5	2.3	0	23.1	0
Mar 2019	0.06	2.0	0	0	0	2.5	0	21.1	0
Apr 2019	1.5	0	0	0	-1.7	1.8	0	16.9	0
May 2019	0.7	0	0	0	-1.5	1.2	0	14.6	0
Jun 2019	9.2	0.2	0.1	0.1	-4.9	4.0	0	12.2	0
Totals for 2018-2019	3.2	0.2	0.01	0.01	-4.8	4.0	0	23.7	0

Note:* =% of actual record (5 days 14 hrs and 45 min of missing record)

The Company operates a null switch, which is activated during periods when the temperature probes are pulled out of the water for protection during high flows, or during calibration. This reduces the number and duration of temperature spikes recorded (it should be noted that 0.1% exceedance during any one month's operations equates to a time period of approximately 1 hour).

There were occasions when temperature differences reached or exceeded 2˚C, during periods of low flow in Kaupokonui Stream. The month in which this occurred for the most time was in March 2019, but this was for only 2% of the month with no missing record.

Condition 4(b) of consent **0919-3** requires that the discharge does not result in an increase of more than 3˚C at any time, and does not alter the temperature of the receiving water by more than 2°C for 90% of the time (on an annual basis). For a period on 6 June 2019 the temperature differential was greater than 3°C, however this was found to have been as a result of the upstream temperature probe having been partially exposed, after having been lifted out of the water by debris during a fresh. Therefore these consent limits were not exceeded during 2018-2019.

Condition 5 of consents **0919-3** requires that the discharge shall not raise the temperature of the receiving water above 25°C at the boundary of the mixing zone. Figure 15 shows that this condition was complied with during the year under review.

The data and summary provided in Figure 16 and Table 6 show that, although the temperature probes comply with the requirements of NEMS standard, and improvements have been made to the calibration processes the Company employs, there still appears to be some occasional issues with the precision of the

recording of the temperature differential between the upstream and downstream sites. During the year under review, the data reported indicated that there was a drop in stream temperature between the upstream and downstream sites for 3% of the time. This is in comparison to 16% of the time in 2017-2018 and 23% of the time in the 2016-2017 year.

Table 7 shows the comparison between the stream temperatures recorded at the time of sampling during the monthly inspections and the temperature provided in the electronic record.

Table 7 Comparison between Council's stream temperatures at the time of sampling and the Company's electronic record provided to Council

Month	Upstream temperature (TRC – KPK000660) (˚C)	Upstream temperature (Fonterra) (˚C)	Differential (˚C)	Downstream temperature (TRC – KPK000679) (˚C)	Downstream temperature (Fonterra) (˚C)	Differential (˚C)
Jul 2018	8.5	8.3	-0.2	8.7	8.7	0
Aug 2018	9.4	9.2	-0.2	9.7	9.7	0
Sep 2018	11.0	10.3	-0.7	11.0	11.8	+0.8
Oct 2018	10.1	10.0	-0.1	11.3	11.6	+0.3
Nov 2018	15.2	15.7	+0.5	17.0	17.0	0
Dec 2018	16.2	16.1	+0.1	16.7	16.7	0
Jan 2019	13.2	13.3	0	13.5	13.7	+0.2
Feb 2019	17.8	17.8	0	19.8	20.3	+0.4
Mar 2019	16.4	16.4	0	17.8	17.8	0
Apr 2019	10.4	12.7	+2.3	11.0	10.6	-0.4
May 2019	11.1	10.9	-0.2	11.6	11.4	-0.2
Jun 2019	6.1	5.9	-0.1	6.1	6.1	0

Although, on the whole, there has been a reduction in the differentials found during the year under review when compared to the previous year, at times, there is still quite a variation between the two temperatures obtained. However, it must be noted that the data comparison is between an instantaneous reading and a 15 minute average.

It is recommended that the Council continues to undertake a period of parallel temperature monitoring on an annual basis to confirm compliance with the condition on the consent, as is the practice in place where the Council is monitoring other consents for cooling water discharges to waterways.

As discussed in Section 2.1.1.4, improved calibration procedures and improved operational management of the cooling water discharge system were made during the year under review. These changes resulted in an improvement in the accuracy of the temperature recording and also reduced cooling water discharge temperatures.

The effects of both of these changes can be seen in a comparison of the temperature differential probability density curves for the 2017-2018 and 2018-2019 years (Figure 17). The most notable changes between the 2017-2018 and 2018-2019 years are:

- A significant reduction in the amount of time that a negative temperature differential is reported;
- A significant reduction in the most common instream temperature differential, from 0.9 to 0.3°C;

- A significant reduction in the percentage of the time that the temperature differential is greater than 1.0°C.

This illustrates the application of the best practicable option to minimise effects on the environment. The reduction in the discharge temperatures will result in a significant reduction in the effects occurring within the approximately 200 m discharge and mixing zone. An additional advantage is that it will improve the sustainability of the cooling water discharge system at times when the upstream receiving water temperature peaks during the summer months whilst still ensuring compliance with the 25°C downstream temperature limit (peak upstream temperature recorded to date, 24.8°C on both 29 and 30 January 2018).

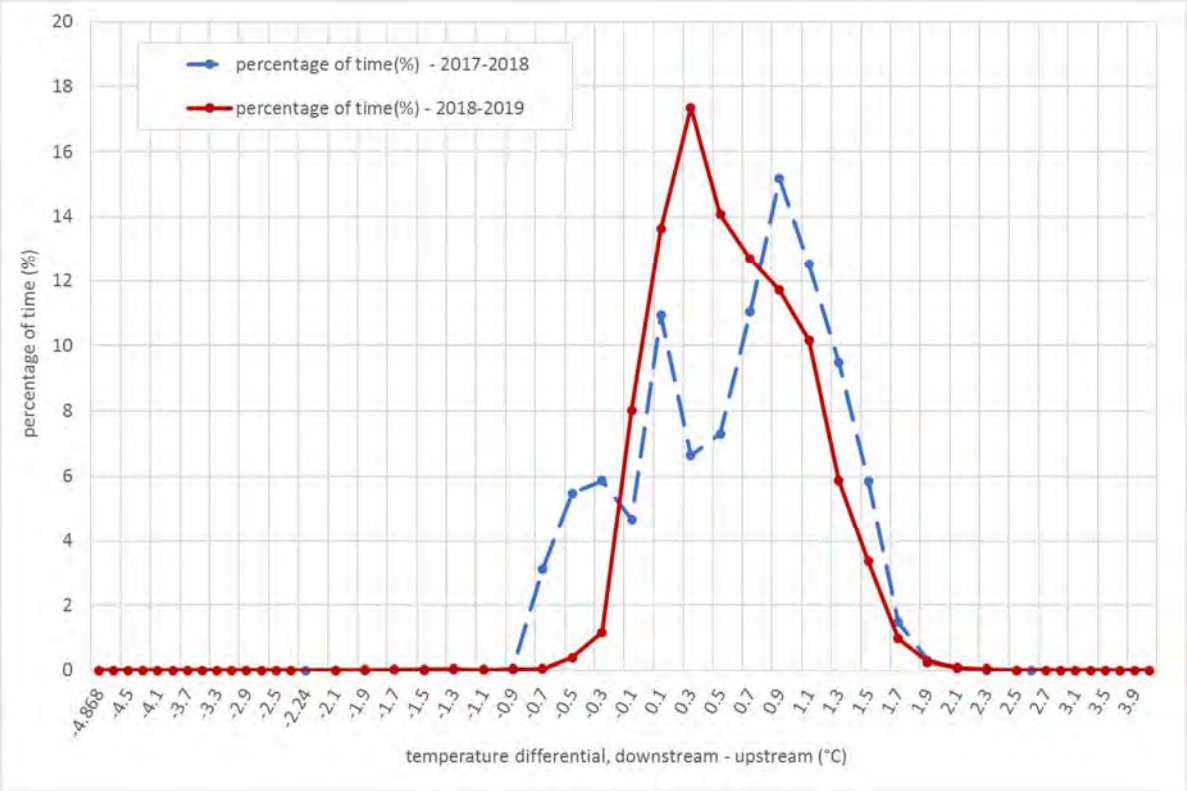

Figure 17 Instream temperature differential probability density during the 2017-2019 years from 1 July - 30 June

2.1.1.7 Wastewater composition

Factory wastewater

The Company commenced monthly monitoring of factory wastewater composition in May 2007. This was done at the request of the Council in order to improve calculations of loadings on irrigation areas and to characterise variation in effluent quality. The Company increased the frequency to weekly grab sampling in July 2008. The plant wastewater is automatically sampled by the Company at the filter on the line from the plant wastewater tank. A grab sample is taken every five minutes when wastewater is being pumped to the farms. The composite of these grab samples is refrigerated and a weekly composite sample is sent to an outside laboratory (Industrial Chemistry Services Ltd) for analysis. In 2018-2019 the pH, organic strength, major mineral components, nutrients (including nitrogen species) and the metals copper and zinc were determined for 46 samples collected between 2 August 2017 and 28 June 2018. It is noted that the number of analyses performed has decreased since the 2015-2016 year. The results are summarised in Table 8.

Table 8 Results of factory wastewater monitoring by Fonterra Ltd

Parameter	Unit	2018-2019		% change	2017-2018		% change	2016-2017	
		Median N = 46	Range		Median N = 42	Range		Median N=43	Range
pH	pH	4.4	3.8 - 7.4	0	4.4	4.0-11.6	0	4.4	4.1 - 4.7
Chemical oxygen demand	g/m^3	5,685	308 - 12,760	-16	6,760	592 - 13,720	-8	7,370	2,790 - 11,430
Biochemical oxygen demand	g/m^3	3,000	140 - 6,600	-6	3,200	360 - 6,300		-	-
Total Nitrogen	g/m^3N	82.0	9.4 - 174.0	13	72.5	45.0 - 147	-24	96	62 - 148
Nitrate	g/m^3N	59	001 - 149	37	43.0	14.5 - 87	5	41	14.8 - 94
Nitrite	g/m^3N	1.2	0.13 - 13.5	64	0.7	0.1 - 16	-66	2.1	0.31 - 7.4
Total Kjeldahl Nitrogen (TKN)	g/m^3N	15.0	1.4 - 65.0	-46	28.0	5.0 - 118	-42	48	5.6 - 82
Calcium	g/m^3	153	50 - 306	-16	182	98 - 298	-9	201	87 - 391
Magnesium	g/m^3	12.0	5 - 97	-43	21.0	4.8 - 96	121	9.5	1 - 154
Sodium	g/m^3	99	54 - 164	-3	102	58 - 227	-18	125	61 - 199
Potassium	g/m^3	55	12 - 150	-50	110	40 - 340	6	104	52 - 480
Total Phosphorus	g/m^3P	51	6 - 260	-42	88.0	4.8 - 262	21	73	29 - 247
Ash	g/m^3	855	328 - 1,868	-9	941.0	469 - 2,112	-14	1,090	511 – 1,799
Sodium adsorption ratio		2.9	1.9 - 5.4	6	2.7	1.5 - 5.6	-18	3.3	1.5 - 5.2
Copper	g/m^3	0.38	0.07 - 0.98	23	0.310	0.13 - 0.67	-	-	-
Zinc	g/m^3	0.48	0.26 - 0.93	17	0.410	0.13 - 0.66	-	-	-

The lactose plant wastewater typically has high organic strength and is acidic. A comparison can be made between results for the 2016-2017, 2017-2018 and 2018-2019 monitoring years on the basis of median values, as shown in Table 8. Wastewater organic strength in 2018-2019, was, on the whole similar to or less concentrated when compared with the 2017-2018 year. Although there was a reduction in the Kjeldahl nitrogen, there were increases in the inorganic nitrogen medians, and in the total and nitrate nitrogen maximum concentrations. It is also noted that the total nitrogen concentration continued to agree reasonably well with the sum of the individual nitrogen species in the 2016-2019 years, unlike the 2013-2015 seasons. It is noted that although the nitrite concentration was elevated between January and April, the concentrations found in the groundwater monitoring bores remained well below the long term drinking water standard of 0.2 g/m^3. The mineral concentrations and the total phosphorus concentrations were generally lower in the year under review with reductions in the medians by somewhere in the range of -3% to -50%. The sodium adsorption ratio was again high on occasion, though well within the safe range for soil stability. Although there was a slight increase in the median when compared to the 2017-2018 year, the median was still lower than in the 2016-2017 year.

The annual volume of factory wastewater produced since 2009-2010, together with the annual mass of factory nitrogen irrigated, is presented in Figure 18. With respect to the mass discharge rate of wastewater components, factory wastewater volume has generally changed little since 2011-2012. Therefore,

historically, the estimated mass discharge rate of the wastewater components has increased or reduced by about the same proportion as their respective concentrations. An exception to this was the 2017-2018 year, when there was a new maximum for the volume of waste water irrigated (there was also a 10% reduction in the number of samples analysed). During the year under review, a return to the more typical trend was observed.

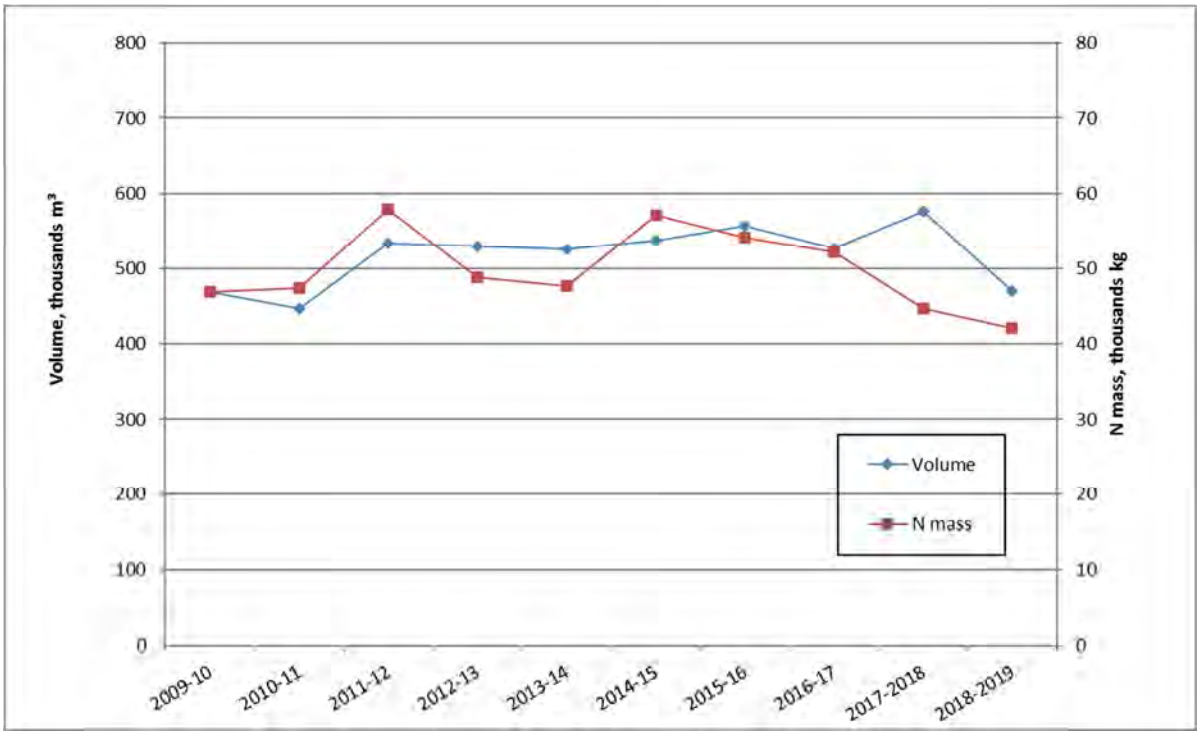

Figure 18 Annual volume of factory wastewater and estimated factory nitrogen mass irrigated, 2009 - 2019

Both the factory wastewater and dairy shed effluent (DSE) strengths vary through the season. A comparison of the relative strengths of these different wastewater streams is discussed following the DSE section.

Dairy shed effluent (DSE)

The Company began weekly analysis of DSE during the 2015-2016 season upon the commencement of spray irrigation of DSE to land, together with factory wastewater. Automatic solenoid samplers, located beside the storage pond pump at each farm, collect composite samples over 24 hours whenever DSE pumping occurs, with a weekly composite being analysed for each farm's DSE. The parameters determined are similar to those for the factory wastewater, with the exception that chemical oxygen demand (COD), copper and zinc are not determined. A total of 39 samples were taken between 22 August 2018 and 6 June 2019 for Kapuni Farm 1, and 29 samples were taken between 6 August 2018 and 28 June 2019 for Farms 2 and 3. The results are summarised in Table 9.

Table 9 Results of dairy shed effluent monitoring by Fonterra Ltd

Parameter	Unit	Farm 1			Farms 2 & 3		
		Median N = 39	Range	2017-2018 median (N=24)	Median N = 29	Range	2017-2018 median (N=23)
pH	pH	7.8	6.2 - 8.1	7.7	7.9	6.3 - 8.3	8.0
Biochemical oxygen demand	g/m^3	340.0	80.0 - 1,640	240	800	200 - 10,000	480

Parameter	Unit	Farm 1			Farms 2 & 3		
		Median N = 39	Range	2017-2018 median (N=24)	Median N = 29	Range	2017-2018 median (N=23)
Total Nitrogen	g/m^{3}N	78	44 - 156	80	214	116 - 815	206
Nitrate	g/m^{3}N	1.3	0.0 - 12	3.1	0.16	0.01 - 0.92	0.10
Nitrite	g/m^{3}N	0.1	0.0 - 2.8	0.07	0.08	0.01 - 0.20	0.04
Total Kjeldahl Nitrogen (TKN)	g/m^{3}N	77.0	42 - 155	74.5	214	116 - 815	206
Calcium	g/m^3	78	39 - 114	79	102	54 - 430	106
Magnesium	g/m^3	17	5 - 81	24	26	5 - 172	36
Sodium	g/m^3	47	12 - 68	51	87	62 - 813	106
Potassium	g/m^3	275	145 - 525	250	840	400 - 2,900	780
Total Phosphorus	g/m^{3}P	40	19 - 72	42	74	44 - 630	75
Ash	g/m^3	769	332 - 1,358	779	1,895	1,042 - 13,317	1,815
Sodium adsorption ratio		1.7	0.5 - 2.5	3.21	3.0	1.6 - 19.2	3.2

Comparison of contaminant loadings from the factory wastewater and DSE

The DSE has generally been found to have lower organic (BOD compared to BOD and COD) and higher mineral strength than factory wastewater (for example potassium, Figure 26), and is slightly alkaline (Figure 21). During the year under review the organic strength of the DSE from Farm 3 exceeded that of the factory wastewater through February and March (Figure 20). In the 2018-2019 year it was found that the Farm 3 DSE had an oxygen demand, total nitrogen (Figure 22), calcium (Figure 25), potassium (Figure 26) and phosphorus concentrations (Figure 27) that were between two and three times higher than in the previous year. The elevated concentrations occurred during the period January to April. Records provided to Council show that Farm 3 DSE was discharged on only 20 days during this period and made up between 6 to 19% of the total wastewater irrigated on Farms 2 and 3. The effluent from Farm 1 had lower component concentrations than that of Farms 2 and 3, possibly owing to a larger presence of stormwater in the former. The median total nitrogen concentration in Farms 2 and 3 effluent (214 g/m^3), was more than double the Farm 1 effluent and factory wastewater (78 and 82 g/m^3 respectively). The predominant nitrogen species present in the dairy shed effluent are generally ammoniacal nitrogen and organically bound nitrogen, whereas the factory wastewater contains much higher concentrations of nitrate and nitrite nitrogen. The additional nitrogen load applied to the paddocks during the year under review from the Farm 1 and Farm 2 and 3 DSE was about 4,352 kg, that is, about another 9% when compared to the nitrogen applied in the factory wastewater.

Within the production season, measured organic strength of the factory wastewater strength (BOD) was significantly higher at the start of the season (Figure 20), as was the case for the minerals (for example potassium as shown in Figure 26) and total phosphorus (Figure 27).

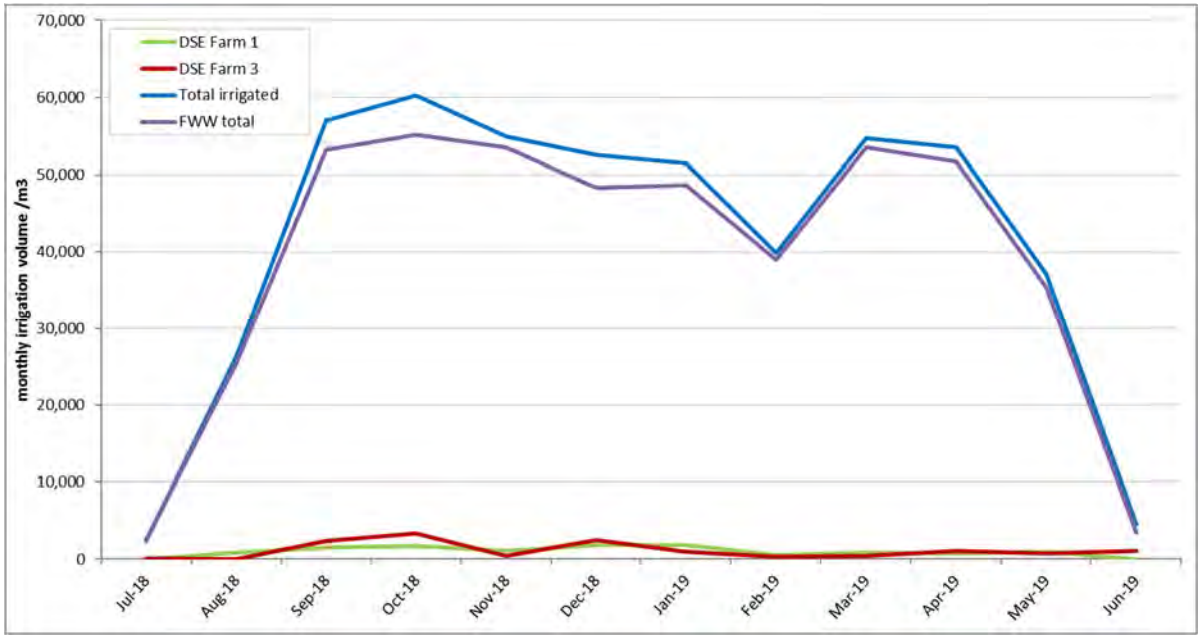

Figure 19 Relative irrigation volumes during the year under review

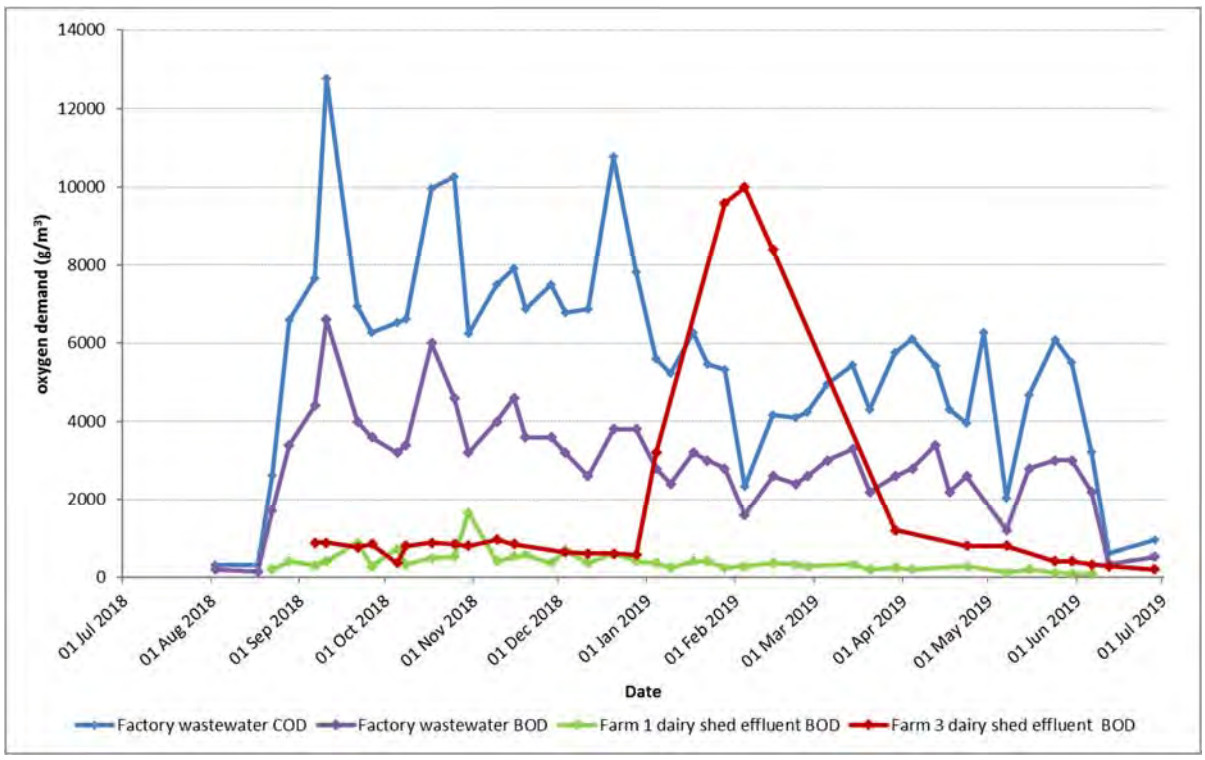

Figure 20 Oxygen demand of the factory wastewater and dairy shed effluents

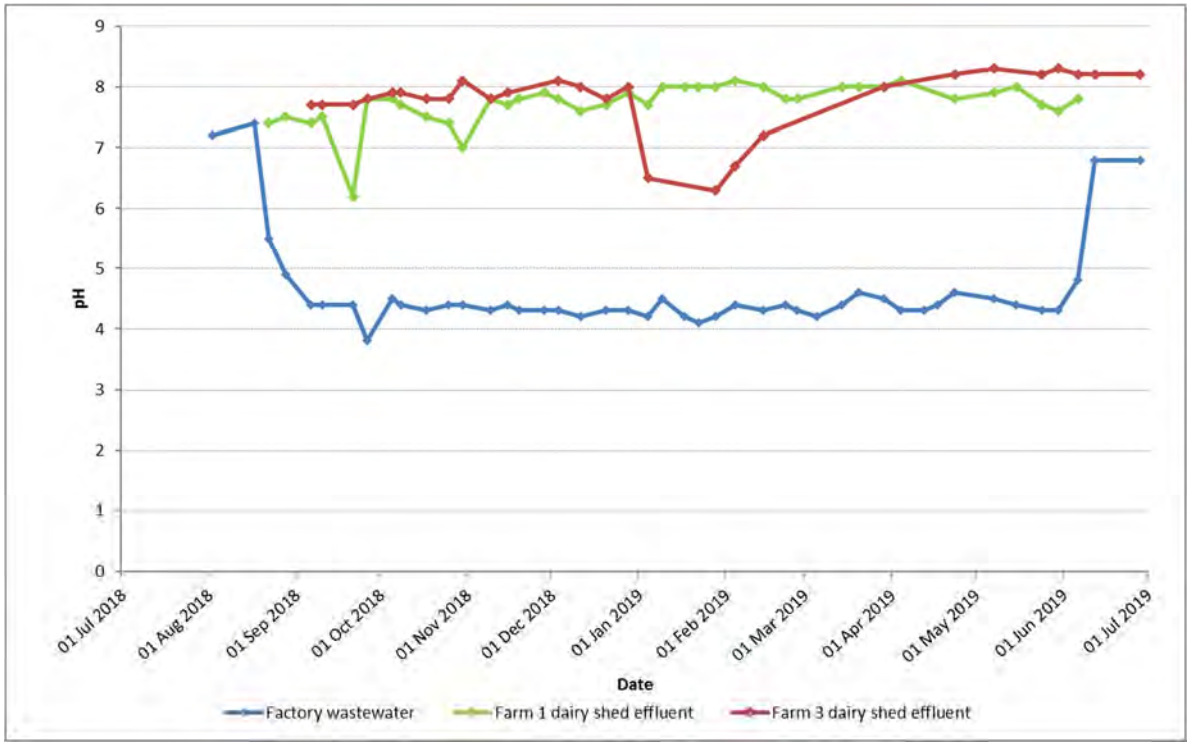

Figure 21 pH of the factory wastewater and dairy shed effluents

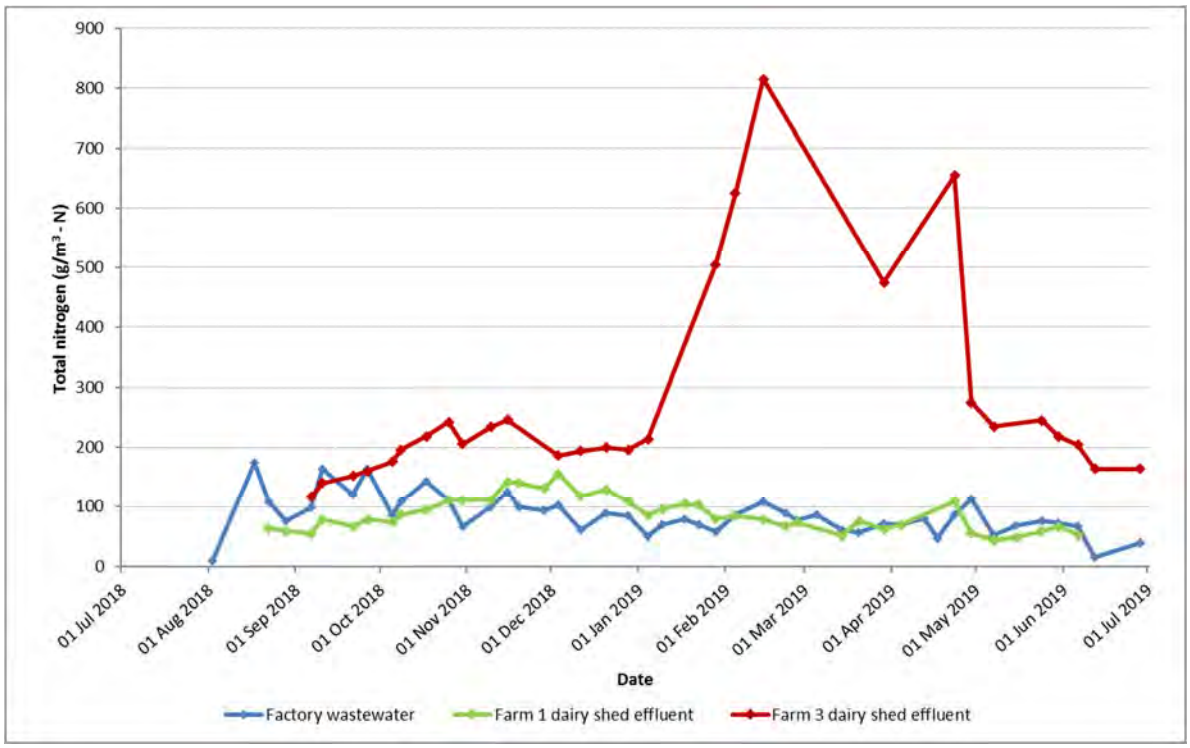

Figure 22 Total nitrogen of the factory wastewater and dairy shed effluents

It is noted that the seasonal profile for the total nitrogen of the Farm 3 dairy shed effluent is quite different when compared to the previous monitoring period (Figure 23) and the factory wastewater has much higher nitrate levels on the whole during the year under review (Figure 24).

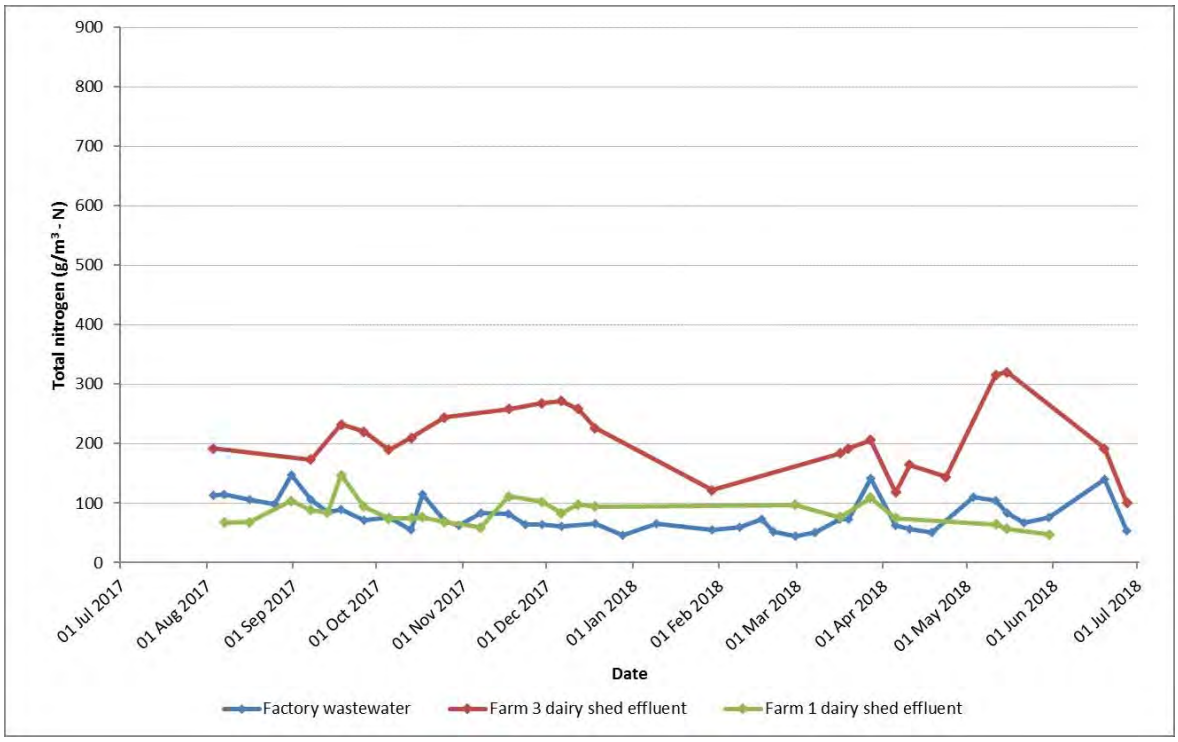

Figure 23 Total nitrogen of the factory wastewater and dairy shed effluents, 2017-2018

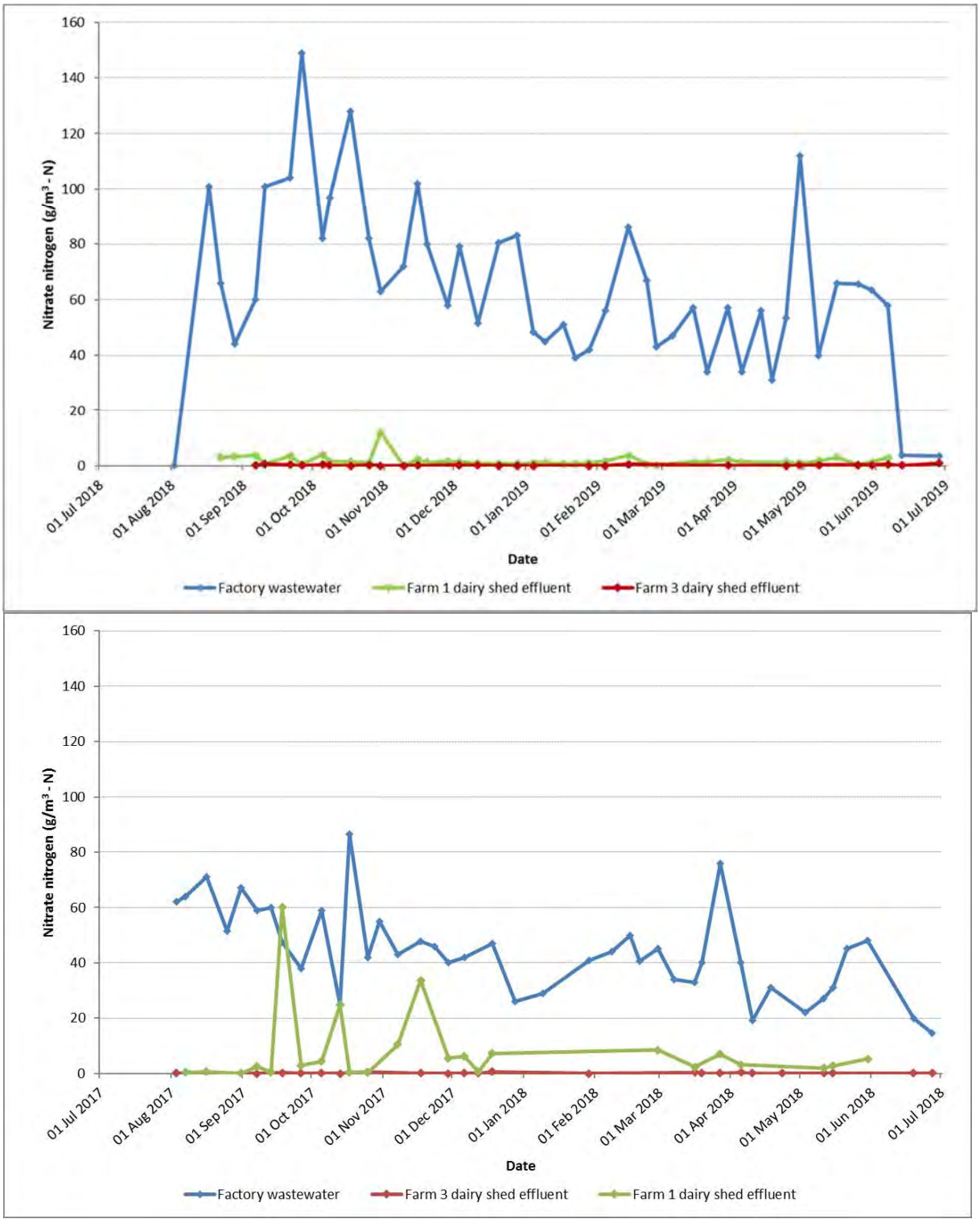

Figure 24 Nitrate nitrogen of the factory wastewater and dairy shed effluents

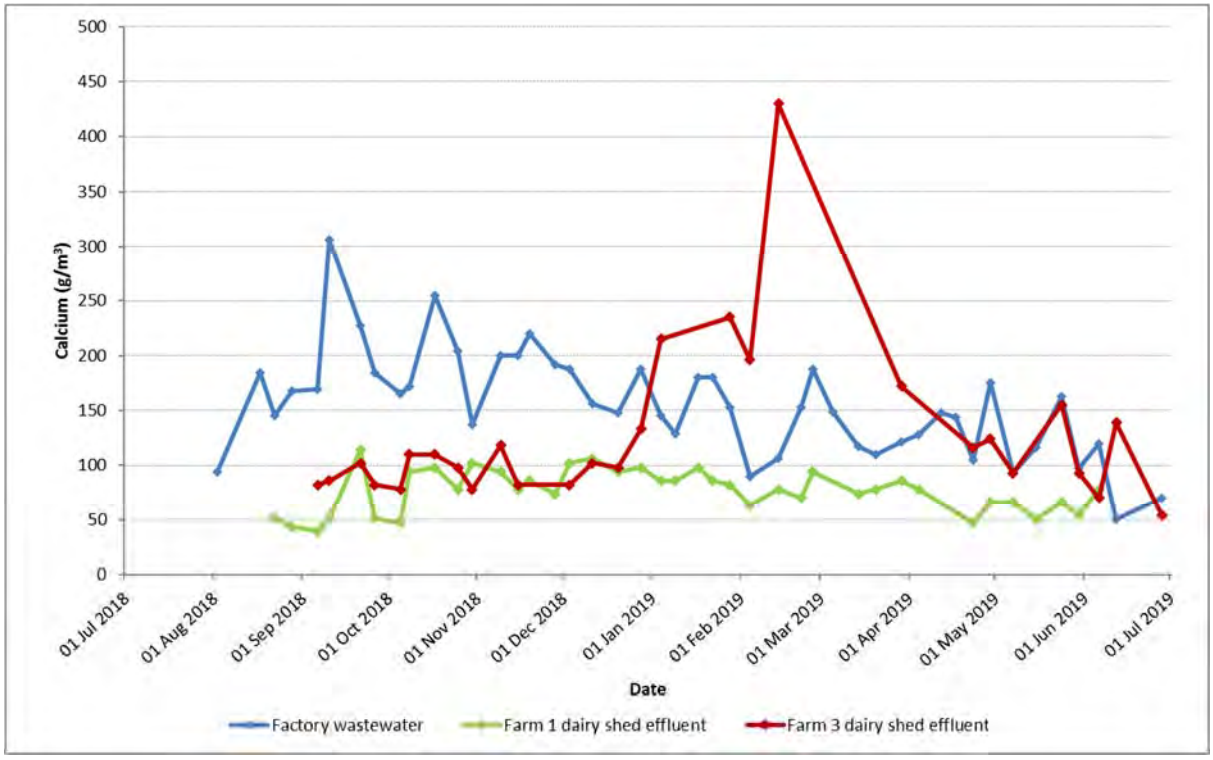

Figure 25 Calcium concentration of the factory wastewater and dairy shed effluents

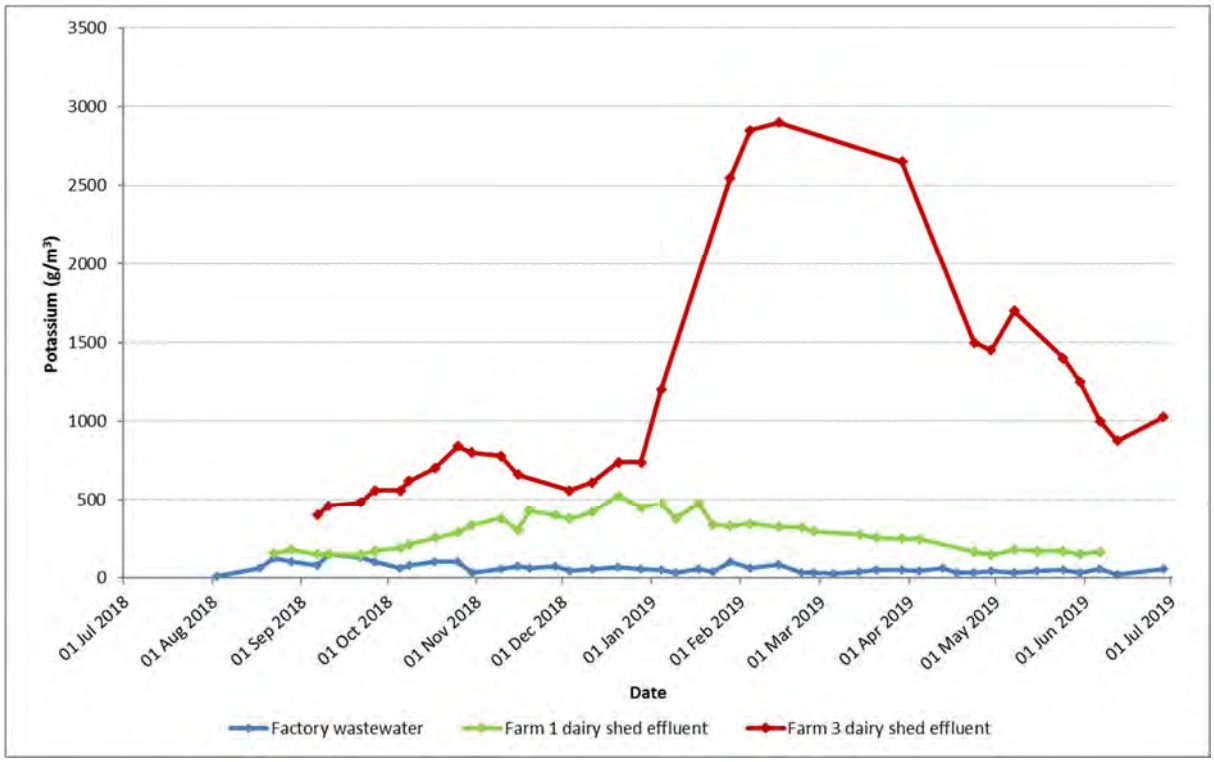

Figure 26 Potassium concentration of the factory wastewater and dairy shed effluents

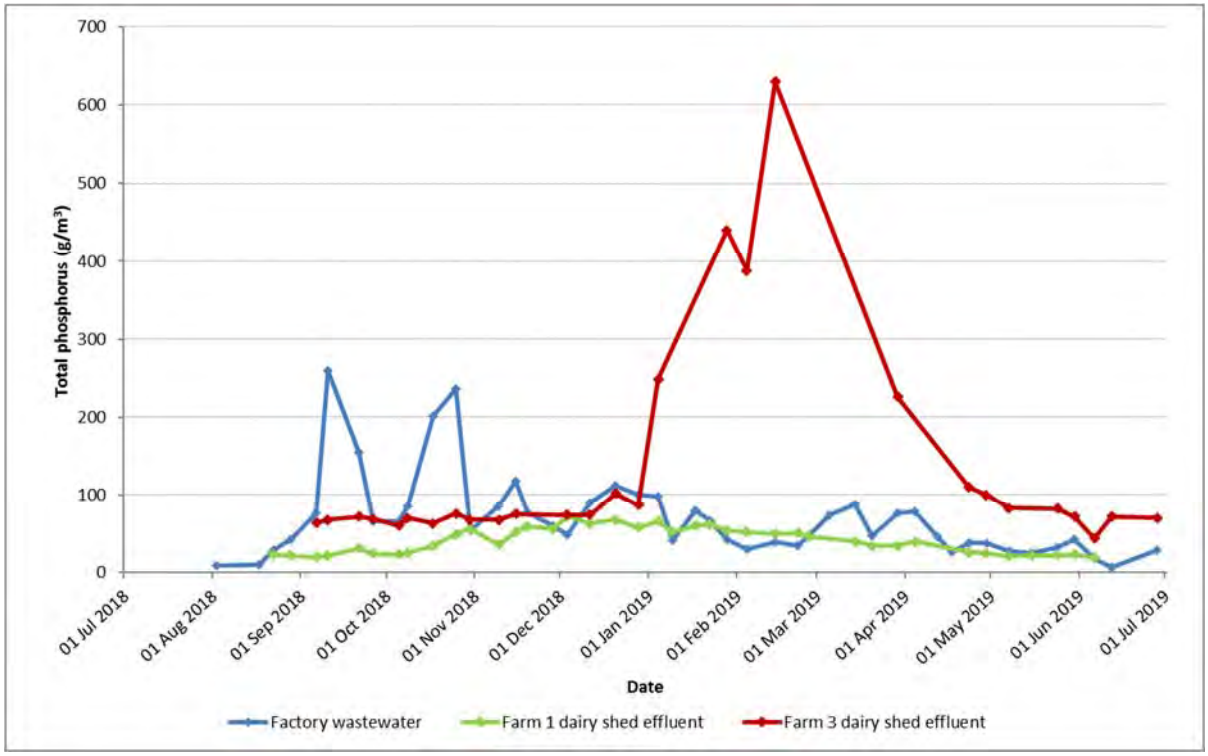

Figure 27 Phosphorus concentration of the factory wastewater and dairy shed effluents

The Company advised that the increase in the Farm 3 DSE constituents in February and March 2019 that are shown in the figures above was due to a breakdown of the separator, which allowed more solids through to the DSE irrigation pond. Following repair, concentrations returned to more typical levels.

Interlaboratory comparison

An interlaboratory comparison exercise was carried out on 20 December 2018 on 24-hour composite samples taken of factory wastewater and farms DSE by the Company. The results are given in Table 10.

Table 10 Results of interlaboratory comparison on factory and dairy effluents, 20 December 2018

Parameter	Unit	Factory wastewater		Dairy shed effluent (Farm 1)		Dairy shed effluent (Farms 2 & 3)	
		Fonterra (ICS)	TRC	Fonterra (ICS)	TRC	Fonterra (ICS)	TRC
Sum of cations	meq/L		6.9		23		31
Sum of anions	meq/L		16.5		23		29
Alkalinity, total to pH 4.5	g/m³ $CaCO_3$	-	< 1.0	-	820	-	1,060
Biochemical oxygen demand (BOD)	g/m³	3,800	5,200	600	200	600	360
Calcium	g/m³	148	139	94	85	98	87
Chloride	g/m³	-	66	-	210	-	350
Chemical oxygen demand (COD)	g/m³	10,790	10,700	-	-	-	-
Conductivity, 25°C	mS/m	-	146	-	243	-	350
Bicarbonate	g/m³ HCO_3	-	< 1.0	-	1,000	-	1,280

Parameter	Unit	Factory wastewater		Dairy shed effluent (Farm 1)		Dairy shed effluent (Farms 2 & 3)	
		Fonterra (ICS)	TRC	Fonterra (ICS)	TRC	Fonterra (ICS)	TRC
Potassium	g/m^3	69	101	525	360	740	600
Potassium adsorption ratio		-	1.3	-	5	-	8
Magnesium	g/m^3	11.9	13.3	21	31	26	38
Sodium	g/m^3	113	108	68	64	87	82
Ammoniacal nitrogen	g/m^{3}N	-	1.68	-	88	-	92
Nitrate + nitrite	g/m^{3}N	-	63	-	0.39	-	0.35
Oil and grease	g/m^3	-	< 10	-	69	-	121
pH	pH	4.3	4.2	7.7	7.8	7.8	8.0
Sodium adsorption ratio		-	2.3	-	1.5	-	1.8
Suspended solids	g/m^3	-	530	-	690	-	1,430
Total Kjeldahl Nitrogen (TKN)	g/m^{3}N	8.2	50	128	143	200	270
Total Nitrogen	g/m^{3}N	89	114	129	144	200	270
Total Phosphorus	g/m^{3}P	112	40	68	71	102	101
Ash	g/m^3	963	-	1,208	-	1,895	-
Nitrate	g/m^{3}N	80	63	0.85	0.30	0.04	0.28
Nitrite	g/m^{3}N	0.44	0.10	<0.01	<0.10	<0.04	<0.10

In the 2015-2016 year, agreement between laboratories was poor, apart from on pH, which led to a revision of the methods of sample compositing, splitting and identification. In this case, it was not possible to obtain a true "split" sample based on the revised methods as the Company had already collected their sample prior to the inspecting officer's arrival. This is likely to impact on the agreement due to possible differences in the samples' consistency. During the year under review, the only parameters that were found to have good agreement (within ± 5%) for all three effluent sources were again pH and sodium. COD agreed well for the factory wastewater, with reasonably good agreement (about ± 10%) for calcium and magnesium. Total phosphorus had a good agreement for the dairy shed effluents, while there was reasonably good agreement between calcium and Kjeldahl nitrogen for Farm 1. In the 2017-2018 year, the other parameters were generally found to have been overestimated by The Company for all waste streams when compared to the Council determinations, however during the year under review there were almost equal numbers of over and under estimates. In the dairy shed effluent, the majority of the components were overestimated by The Company in comparison. Getting good agreement for the dairy shed effluents can be particularly problematic due to the nature of the waste. The first area of focus would be to ensure that the samples are split in an effective manner, which was not achieved during the year under review. BOD, potassium and total nitrogen were the parameter showing particularly poor agreement across all of the wastewater streams. In the case of total nitrogen, there was a consistent underestimation of between 10 and 26%, in the results reported by The Company. This is the fourth series of interlaboratory comparisons that have been undertaken, and these are scheduled to continue.

A wide range of parameters were tested by Council, for future reference. Historically, for nitrogen species, it has been determined that nitrate was the major single component in the factory wastewater, whereas the DSE was almost exclusively ammonia and organics (which are the components that are measured by TKN

analysis). During the 2017-2018 year, the Council laboratory obtained atypical results for the nitrate-N and the TKN of the factory wastewater, with the TKN having been calculated from nitrate/nitrite nitrogen and total nitrogen results. During the year under review atypical results were again obtained for the nitrate and TKN results, however the contract laboratory determines the nitrate-N, nitrate-N and TKN, on which the total nitrogen is calculated. The two different methods of obtaining the TKN result both showing atypical results, supports the indications that the factory wastewater has contained an increased amount of organic nitrogen than would be expected for this waste stream.

The discrepancy between the sum of anions and sum of cations, and conductivity indicate the presence of another anion (organic acid) in the factory wastewater that has not been quantified in the parameters determined.

2.1.2 Council monitoring

2.1.2.1 General inspections of factory premises

Twelve scheduled inspections of the premises, treatment system and Kaupokonui Stream were performed during the 2018-2019 period. A standard pattern was followed by the officer of the Council with all areas of discharges and potential spillage sites inspected. The inspections were made at approximately monthly intervals. Company staff met with the Council officer and provided an update on the Company's performance on each inspection occasion.

2.1.2.1.1 General site

The monthly inspections revealed no major problems with the general factory site. Generally the site was clean, tidy and orderly.

Improvements discussed at the site inspections included:

- Approval was granted for a medium term plan to move to a fixed irrigator system that will eventually replace all travelling irrigators on the farms. Detailed planning will commence following replacement of the consent.

2.1.2.1.2 Intake from the Kaupokonui Stream

The monthly inspections showed that both the Company's weir and intake system worked well during the period under review. The intake screens were in place and cleaned regularly during the year under review.

The fish pass installed by the Company under the guidance of the Council in March 2004, contained an adequate level of water during all inspections. Trout were observed around the weir at the August and November 2018 inspections.

2.1.2.1.3 Spray cooling wastes discharges to the Kaupokonui Stream

New cooling towers were constructed and commissioned in August and September 2015, designed to achieve an improved performance. Flow and temperature meters were installed on the inflow line to the towers, along with a temperature sensor on the outflow from the cooling tower that is used to provide the cooling water discharge temperature to Council. A flow meter had been placed on the line through which combined recovery condenser cooling water and stormwater was discharged directly to the stream under consent 0924-3. This was removed during the 2017-2018 year with the diversion of the cooling water to the cooling towers and stormwater to the northern stormwater pond. The installation of telemetry for the monitoring data from these meters had been delayed until December 2015, while landscaping around the towers was carried out.

The cooling water discharge system had variable performance during the monitoring year. The Company's recording system worked well during the year under review. However there were issues with accuracy of the flow data and these are covered in Sections 2.1.1.4, 2.3 and 3.1.

Historically, the most common cause of missing data was due to a third party server going off line temporarily, which then did not accept data until the link was reset. Alerts have now been put in place so that the link can be re-established by Fonterra staff in a more timely fashion. The only remaining missing data tends to be when the probes have been removed during flood conditions, the null switch has been activated during calibrations, or rarely there are faults or electrical problems at the site. The missing data rate has been reduced to about 3% for the last two years.

The growth in riparian vegetation continued to be effective at preventing spray drift of cooling water beyond the property.

2.1.2.1.4 Other discharges to the Kaupokonui Stream

During October 2017 works to combine and relocate the IGL plant and factory extension stormwater pipes had occurred and for a period, the stormwater discharged via the new outfall without any treatment as the stormwater pond was yet to be completed, however a shut off valve had been installed and was functional at the time of this inspection (Photo 1). All discharges from the norther area of the site occurred from this new combined outfall following this with the first discharge from the new pond logged by the Company as being 8 March 2018.

Photo 1 Northern stormwater pond, stop valves and outfall to the Kaupokonui Stream

At the August inspection it was noted that the groundwater discharge from southern pond was to be addressed in near future by contractors.

2.1.2.1.5 Water bore in the Kaupokonui Catchment

The Company ceased using its groundwater bore in mid-March 2013, when an upgrade of the York Chiller removed the need for additional cooling during periods of warmer temperatures in Kaupokonui Stream. Groundwater level in the bore was last measured on 25 September 2014, at 6.17 m below the top of the upstand. The Council was advised during the 2017-2018 year that the Company intended to decommission this bore and withdraw the application to renew this consent at some point. The withdrawal application was not received by Council during the year under review.

2.1.2.1.6 Discharges to the Motumate Stream

There is no longer any discharge of heat-elevated cooling water to the unnamed tributary of the Motumate Stream, previously used by the Kapuni School to heat its swimming pool. The school is now closed and no longer has a need for this service.

Bore water, when used, was also discharged back to the Motumate catchment via a tributary immediately opposite the factory across Manaia Road. The Council was advised by the Company that, as the groundwater cooling water system has not been utilised for a number of years, the Company also intend to withdraw the application to renew this consent at some point.

2.1.2.1.7 Spray irrigation of wastewater

In general, the monthly inspections showed a good level of compliance in relation to the irrigation of wastewater.

Spray irrigation involves the use of both travelling irrigators and in-ground spray irrigators. Prior to mid-2007, approximately 95 ha was irrigated using travelling irrigators, while a further 25 ha was irrigated using in-ground irrigators. Works commenced in January 2007 on extension of the in-ground irrigation system, mainly on a parcel of land between Farm 2 and Farm 3 that had been purchased by the Company.

This extension increased the irrigated area during the 2007-2008 dairy season by 49 ha to 169 ha, of which 44 ha is reticulated with in-ground irrigators. The total area farmed is 244 ha.

No spray drift across streams was observed. Care is required while irrigating near watercourses particularly during wet and/or windy conditions. Spraying is not to occur within 20 m of a watercourse (condition 6 of consent **0923**). A weather station with telemetry to the pump station on Farms 2 and 3 was installed in August 2015, allowing faster response to changes in wind direction.

In previous monitoring periods some browning of grass, overland flow and minor ponding has been noted. Fonterra Research Centre was engaged to investigate the ponding/run-off issues. Subsequently, annual aeration was conducted for several years from the 2002-2003 monitoring period over a significant area of the Company's farms, which improved the performance of these areas ability to receive and assimilate the irrigated wastewater. Testing undertaken in May 2010 indicated that aeration is no longer required, unless there are visible signs of ponding. Some additional aeration was undertaken in February 2016.

On the whole, the general wastewater irrigation was found to be well managed. The pasture receiving irrigation appeared to be healthy, with no ponding, grass burn, or run-off observed during the inspections. Buffer distances were being adhered to at the time of all inspections.

2.1.2.1.8 Riparian planting

The riparian planting on the left bank of the Kaupokonui Stream adjacent to and downstream of the cooling sprays continues to provide secondary filtering of windblown spray cooling water drift as well as aesthetically benefiting the site. New planting was undertaken on the riverbank upstream of the factory in the 2001-2002 monitoring period. The gully areas in the vicinity of the Farm 1 cowshed to the downstream farm boundary, which were planted during the 1997 and 1998 winter periods, continued to be maintained during the 2018-2019 monitoring period.

The Company has continued to invest in planting and fencing of waterways around the factory and Company farms, with a significant riparian programme of approximately $77,000 value over about 12 km of the Kaupokonui Stream. This also includes an annual (index linked) donation of $3,000 to the Taranaki Tree Trust in accordance with condition 10 (b) of consent **0919.** The Taranaki Tree Trust was dissolved in 2016 after which time the donations were paid directly to the Council. To date a total of $52,080.00 had been donated to the Trust. There was no contribution received during the 2018-2019 year (and no funding allocated to plan holders). The contribution is normally paid upon invoice from the Council. Due to the consent expiring, Council omitted to send out an invoice. The Council systems have now been updated to cater to activities operating under Section 124 protection and the Company have now been invoiced for the 2018-2019 contributions. A further invoice will be sent at the usual time for the 2019-2020 contributions.

At the end of the 2018-2019 year, the Council had prepared 160 Riparian Management Plans (RMP's) fully or partially located in the Kaupokonui Stream catchment (no change in plan numbers). Of these, 24 plans, covering 31 km of streambank, meet the criteria for funding given in condition 10 of consent 0919-3 (that is, are located in the Kaupokonui Stream catchment above the Company's cooling water discharge). The riparian plan planting progress is illustrated in Figure 28.

Figure 28 Riparian planting progress in the Kaupokonui Stream catchment above the lactose plant

Subject to confirmation by audit, the riparian plantings recommended in the plans that had received funding to the end of June 2018 (9 plans) covered a total stream bank distance of 33.8 km, of which five (55%) were 100% completed.

This compares to 28 plans covering a total of 30.3 km, of which ten (36%) were 100% completed in the Kaupokonui Stream catchment downstream of the plant, and 160 plans covering a total of 764 km, of which 34 (21%) were 100% completed in the wider Kaupokonui parent catchment.

During the 2018-2019 year no farms received rebates under this scheme.

Taking into account the riparian planting that was already existing at the time the plans were developed, the progress towards full implementation of the additional planting required is shown in Table 11.

Table 11 Comparison of riparian plan progress in the Kaupokonui Stream catchment and Kaupokonui catchment (subject to confirmation by audit)

	Kaupokonui Stream				Kaupokonui Catchment total
	Upstream Fonterra	Plans that have received funding	Upstream of Fonterra no funding	Downstream Fonterra	
Total length of streambank, km	92.9	32.7	60.2	30.3	764
Original additional recommended planting, km	32.1	12.5	19.6	14.3	343
Planting implemented, km	14.5	8.9	5.6	9.4	195
Planting percentage implemented,%	45	71	29	66	57
Fencing implemented, km	84.3	29.8	45.3	-	-
Percentage of steam bank fenced, %	90	91	75	-	-

It can be seen that the current data indicates that although there is a moderate implementation rate in the catchment as a whole (57%), there is a low implementation rate upstream of the plant (45%). As would be expected, there is a higher implementation rate on those farms that have received funding (71%) when compared to those that have not (29%). It is noted that the figure reported above are now likely include the additional planting that was facilitated and funded by the Company at the end of the 2016-2017 year.

It is also important to note that due to the fact that the Kaupokonui Stream catchment upstream of the plant has an extensive network of tributaries, there is a longer distance of stream bank above the plant than there is below it. There was also only half the amount of new planting originally recommended below the plant. This means that it only required 0.9 km of planting to increase the downstream percentage completion from 57% to 66% in the past year. This length of additional planting would only increase the percentage completion upstream of the plant by 3%.

The data shows that progress continues to be made with the riparian planting in the Kaupokonui Stream and wider Kaupokonui catchment. The plan percentages implemented have increase by between 8 and 16 %, and the percentage of completed plans has increase by between 8 and 22 %, when compared to the data available at the end of the 2017-2018 year.

An example of riparian planting is given in Photo 2, along the Waiokura Stream on Farm 2, and about 1.1 km south of Skeet Road (Riparian Management Plan RMP1425). Groundwater monitoring bore

GND2050 is situated down gradient of the fixed-in-place irrigators and up-gradient of the riparian plantings.

In a separate project initiated by the Company in September 2009, the Manaia Road boundaries of Farm 1 and Farm 3 were planted with native species for screening of the adjacent irrigation areas. A total of 2,142 plants were planted, over a total distance of 1,071 metres, at a cost of $6,224. The roadside plantings provide visual screening and amenity value, protection of neighbours and road users from spray drift, and shelter for livestock and pasture. In addition, the Manaia Road boundary adjacent to the storm pond on the lactose plant site was planted in winter 2010. In November 2011, approximately 1,600 more plants were planted on the Manaia Road boundary of the Farm 1 run-off. Replanting was undertaken where a new crossing was installed over Waiokura Stream between Farm 2 and Farm 3 in June 2013. In June 2017, the Company purchased 4,000 native plants at a cost of $14,387. The Company supplied these to 11 upstream properties, all but one of which has a Riparian Management Plan. The Company also liaised with farmers regarding the planting. Additional fencing and planting was undertaken by the Company on Farm 3 during the year under review.

All Fonterra plantings were maintained in the 2018-2019 year.

Photo 2 Riparian plantings along Waiokura Stream, Farm 2 with fixed irrigators in operation

2.1.2.1.9 Disposal of solid wastes

Solid wastes from annual cleaning of the waste effluent tank and lime silo have been disposed of by burial on Farms 2 and 3 during the winter maintenance shut-down for a number of years. This activity is permitted under Rule 29 of the Regional Freshwater Plan, which covers the discharge of contaminants from industrial and trade wastes premises onto and into land subject to certain conditions, including minimum distance from water courses and water supply bores. A record is kept of the volumes discharged and of the burial

site locations. The disposal sites are monitored during the routine monthly inspection of the farms by Council. Compliance with the conditions of the Rule has been found on each monitoring occasion.

During the 2016-2017 year a Trommel (solids separator) was installed on site to separate the solids (diatomaceous earth and activated carbon) out of the waste stream from the filtration of the whey permeate. Prior to the installation the Trommel, these solids were either accumulated in the wastewater tank or were irrigated onto land within the wastewater. In October of that year the Company advised that the current carbon burial pit was to be filled in due to operational and health and safety constraints surrounding the regular on going presence and use of open pits on the farm. From January 2018 the filtered material has been removed from the site by a composting/fertiliser company for use in their products.

Carbon from the wastewater tank continued to be buried on farm during the cleaning operations that occur during the shutdown period upto and including the winter 2018 shutdown. During the year under review, the Company approached the Council for confirmation that shallow (between 25 and 50mm) direct drilling of the waste into the pasture would still comply with Rule 29. Approval was given and during the 2019 winter shutdown the waste was direct drilled into the paddock to the south of the southern stormwater pond on the corner of Manaia and Skeet Roads.

2.1.3 Results of discharge monitoring

2.1.3.1 Physicochemical

2.1.3.1.1 Cooling waters' quality

Monthly sampling of the spray cooling water discharge (authorised by discharge permit **0919-3**) involved the collection by the Company of one representative 24-hour composite sample of each waste, to be analysed by the Council. The results of these analyses for year under review are presented in Table 12 (STW002017). Conditions of this consent do not place limits on individual component concentrations in the discharge, but focus on the avoidance of effects in the receiving waters.

The cooling water previously discharge via the combined stormwater/cooling water pipe discharge (STW02018, permit **0924-3**) was diverted to the cooling tower and the pipework was removed in February 2018. Prior to this, a composite sample was collected from the discharge from this system by the Company, which was analysed by the Council.

A summary of the historical results for both the cooling water discharge and combined stormwater/cooling water discharge are given in Table 13 for comparative purposes.

Nine of the ten samples collected during the year under review were composite samples, however there was one occasion on which there was no discharge and occasions when a composite sample was not available at the time of inspection.

Table 12 Results of the analysis of spray cooling water discharge during the year under review (STW002017)

Date	BOD_5		Conductivity @ 25˚C	pH	Turbidity
	Total	Filtered			
	g/m^3	g/m^3	mS/m	pH	NTU
20 Jul 2018[a]	-	-	-	-	-
16 Aug 2018[b]	-	-	-	-	-
20 Sep 2018	< 0.8	< 1.0	9.9	7.3	3.2

Date	BOD_5		Conductivity @ 25˚C	pH	Turbidity
	Total	Filtered			
	g/m^3	g/m^3	mS/m	pH	NTU
17 Oct 2018	< 0.8	< 1.0	10.5	7.4	0.68
15 Nov 2018	< 0.8	< 1.0	11.4	7.4	1.04
20 Dec 2018	2.2	< 1.0	11.4	7.4	0.92
15 Jan 2019	0.8	< 1.0	8.0	7.4	7.4
21 Feb 2019	0.4	0.5	12.1	7.6	0.4
21 Mar 2019[c]	0.6	< 0.4	11.8	7.6	11.6
30 Apr 2019	< 0.8	< 0.8	7.8	7.4	1.05
23 May 2019	0.7	0.6	11.3	7.6	0.57
20 Jun 2019	0.5	< 0.4	12.9	7.4	0.74
Range	0.4 – 2.2	<0.4 - <0.8	7.8 – 12.9	7.3 – 7.6	0.4 – 11.6
Median	0.5	<1.0	11.4	7.4	0.98

a No discharge

b Insufficient volume

c Insufficient composite volume, cycle grab sample collected

Both discharges have been sampled (mainly as 24 hour composites) and analysed by the Council during previous monitoring periods. A summary of these results is presented in Table 13.

Table 13 Summary of cooling water discharge quality from the Council surveys during the period March 1992 to June 2018

Waste	Spray cooling water (STW002017)				'Stormwater/cooling' water (STW002018 – to 15 Feb 2018)		
Parameter	Unit	No. of samples	Range	Median	No. of samples	Range	Median
BOD_5	g/m^3	218	<0.5 - 460	2.1	233	<0.5 - 1,100	2.5
BOD_5 (filtered)	g/m^3	207	<0.5 - 91	1.0	216	<0.5 - 1,100	1.4
Conductivity at 20˚C	mS/m	225	3.1 - 46.8	9.8	240	5.4 - 132	10.8
Oil and grease	g/m	2	<0.5	<0.5	99	<0.5 - 4.3	<0.5
pH	pH	105	5.8 - 8.2	7.4	144	4.6 - 10.6	7.2
Turbidity	NTU	112	0.51 - 120	3.5	125	0.26 - 110	4.2

For the spray cooling water, there were no notable seasonal variations in the parameters monitored. The median total BOD has remained low (less than 1 g/m^3) for two successive years following the three successive years when it decreased significantly (2016-2017 annual median of 0.5 g/m^3 down from 1.2 g/m^3 in 2015-2016, 4.7 g/m^3 in 2014-2015 and 7.2 g/m^3 in 2013-2014).

2.1.3.1.2 Stormwater quality

Discharges from stormwater pipe outlets to the stream have previously been sampled at four locations: from the northern (STW001062) and southern (STW002018) areas of the lactose plant, the IGL plant (STW001109), and the southern stormwater pond (STW002078), as shown in Figure 29.

The discharge from the previously combined stormwater/cooling water discharges have been addressed in section 2.1.3.1.1 above.

During 2017-2018, stormwater from the IGL plant, factory extension (STW001109), and the southern area outside the lactose plant itself (stormwater component of STW002018) was combined with the northern discharge (STW001062) for treatment in the northern stormwater pond. The discharge location for the northern stormwater pond outfall is STW002099.

Stormwater discharges from the containment ponds were found to be occurring very rarely at the time of inspection during the year under review.

2.1.3.1.2.1 Northern stormwater pond outfall

A sample was collected of the discharge from the northern stormwater pond outfall (site STW002099, Table 14) once during the period under review.

Table 14 Results of the analysis of a grab sample of the northern stormwater pond during year under review (STW002099)

Date	Flow rate (estimated)	BOD_5	Conductivity @ 25˚C	Oil and grease	pH	Suspended solids	Turbidity
	L/s	g/m^3	mS/m	g/m^3		g/m^3	NTU
20 Sept 2018	-	5.2	11.4	< 4	7.2	8	4.5
Consent limit	**-**	**-**	**-**	**15 (hydrocarbons)**	**6.0 – 8.5**	**100**	
2017-2018							
No of samples	-	4	1	4	4	4	4
Minimum	-	1.7	7.1	<0.5	6.0	2	0.91
Maximum	-	290	7.1	<5	8.2	27	10
Median	-	128	7.1	0.6	6.7	8	7

The limits prescribed by consent conditions for hydrocarbons, pH and suspended solids were complied with at the time of the sampling. The BOD was elevated above the guideline value given in the Regional Freshwater Plan 5.0 g/m^3), however, this is not limited by the consent and no effects were observed in the receiving water.

2.1.3.1.2.2 Southern stormwater pond outfall

Samples were collected from the outlet of the stormwater pond (Site STW002078, Table 15 and Photo 3) on three occasions during the year under review, with the stormwater pond outlet valve reported to have been closed on two of these sampling occasions, suggesting groundwater seepage. At the April inspection a grab sample was taken from the pond as an indicator of the stormwater quality at that time. The high BOD, low flow discharge in July 2018 had no observable effect on the Kaupokonui Stream, which was in fresh at the time of the sampling survey. The sample collected from the pond on 30 April was found to have elevated BOD and a pH that was marginally lower than the permitted level. Stormwater discharge records provided by the Company showed that there had been no stormwater discharges from the southern pond between this sampling date and 16 May 2019. The condition of the water at that time was visually excellent and the pH was within consent limits at the time of discharge.

Table 15 Results of the analysis of grab samples of the southern stormwater pond discharge during the year under review

Date	Flow rate (estimated)	BOD_5	Conductivity @ 25˚C	Oil and grease	pH	Suspended solids	Turbidity
	L/s	g/m^3	mS/m	g/m^3		g/m^3	NTU
20 July 2018^	-	12	54.5	< 4	7.9	< 6	23
16 Aug 2018^	-	1.0	51.4	< 4	7.7	< 3	1.7
20 Sept 2018	1.0	6	38.2	< 5	7.6	11	22
30 April 2019*	-	18	5.6	5	6.4	9	4.4
Consent limit (0924-3)	**-**	**-**	**-**	**15 (hydrocarbons)**	**6.5 – 8.5**	**100**	
2008-2018							
No of samples	-	34	34[a]	31	35	32	35
Minimum	-	<0.5	4.6	<0.5	4.6	<2	0.05
Maximum	-	920	48.8	< 6	7.9	150	31
Median	-	1.2	38.0	<0.5	7.4	2	1.0

^ Stormwater pond outlet valve closed

* Sample collected from pond, no discharge

[a] Conductivity at 20˚C

Photo 3 Outfall from the southern stormwater pond to Kaupokonui Stream (STW002078)

Conductivity values at this site have been found to vary widely in the past, tending to be higher in winter when groundwater infiltration occurs. (Two sources of groundwater infiltration to the stormwater lines were found by video camera and the lines re-grouted in July 2009, but some infiltration continued). Limits prescribed by conditions on consent **0924-3** were complied with.

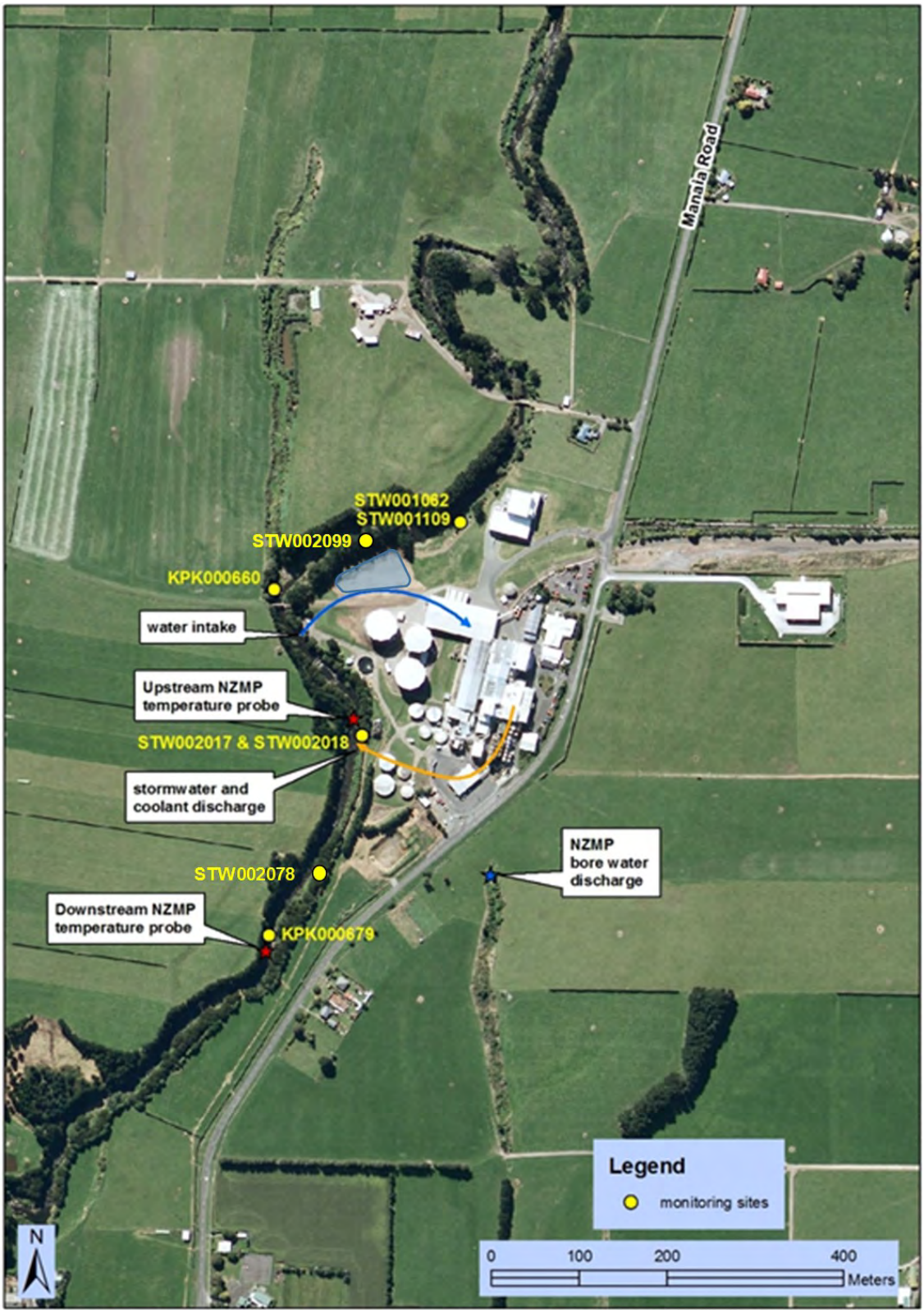

Figure 29 Section of Kaupokonui Stream for physicochemical monitoring in relation to Fonterra Ltd's waste discharges to water

2.1.4 Receiving water (Kaupokonui Stream) quality

Sampling of the Kaupokonui Stream adjacent to the Company's factory and Farm 1's wastes irrigation area was performed by the Council on the monthly inspection visits. Three sites are located in the Kaupokonui Stream (Figure 29).

Table 16 Location of water quality sampling sites

Site code	Site	Location	Map reference, NZTM	
			Easting	Northing
KPK000655	Kaupokonui Stream	1 km upstream of rail bridge	1697963	5630770
KPK000660	Kaupokonui Stream	Immediately upstream of rail bridge	1697613	5629791
KPK000679	Kaupokonui Stream	150 m downstream of spray cool discharge zone	1697607	5629399

Sampling was performed under varying flow conditions ranging from 0.58 m^3/s to about 5.41 m^3/s, as measured at Upper Glenn Road hydrometric station, 9.8 km downstream, where the median flow is 2.0 m^3/s, and mean annual low flow (MALF) is 0.74 m^3/s. A record of flows (hydrograph) over the reporting period is presented in Figure 57 . Samples were taken in the mornings. The results of this monitoring are summarised in Table 17 and a copy of the full results are available on request. Past Council sampling results from these sites are presented in summary form in Table 18 for comparative purposes. It is noted that the Council moved to using a contract laboratory for analytical work in April 2018.

Table 17 Summary of Kaupokonui Stream water quality data (ranges) from monthly monitoring for the year under review (N=12 samples)

Parameter	Unit	KPK000655		KPK000660		KPK000679	
		Range	Median	Range	Median	Range	Median
Total BOD_5	g/m^3	<0.4 – 1.6	<0.8	<0.4 - <2	<0.8	<0.4 - <2	<0.8
Filtered BOD_5	g/m^3	<0.4 – 1.0	<1.0	<0.4 - <2	<1.0	<0.4 - <2	<1.0
Conductivity @ 25˚C	mS/m	6.6 – 11.5	10.6	6.8 – 12.2	11.2	6.9 – 14.6	11.8
DRP	g/m^3 P	0.006-0.026	0.014	0.007-0.025	0.014	0.006 – 0.024	0.015
Ammonia-N	g/m^3 N	<0.010-0.074	0.022	<0.010-0.055	0.02	<0.010-0.049	0.017
Nitrate+Nitrite	g/m^3 N	0.21 – 1.15	0.56	0.23 – 1.28	0.67	0.24 – 1.29	0.68
pH	pH	7.2 – 7.8	7.5	6.9 – 7.8	7.5	7.2 – 8.0	7.5
Temperature	˚C	6.0 – 17.4	10.7	6.1 – 17.8	11.1	6.1 – 19.8	11.5
Turbidity	NTU	0.67 – 9.2	1.2	0.54 – 10.4	1.2	0.56 – 10.8	1.1

Table 18 Summary of Kaupokonui Stream water quality data from the Council surveys during the period August 1994 to June 2018

Parameter	Unit	KPK000655			KPK000660			KPK000679		
		No.	Range	Median	No.	Range	Median	No.	Range	Median
Total BOD_5	g/m^3	232	< 0.5 - >8.3	0.6	236	<0.5 - 7.5	0.6	236	<0.5 - >8	0.7
Filtered BOD_5	g/m^3	232	<0.5 - 1.8	0.3	235	<0.5 - 2.4	0.3	234	<0.5 - >8	0.5
Conductivity @ 20˚C	mS/m	233	3.3 - 11.1	9.1	236	3.3 - 11.8	9.5	235	3.2 - 11.9	9.7
DRP	g/m^3 P	47	<0.003 - 0.097	0.015	48	<0.003 - 0.101	0.017	48	<0.003 - 0.103	0.02
Ammonia-N	g/m^3 N	234	<0.003 - 0.869	0.022	228	0.003 - 0.147	0.018	234	<0.003 - 0.248	0.018
Nitrate+Nitrite	g/m^3 N	104	0.06 - 1.26	0.43	105	0.07 - 1.36	0.48	105	0.06 - 1.40	0.52
pH	pH	232	6.8 - 8.5	7.7	235	6.6 - 9.0	7.7	234	6.9 - 8.6	7.8
Temperature	˚C	233	4.9 - 19.1	12.1	237	5.1 - 19.5	12.3	236	5.2 - 21.7	13.5
Turbidity	NTU	133	0.39 - 120	1.1	137	0.40 - 130	1.0	136	0.42 - 160	1.1

The receiving water quality results indicated that there were minimal impacts from the stormwater and cooling water discharges measured in the Kaupokonui Stream, at time of sampling, with no sewage fungus noted over the monitoring period. The biggest pH change was from 7.4 at site KPK000655 to 6.9 at KPK000660 on 20 September 2018. At the time of this survey the northern pond was discharging at a pH of 7.2, which was not significantly different from the upstream site. The cause of the receiving water change could not be identified, however it was not more than the ± 0.5 pH units that is considered to present a barrier to the passage of fish.

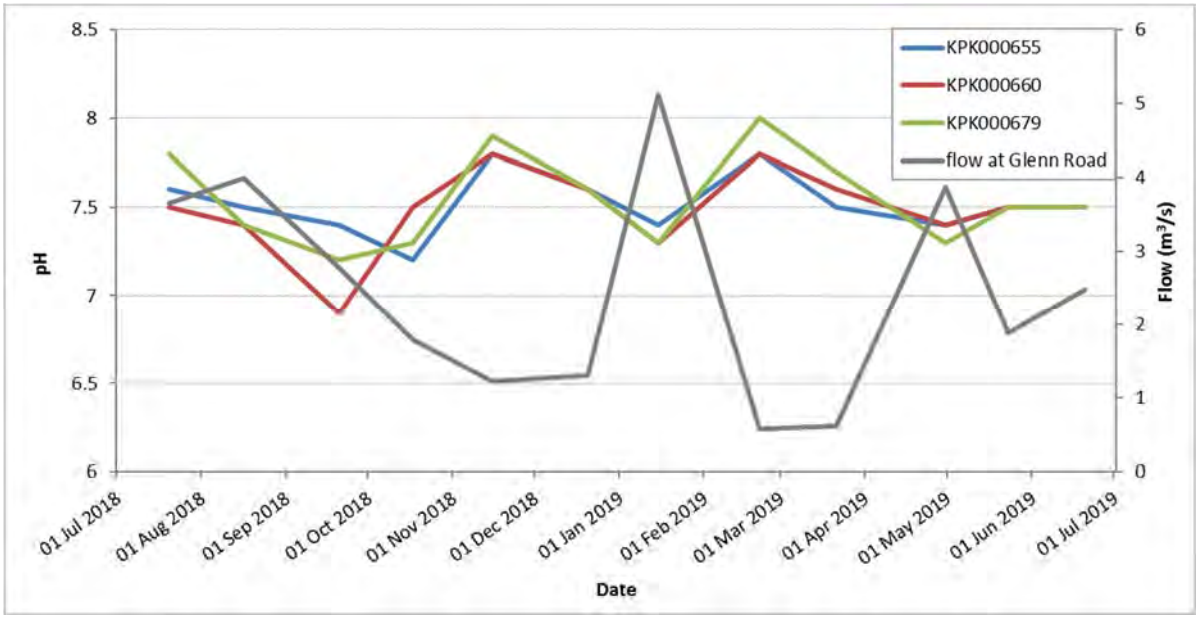

Figure 30 Downstream pH changes in the Kaupokonui Stream from the monthly stream surveys

The consent limit on maximum concentration of filtered BOD of 2 g/m^3, in the river at the mixing zone periphery, was complied with on all monitoring occasions.

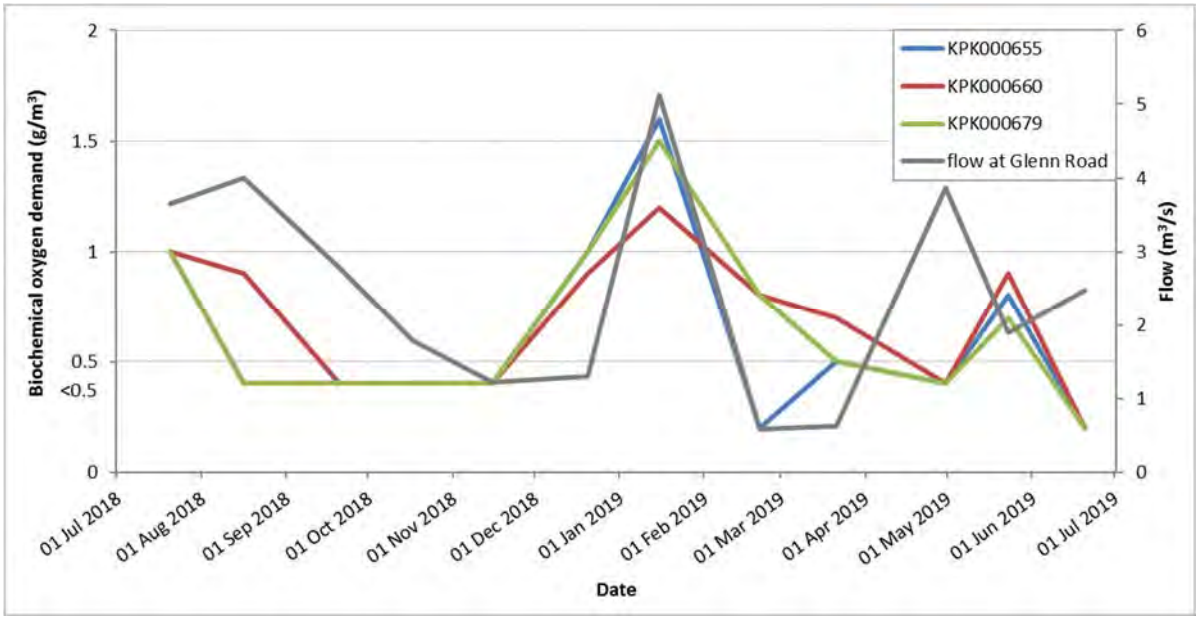

Figure 31 Downstream biochemical oxygen demand changes in the Kaupokonui Stream from the monthly stream surveys

Ammoniacal nitrogen generally decreased in a downstream direction, as one would expect where there are no additional ammoniacal nitrogen inputs.

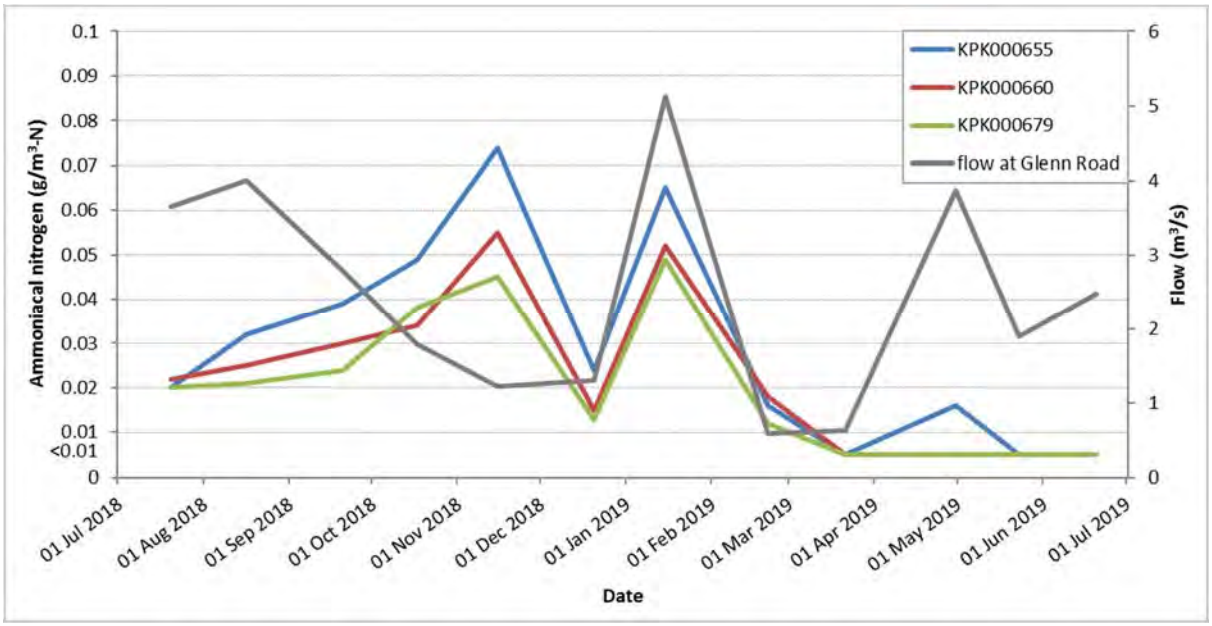

Figure 32 Downstream ammoniacal nitrogen concentration changes in the Kaupokonui Stream from the monthly stream surveys

Conductivity increased slightly in a downstream direction. The largest increase recorded was at site KPK000679 on 20 September 2018, with the influence of the southern stormwater pond discharge evident (38.2 ms/m@25°C). The stormwater discharge was within consent conditions at the time of sampling, and the change in the receiving water was not one that would cause significant adverse effects.

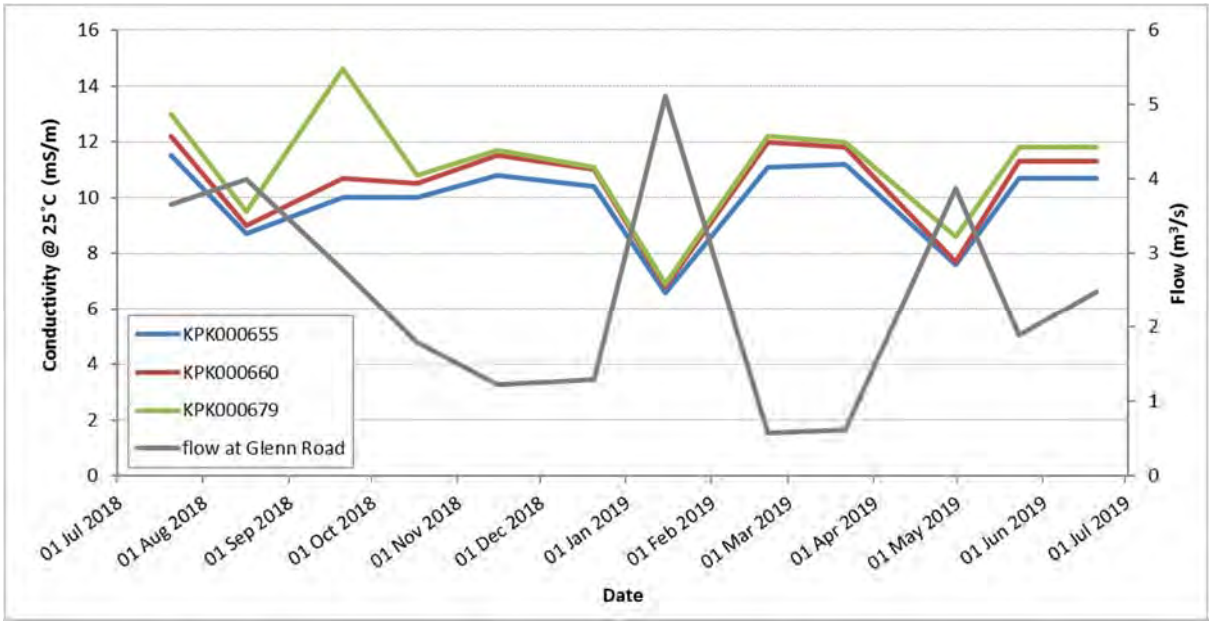

Figure 33 Downstream conductivity changes in the Kaupokonui Stream from the monthly stream surveys

Nitrate-nitrite nitrogen increases slightly between the top site (KPK000655) and the site downstream of Farm 1 and the northern pond (KPK000660), whilst ammoniacal nitrogen is relatively low and generally decreases. Although the nitrate-nitrite nitrogen concentrations are well below the drinking water standards (11.3 g/m^3), and the National Policy Statement for Freshwater Management, Guide to Attributes (draft for comment)[2] (NPS) bottom line values of 9.8 g/m^3 (annual 95th percentile) and 6.9 g/m^3 (annual median). Total nitrogen was added to the analysis suite in September 2018 to help quantify relative influences of the instream oxidation of the reduced ammoniacal form of nitrogen and/or organic nitrogen inputs, compared to increased nitrates due to additional inorganic nitrogen inputs.

[2] Ministry for the Environment. 2018: *A Guide to Attributes in Appendix 2 of the National Policy Statement for Freshwater Management (as amended 2017)*. Wellington: Ministry for the Environment.

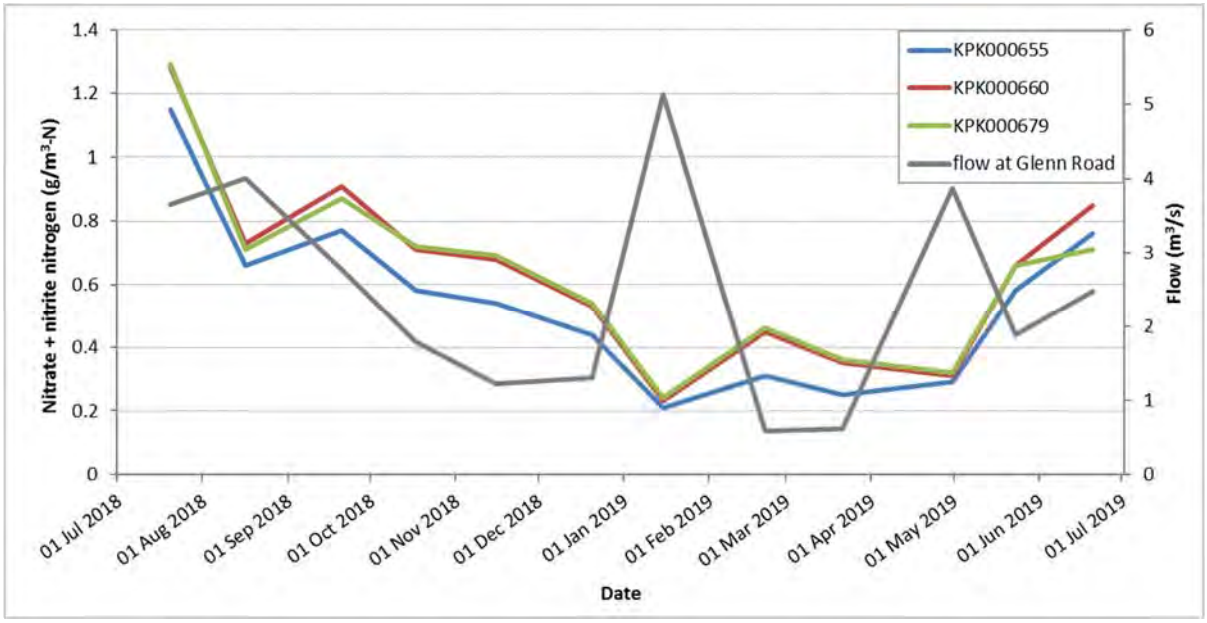

Figure 34 Downstream nitrate-nitrite nitrogen concentration changes in the Kaupokonui Stream from the monthly stream surveys

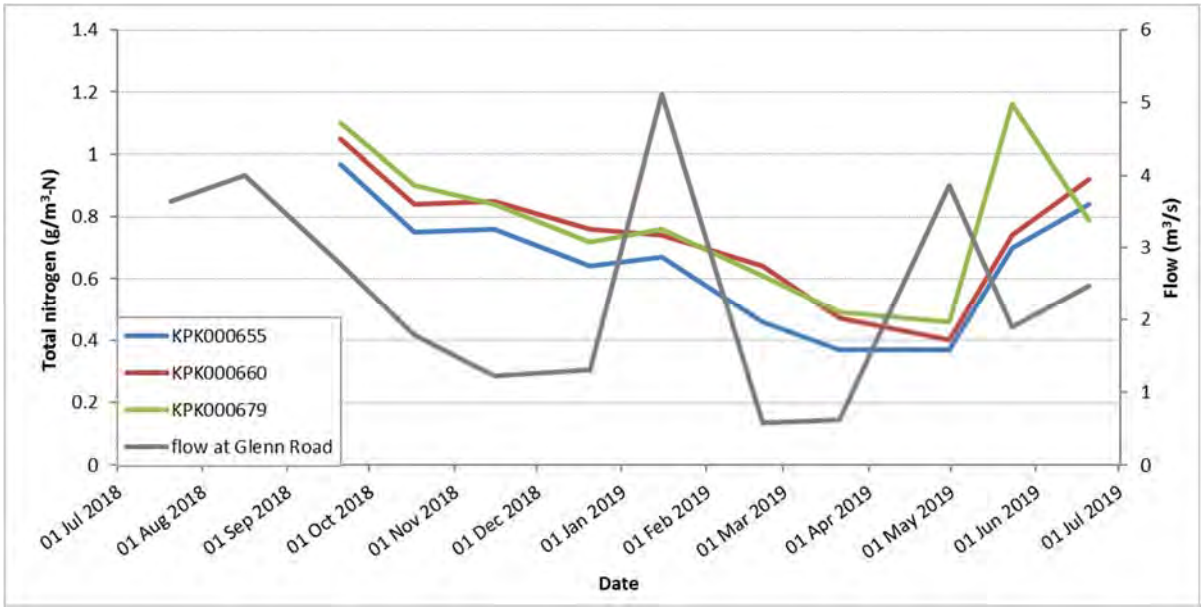

Figure 35 Downstream total nitrogen concentration changes in the Kaupokonui Stream from the monthly stream surveys

Total nitrogen generally follows similar trends to the nitrate-nitrite concentrations, with the exception of the fresh conditions on 21 January 2019 and in the sample collected at KPK000679 on 23 May 2019. On both of these occasions the ammoniacal nitrogen remained low, but there was an increase in the total Kjeldahl nitrogen TKN, indicating the presence of organic nitrogen species. During the fresh conditions all three sites were impacted, whereas during the dry and lower flow conditions on 23 May, the TKN's presence was most noticeable in the KPK000679 sample only.

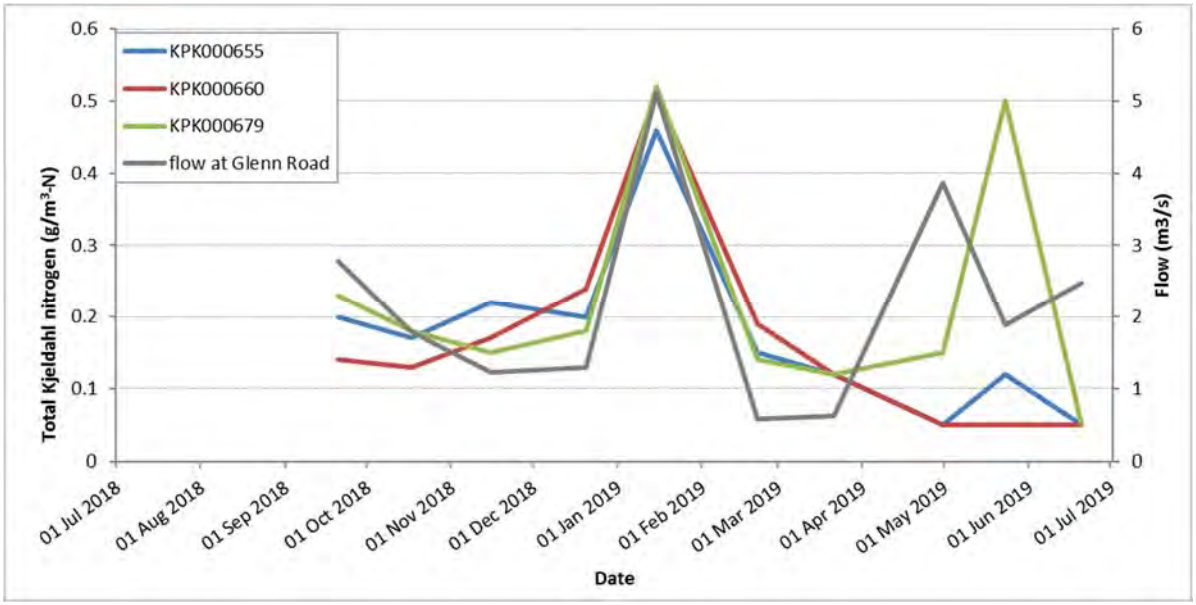

Figure 36 Downstream total Kjeldahl nitrogen concentration changes in the Kaupokonui Stream from the monthly stream surveys

All water temperature increases at the periphery of the mixing zone (150 m downstream of the spray system) were within the 3˚C rise permitted by consent conditions at the time of monitoring (Figure 37).

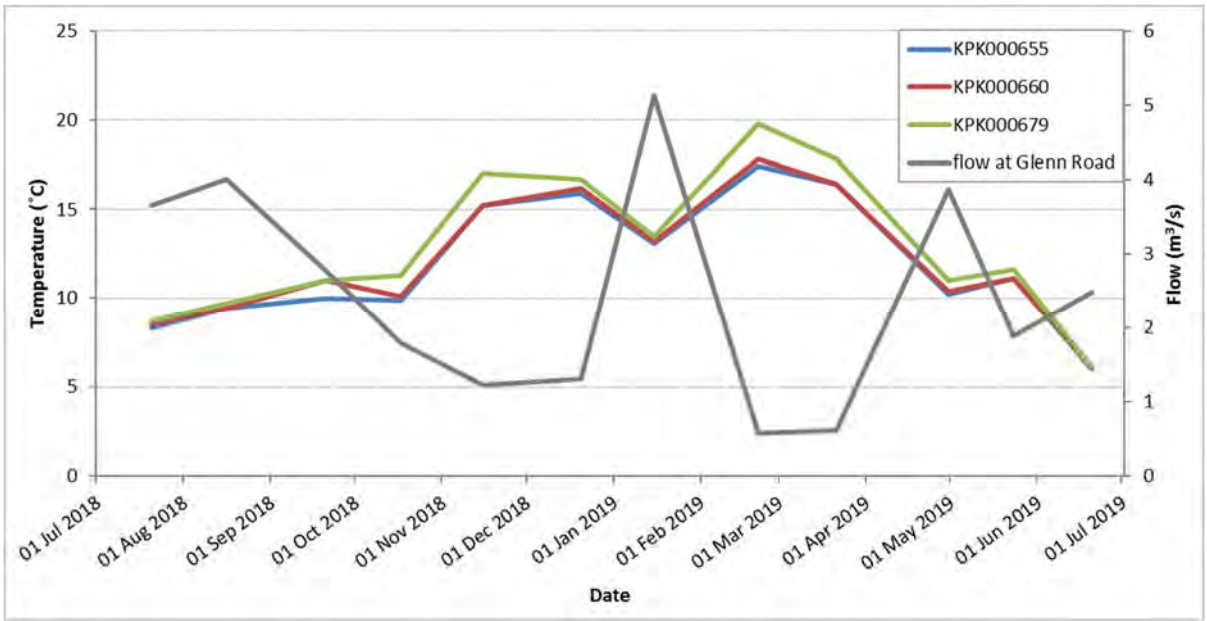

Figure 37 Downstream temperature changes in the Kaupokonui Stream from the monthly stream surveys

It is noted that, as expected, the larger temperature increases are observed at lower stream flows, particularly during the summer months, when there are also warmer air temperatures and higher humidity.

There were no significant changes in clarity, as indicated by turbidity measurements and field comments. Natural variation in clarity was observed, in relation to stream flow and rainfall.

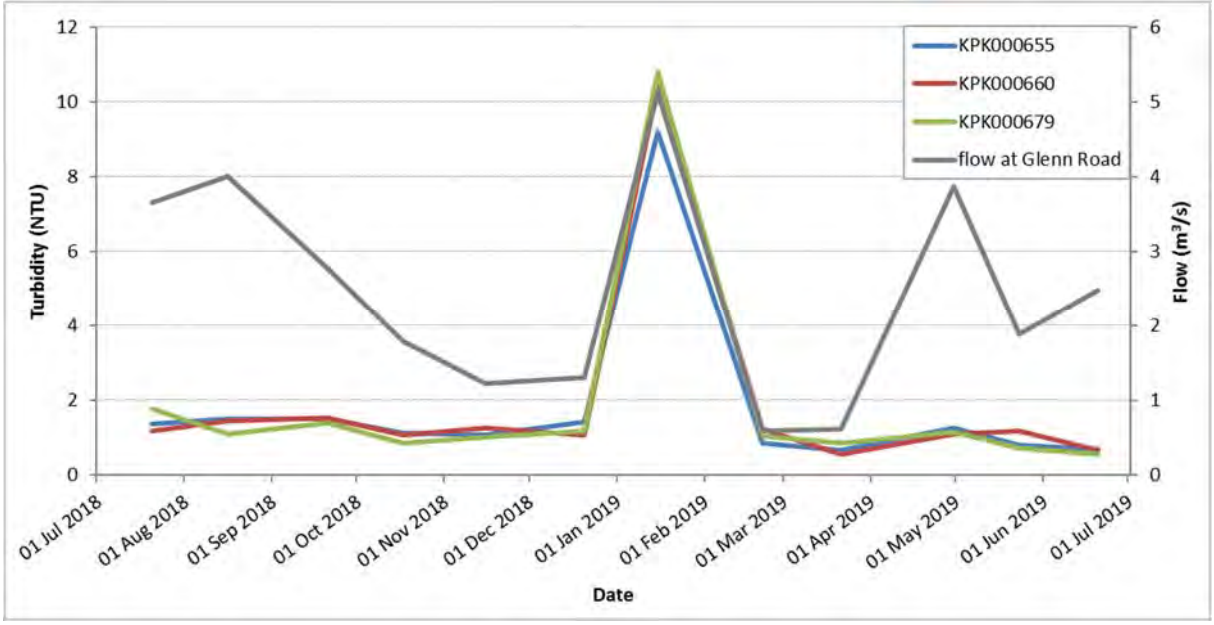

Figure 38 Downstream turbidity changes in the Kaupokonui Stream from the monthly stream surveys

The summary of Kaupokonui Stream water quality data for the upstream (control) site recorded over the 23 year period prior to the 2018-2019 monitoring period (Table 18) and during this period (Table 17), shows that generally, apart from a single lapse in May 2007, there has been good water quality for the parameters measured under normal flow conditions.

2.1.5 Groundwater quality

Sampling of shallow groundwater bores was undertaken approximately every two months through the monitoring period by the Council. The monitoring frequency had been increased from bi-annual to monthly in 2006-2007 for a period of three years to gain a better understanding of the seasonal variation in groundwater quality, and was reduced to approximately every second month in 2009-2010. Eleven bores were sampled on the three wastewater spray irrigation farm properties, as described in Table 19 and depicted in Figure 39. One bore ('control') on each property is sited upslope of the irrigation area and at least another one or two bores ('impact') within or down-slope of each irrigation area.

Table 19 Groundwater monitoring sites

Property	Bore	Designation	Site code	Depth m	Map reference, NZTM	
					Easting	Northing
Farm 1	North	Control	GND0636	6.5	1697543	5630420
	South	Impact	GND0637	6.5	1697238	5629857
Farm 2	North	Control (new)	GND2049	5.6	1698575	5628905
	West	Impact	GND0638	5.9	1698332	5628562
	South-west	Impact	GND0639	4.3	1698408	5627793
	South-west	Impact (new)	GND2050	7.0	1698397	5627747
	South-east	Impact	GND2063	7.0	1698397	5627747
Farm 3	North	Control (new)	GND2051	6.5	1697634	5627538
	Central	Impact	GND0641	3.4	1697367	5626969
	South-west	Impact (new)	GND2052	7.0	1697216	5626790
	South-east	Impact	GND0700	4.5	1697445	5626790

Relocation and replacement of the original 'impact' bores on Farm 2 and Farm 3 was performed in April 1998 (see TRC 98-73, Southern and No. 3 farms respectively), in consultation with the consent holder and following investigations into groundwater contours and flow directions at each of these farms' monitoring sites.

A summary of groundwater quality data previously collected by the Council from the farm bores is presented in Table 20 for comparison with data collected during the monitoring period under review. The shaded bores are those no longer monitored.

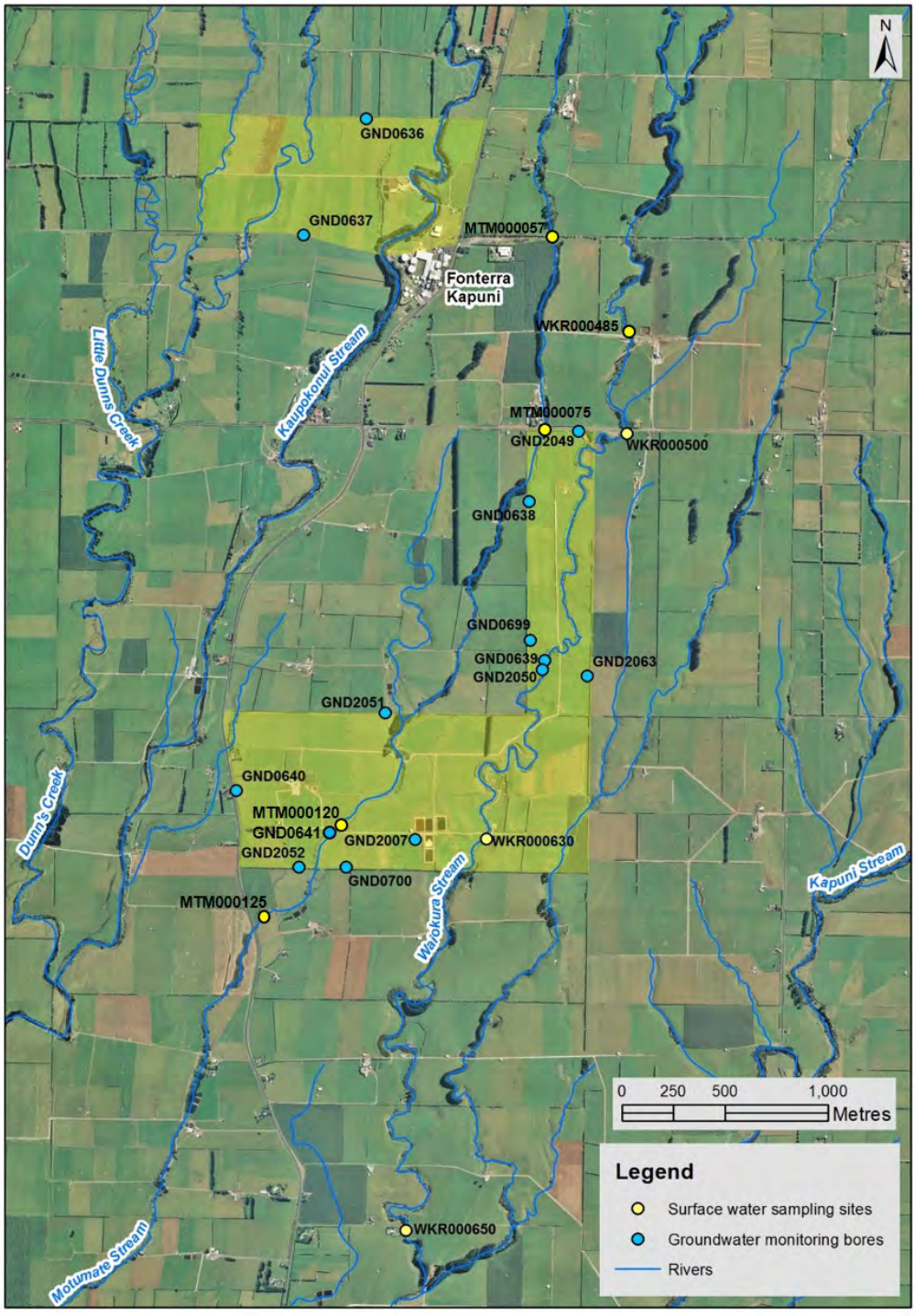

Figure 39 Groundwater monitoring bores, Motumate and Waiokura Stream sampling site locations on the three Company farms

Table 20 Summary of previous Council groundwater quality sampling performed during the period October 1991 to June 2018

Parameter		Level		pH		Conductivity @ 20˚C		Sodium		Nitrate-N		COD*	
Unit		m		pH		mS/m		g/m³		g/m³N		g/m³	
Farm site	Bore	N	Range (median)	N	Range (median)	N	Range (median)	N	Range (median)	N	Range (median)	N	Range (median)
Farm 1	Control GND0636	113	1.47-4.83 (2.90)	162	5.8-7.1 (6.5)	162	26.4 -57.7 (29.9)	88	12.0-56 (25.7)	134	3.7-31 (8.2)	72	<5-27 (6)
	Impact GND0637	94	2.77-6.15 (4.14)	132	6.1-7.8 (6.5)	130	34.0-82.4 (57.3)	83	40-179 (78)	131	1.5-33 (13.26)	70	<5-50 (7)
Farm 2	Control ('new') GND2049	67	1.73-3.80 (2.57)	69	6.2-7.2 (6.4)	69	21.2-48.3 (38.0)	32	26-36 (31)	68	2.4-23 (14.9)	31	<5-7 (<5)
	Impact ('central') GND0638	93	1.08-3.68 (2.58)	128	4.7-6.9 (6.5)	127	54.4-149 (73.7)	79	67-136 (91)	129	<0.01-49 (8.3)	73	<5-1600 (13)
	Impact ('original') GND0639	62	1.90-4.22 (2.87)	80	6.5-7.5 (6.9)	80	43.7-82.6 (64.1)	51	73-157 (118)	80	3.8-29 (12.0)	46	<5-57 (12)
	Impact ('new') GND2050	69	1.60-3.20 (2.64)	70	6.5-7.0 (6.8)	70	13.7-72.4 (54.6)	32	49-102 (69)	69	<0.01-13.3 (0.86)	31	<5-21 (6)
	Impact GND2063	66	1.55-5.22 (3.43)	67	6.1-6.9 (6.5)	67	25.2-49.1 (30.0)	31	35-59 (40)	66	0.4-18.6 (3.1	30	<5-24 (5)
Farm 3	Control ('original') GND0640	18	0.85-3.24 (1.99)	51	6.4-7.0 (6.8)	51	21.0-41.8 (25.9)	45	28-49 (29)	51	<0.01-3.4 (0.13)	42	4-30 (6)
	Control ('new") GND2051	67	1.86-4.46 (3.07)	67	6.3-7.2 (6.5)	67	25.4-61.1 (32.8)	31	24-37 (29)	67	0.03-30 (7.0)	31	<5-31 (8)
	Impact GND0641[a]	35	1.01–2.94 (1.57)	53	6.3-6.8 (6.5)	54	25.2-63.6 (55.9)	35	30-57 (42)	54	0.87-15.6 (10.7)	32	<5-34 (8)
	Impact ('original') GND0700	91	0.40-4.60 (2.14)	103	5.6-7.2 (6.7)	103	30.3-154 (61.0)	58	39-188 (81)	104	0.02-47 (7.8)	58	<5-33 (6)
	Impact ('new') GND2052	67	1.30-4.38 (2.49)	67	6.4-7.3 (6.6)	67	18.9-45.0 (32.7)	31	35-55 (43)	67	<0.01-12.9 (1.9)	31	<5-29 (<5)
	Impact ('deep') GND2007	0	-	48	6.7-8.0 (7.7)	48	32.4-35.3 (33.4)	26	35-39 (37)	48	<0.01-0.10 (<0.01)	23	<5-44 (10)

* COD filtered prior to 2006

a GND0641 not monitored between June 2013 and May 2018 due to a blockage that has now been cleared

The groundwater quality monitored at each farm is discussed below. Wastewater irrigation occurred on each farm throughout the monitoring period (see Section 2.1.1.5).

2.1.5.1 Farm 1 groundwater

The results of groundwater monitoring on this farm during the period under review are summarised in Table 21. The full set of results is available upon request.

Table 21 Results of groundwater quality sampling on Farm 1

Waste		Control (GND0636)			Impact (GND0637)		
Parameter	**Unit**	**No.**	**Range**	**Median**	**No.**	**Range**	**Median**
Alkalinity Total	g/m³ CO_3	6	37 - 42	39.5	6	86 - 131	120
Ammoniacal nitrogen	g/m³N	6	<0.01 - <0.01	<0.01	6	<0.01 - 0.024	<0.01
Bicarbonate @ 25'C	g/m³	6	45 - 51	48	6	104 - 160	146
Calcium	g/m³	6	18.3 - 22	19.3	6	16.7 - 22	18.7
COD	g/m³	6	<6 - <6	<6	6	<6 - 8	<6
Chloride	g/m³	6	30 - 32	31	6	35 - 56	40.5
Conductivity @ 25'C	mS/m	6	29.9 - 32	31	6	39.8 - 64.4	53.3
DRP	g/m³P	6	0.007 - 0.014	0.012	6	0.014 - 0.096	0.041
Hardness Total	g/m³ CO_3	6	70 - 78	76.5	6	73 - 91	80.5
Magnesium	g/m³	6	4.9 - 7.4	7	6	6.2 - 10.2	8.6
Nitrate nitrogen	g/m³N	6	7.0 - 9.2	7.4	6	5.0 - 10.2	8.6
Nitrite nitrogen	g/m³N	6	<0.002 - <0.002	<0.002	6	<0.002 - <0.002	<0.002
Nitrite+nitrate	g/m³N	6	7.0 - 9.2	7.45	6	5.0 - 10.2	8.6
pH		6	6.5 - 7.1	6.6	6	6.7 - 6.8	6.75
Potassium	g/m³	6	6.3 - 15	7.6	6	10.3 - 65	46.5
Sodium	g/m³	6	21 - 24	23	6	42 - 60	49
Sulphate	g/m³	6	21 - 25	23	6	30 - 50	37
Sum of Anions	g/m³N	6	2.6 - 2.8	2.7	6	3.7 - 5.8	4.95
Sum of Cations	g/m³N	6	2.6 - 2.8	2.7	6	3.7 - 5.8	4.95
Temperature	˚C	6	13.5 - 14.6	14.0	6	13.2 - 14.7	14.2
Un-ionised ammonia	g/m³	6	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01
Water Level	m	6	2.22 - 3.83	3.30	6	9.50 - 5.70	4.77

At the end of the 2016-2017 year it was considered that the water quality of the control bore GND0636 groundwater appeared to be improving slightly in terms of nitrate. Based on the 2017- 2018 and 2018-2019 data, it appears that this has stabilised somewhat. The median nitrate-N concentration of 7.45 g/m³ was higher than the 2017-2018 and 2016-2017 medians (6.8 g/m³ and 6.6 g/m³ respectively), but is still lower than the historical median of 8.0 g/m³. The highest concentration recorded in this bore during the year under review (9.2 g/m³) was lower than the peak of 11.9 g/m³ obtained in the 2017-2018 year, but higher than the peak concentrations of 6.9 g/m³ in the 2016-2017 year. It is noted that the nitrate concentration remained below the drinking water standard and that groundwater levels were generally lower than the

previous year. This is consistent with the observation that heavy rainfall tends to flush more nitrate into the groundwater.

Water quality at the impact bore GND0637 showed a marked elevation in alkalinity, bicarbonate, sodium, potassium, sulphate and conductivity levels when compared with the control bore, consistent with the effect of leaching of wastewater from spray irrigation disposal to shallow groundwater. The sodium concentration again appears to be reducing overall, with all values recorded during the year under review being below the historical median (refer to Figure 40 and Table 20). The COD of both bores was found to be low at each of the sampling surveys. Although the nitrate concentration was lower at this site than the control bore on two of the monitoring occasions, it is noted that this bore had significantly lower groundwater levels at these times (approximately 2 metres), and that both the median values for the 2018-2019 year, and for the historical data, are higher at the impact bore than at the control bore

Figure 41 compares the long term trends in groundwater nitrate-N levels at the impact bore with the control bore, 640 m up-gradient, on the northern boundary of the farm. Levels of nitrate-N in the impact bore were again higher in winter and spring, although during the year under review none of the concentrations were found to be above the drinking water standard (11.3 g/m^3) in either bore. When looking at the changes in groundwater level and nitrate concentration at the time of the November 2018 survey (Figure 42), it is likely that the effects of irrigation are evident in the impact bore. This may be a continuation of the effect noted in the May and June surveys in the 2016-2017 year when, additionally, the groundwater level also increased to a greater extent at the impact bore than at the control bore. Although on this occasion the groundwater levels at the two sites were consistent with each other, the nitrate-N concentration was significantly higher on the down gradient farm boundary than at the control bore. Without onsite rainfall and time series paddock by paddock irrigation data, it is difficult to gauge whether the effects are related to periods of irrigation, rain related flushing, or a combination of these. It has been signalled to the Company that paddock by paddock irrigation records are likely to be required by the renewed discharge consent.

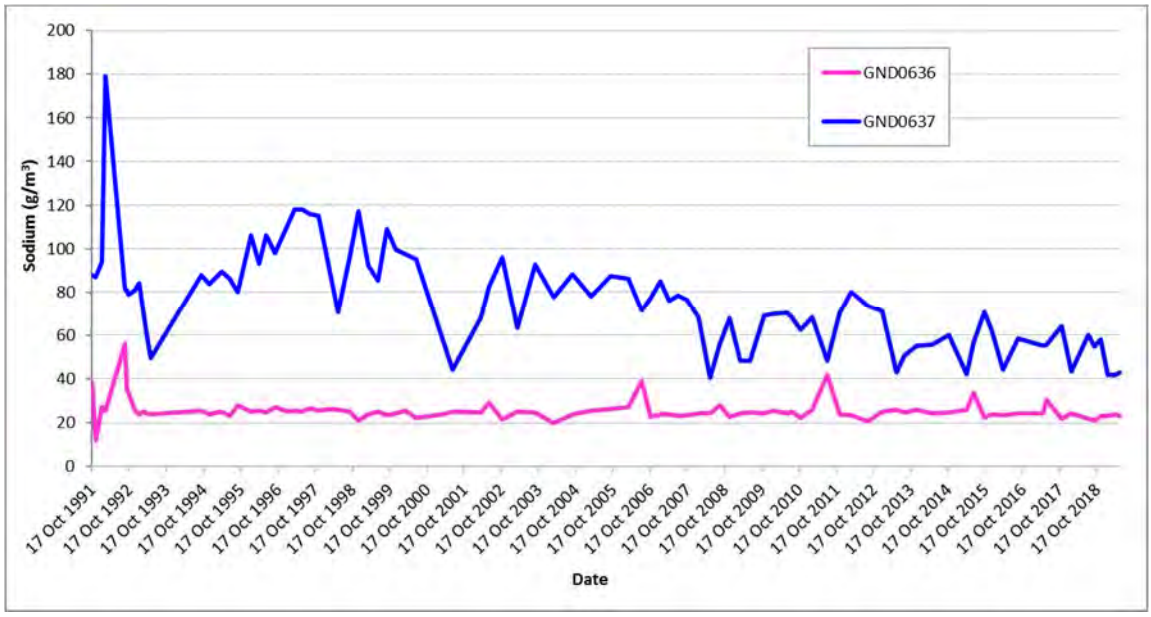

Figure 40 Long term trends in groundwater sodium concentration at Farm 1

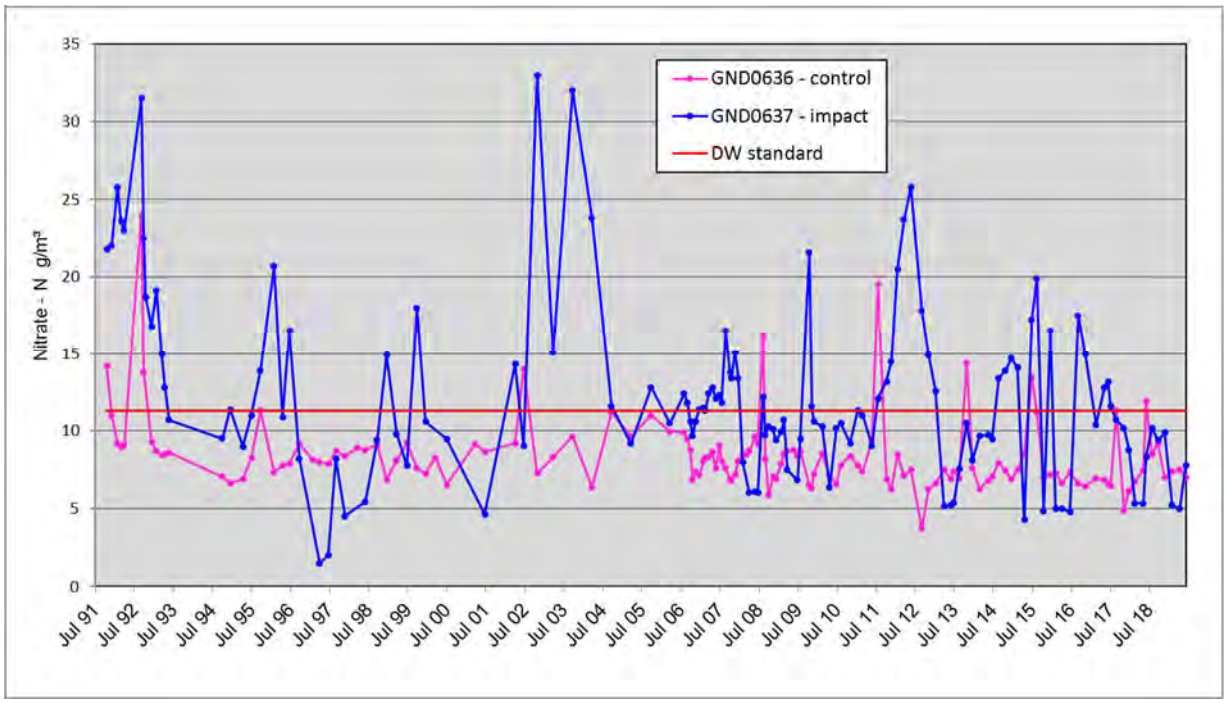

Figure 41 Long term trends in groundwater Nitrate-N concentration at Farm 1

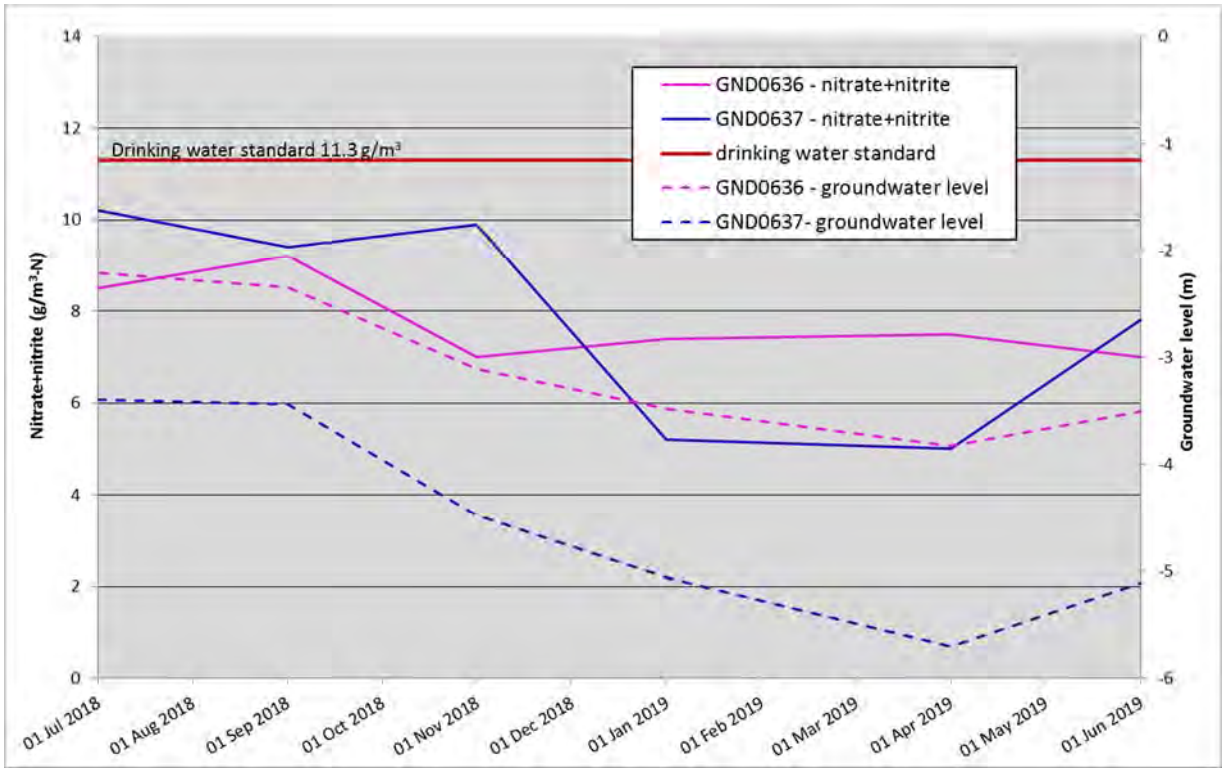

Figure 42 Farm 1 groundwater levels and nitrate + nitrite nitrogen concentrations during the year under review

2.1.5.2 Farm 2 groundwater

The results of groundwater monitoring on this farm during the year under review are summarised in Table 22. The full set of results is given in Appendix III. Site GND0638 could not be sampled in the January 2019 survey as maize was being grown in this paddock.

Table 22 Results of groundwater quality sampling on Farm 2

Parameter	Unit	Control (GND2049)			Impact (GND0638)			Impact (GND0639)			Impact (GND2050)			Impact (GND2063)		
		No.	Range	Median	No.	Range	Median	No.	Range	median	No.	Range	median	No.	Range	median
Alkalinity Total	g/m³ CO_3	6	48 - 57	49	5	181 - 240	230	6	118 - 159	153	6	138 - 179	166.	6	39 - 46	42.5
Ammoniacal nitrogen	g/m³N	6	<0.01 - 0.015	<0.01	5	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	0.01	6	0.01 - 0.460	0.235	6	<0.01 - 0.013	<0.01
Bicarbonate @ 25'C	g/m³	6	59 - 70	59.5	5	220 - 290	270	6	144 - 194	186	6	168 - 220	203	6	47 - 56	52
Calcium	g/m³	6	28 - 33	30.5	5	38 - 44	39	6	14 - 17.5	16.0	6	14.8 - 35	29	6	9.3 - 12.4	11.3
COD	g/m³	6	<6 - <6	<6	5	<6 - 18	<6	6	<6 - 12	<6	6	<6 - <6	<6	6	<6 - 6	<6
Chloride	g/m³	6	35 - 43	40	5	40 - 52	45	6	46 - 60	54	6	34 - 58	56	6	37 - 43	38
Conductivity @ 25'C	mS/m	6	43.9 - 51.8	48.2	5	77.3 - 84.5	78.8	6	63.1 - 75.9	73.4	6	55.9 - 66.5	63.6	6	35.7 - 38.4	37.2
DRP	g/m³P	6	0.005 - 0.008	0.007	5	0.010 - 0.063	0.024	6	0.023 - 0.040	0.026	6	0.004 - 0.040	0.008	6	0.01 - 0.13	0.022
Hardness Total	g/m³ CO_3	6	122 - 149	133.5	5	148 - 174	156	6	76 - 91	84	6	64 - 191	152	6	55 - 69	67
Magnesium	g/m³	6	12.6 - 16.0	14.0	5	12.7 - 15.7	14.1	6	10.1 - 11.6	10.8	6	6.5 - 25.0	18.9	6	7.7 - 10.0	9.2
Nitrate nitrogen	g/m³N	6	19.2 - 27.0	25	5	8.6 - 13.8	9.4	6	10.4 - 11.2	10.8	6	0.028 - 6.7	0.305	6	6.6 - 11.4	10.6
Nitrite nitrogen	g/m³N	6	<0.002 - 0.004	<0.002	5	<0.002 - 0.008	<0.002	6	<0.002 - 0.002	<0.002	6	0.002 - 0.004	<0.002	6	<0.002 - <0.002	<0.002
Nitrite+nitrate	g/m³N	6	19.2 - 27	25	5	8.6 - 13.8	9.4	6	10.4 - 11.2	10.8	6	0.028 - 6.7	0.3055	6	6.6 - 11.4	10.6
pH		6	6.5 - 6.6	6.5	5	6.7 - 6.9	6.8	6	6.8 - 7.1	7.0	6	6.9 - 7.0	6.95	6	6.5 - 6.8	6.7
Potassium	g/m³	6	7.3 - 7.7	7.4	5	51 - 67	64	6	21 - 31	29.5	6	16 - 49	21.9	6	6.7 - 13.7	9.2
Sodium	g/m³	6	31 - 38	34	5	67 - 83	69	6	82 - 118	110	6	60 - 71	62.5	6	38 - 43	40
Sulphate	g/m³	6	17.5 - 19.5	18.6	5	54 - 67	64	6	67 - 84	77.5	6	44 - 70	63.5	6	23 - 37	26
Sum of Anions	meq/L	6	3.9 - 4.5	4.3	5	7.3 - 8.0	7.7	6	5.8 - 7.2	7.0	6	5.1 - 6.6	6.2	6	3.1 - 3.4	3.2
Sum of Cations	meq/L	6	4.0 - 4.8	4.4	5	7.4 - 8.5	7.8	6	5.8 - 7.3	7.2	6	5.2 - 7.1	6.4	6	3.1 - 3.4	3.3

Parameter	Unit	Control (GND2049)			Impact (GND0638)			Impact (GND0639)			Impact (GND2050)			Impact (GND2063)		
		No.	Range	Median	No.	Range	Median	No.	Range	median	No.	Range	median	No.	Range	median
Temperature	˚C	6	13.8 - 15	14.4	5	14.5 - 15.1	14.7	6	14.3 - 15.1	14.5	6	14.2 - 14.8	14.55	6	14.1 - 14.6	14.4
Un-ionised ammonia	g/m^3	6	<0.01 - <0.01	<0.01	5	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01
Water Level	m	6	2.12 - 3.51	2.52	5	2.10 - 3.39	2.52	6	2.29 - 3.86	2.90	6	2.40 - 2.91	2.615	6	2.83 - 4.87	3.91

The control bore for Farm 2, GND2049, was drilled in March 2008, on the northern boundary beside Skeet Road (Figure 39). This replaced the original 'control' bore, GND0638, which is situated on the western boundary with about 350 m of irrigated paddocks up-gradient, and was affected by ponding of effluent in Spring 2006 and possibly again in spring 2007. For this reason, wastewater is now irrigated only in summer in the paddock (new number 13B) immediately up-gradient.

The impact monitoring bore, GND0699, some 670 m down-gradient due south of GND0638 collapsed in December 2006, following damage caused by farm activities. A replacement impact bore, GND2050, was installed above the Waiokura Stream in March 2008. This was the third impact bore drilled on Farm 2 west of the Waiokura Stream. Figure 43 compares the long term trends in groundwater nitrate-N levels at the newer impact bores (GND2063 and GND2050), the two longer standing impact bores (GND0639 and GND0699), and the original control bore (GND0638) with the new control bore (GND2049).

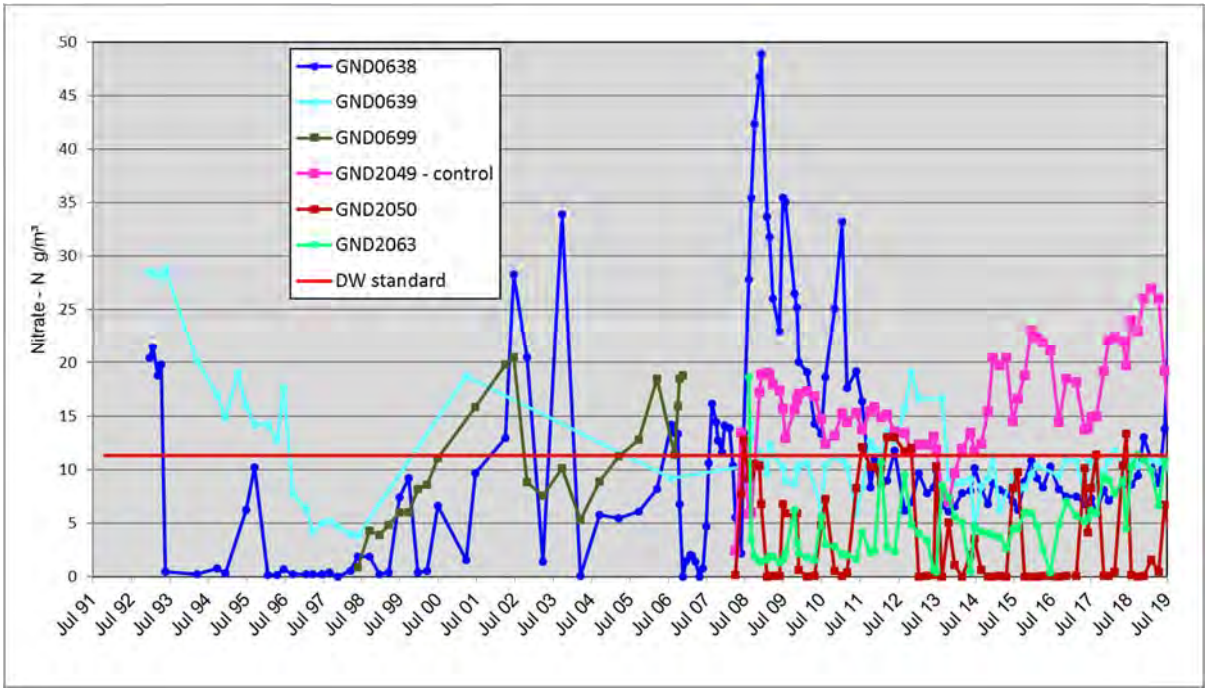

Figure 43 Long term trends in groundwater Nitrate-N concentration at Farm 2

The control bore, GND2049, continued to show the influence of an unknown source, with the nitrate-N concentration ranging from 19.2 to 27.0 g/m^3 during the monitoring period, with the annual median continuing to increase from 13.0 g/m^3 in 2013-2015 to 25 g/m^3 in the year under review. This is the third consecutive year in which the annual median has increased, with the maximum concentration during the year under review being 17% higher than the previous maximum value, recorded in December 2015. All results obtained during the year under review were above the drinking water standard. The historical median also continued to increase slightly, with a change from 14.9 to 15.1 g/m^3. For the assessment of environmental effects to accompany the consent renewal application, the Company had been asked to investigate whether the nitrate comes from farming activities up-gradient across Manaia Road, from "mounding" of factory effluent applied down gradient, or by some other mechanism, noting that the nitrate level is varying inversely with groundwater level. The conductivity, pH, sodium and chloride levels of the control bore were within the normal ranges found in adjacent farming areas. COD and ammonia were low, indicating little leaching of organics.

At the bore inside the irrigation area, GND0638, nitrate-N concentration had reduced from the peak of 49 g/m^3 recorded during 2008-2009 down to 8 g/m^3 in 2012. For the five years from June 2012 to June 2018 it had been fluctuating between 6 to 11 g/m^3, remaining just below the drinking water standard of 11.3 g/m^3. During the year under review the fluctuations were more pronounced and higher than in the

previous year with the range being 8.6 to 13.8 g/m^3. The annual median of 9.4 g/m^3 was also higher when compared to the previous two years (7.7 g/m^3 in 2017-2018 and 7.5 g/m^3 in 2016-2017). Two nitrate-N results were recorded that exceeded the drinking water standard. Conductivity, sodium, potassium and chloride values were elevated, as might be expected underneath such a wastewater irrigation area, though COD and ammonia levels were low.

At the impact bore GND0639 it was found that the nitrate concentration varied little during the year under review and remained just below the drinking water standard. In contrast to the 2017-2018 year, there appeared to be little influence from changes in ground water levels.

Historically, it has been found that at the newer impact bore beside the Waiokura Stream, GND2050, nitrate-N concentration appears to fluctuate with groundwater level (shown in Figure 44). Over the total record, the nitrate-N concentration is typically in the range 3 to 13 g/m^3 during winter and spring, falling to <1 g/m^3 in summer and autumn. Denitrification is a likely explanation, as ammonia concentration varies inversely with nitrate, reaching >0.5 g/m^{3}N, while a low oxygen level (that is, conducive to denitrification) has been recorded. Consideration should be given to the addition of total nitrogen and ammoniacal nitrogen to the analysis suite if this finding continues. During the year under review, the nitrate-N concentration was low in the spring and summer, with only one elevated result obtained in June 2019 (6.7 g/m^3) as the groundwater levels started increasing after the summer period. It is noted that the conductivity, sodium, potassium and chloride values were elevated at GND2050 when compared to the control bore.

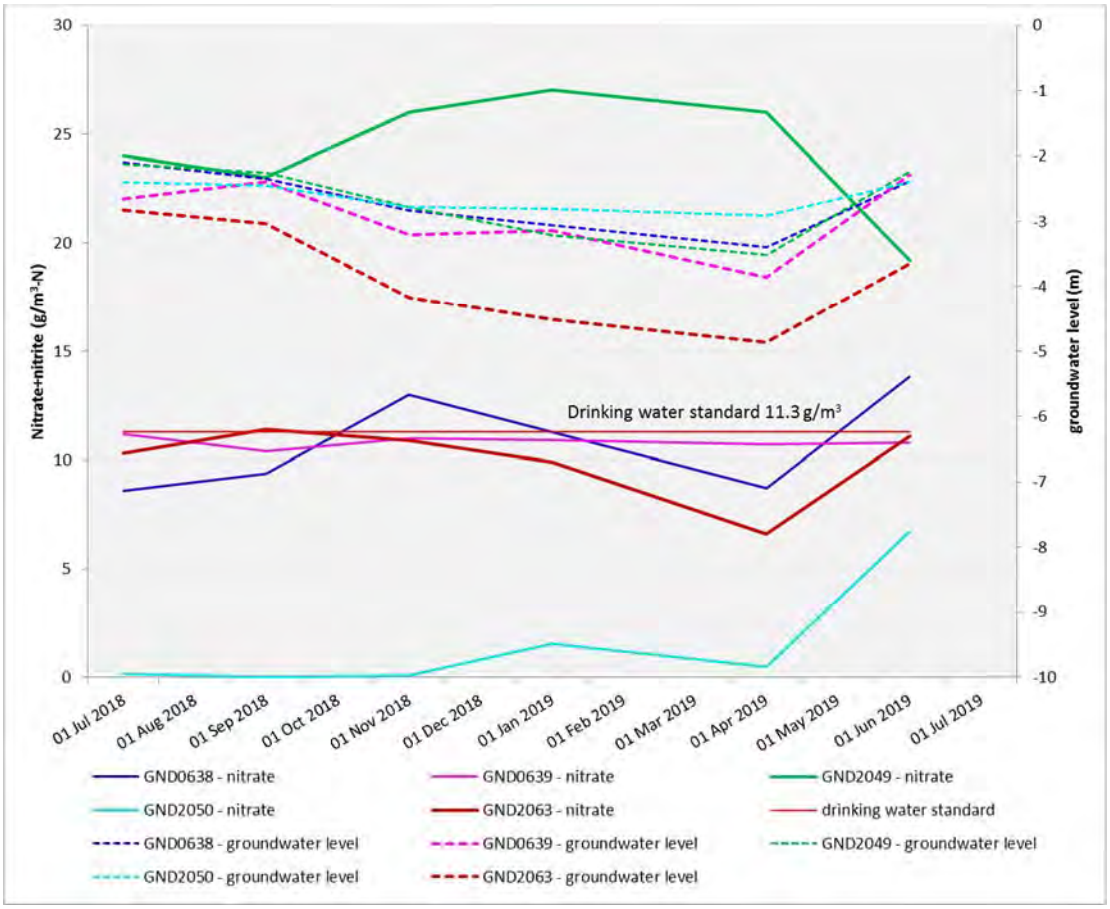

Figure 44 Farm 2 groundwater levels and nitrate + nitrite nitrogen concentrations and groundwater levels during the year under review

The relative concentrations of selected parameters, conductivity, pH, sodium, chloride and potassium, are shown in Figure 45 to Figure 49.

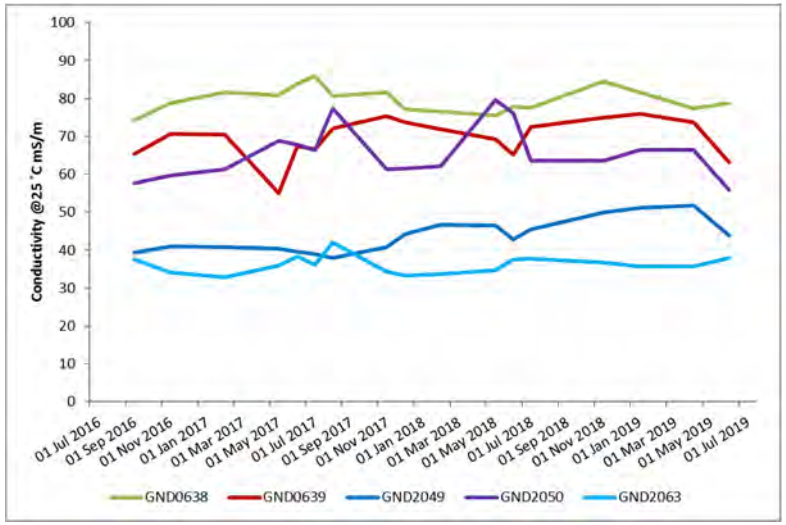

Figure 45 Groundwater conductivity at Farm 2 bores, June 2016 to date

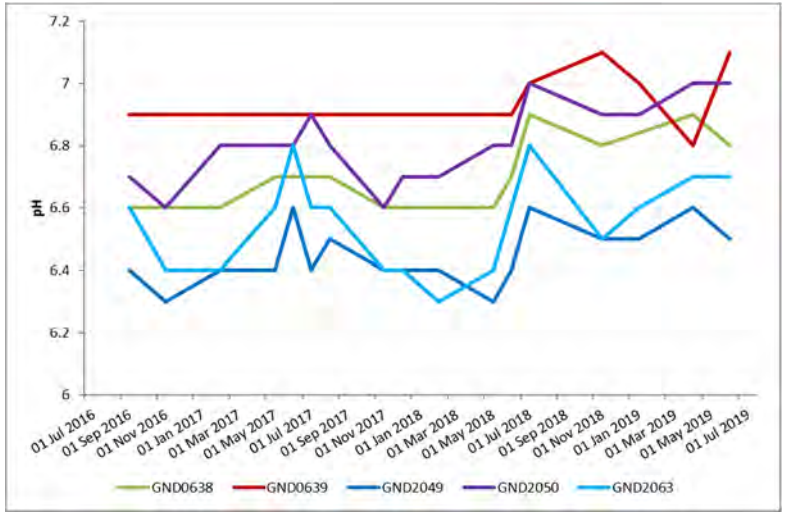

Figure 46 Groundwater pH at Farm 2 bores, June 2016 to date

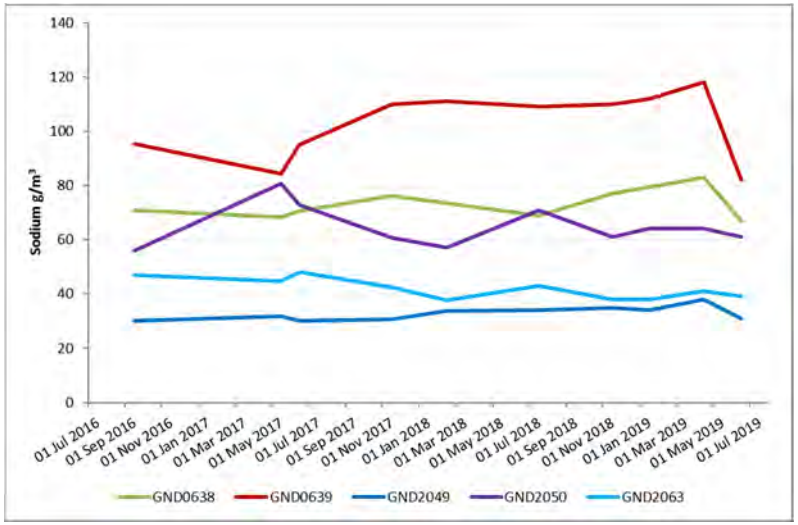

Figure 47 Groundwater sodium concentration at Farm 2, June 2016 to date

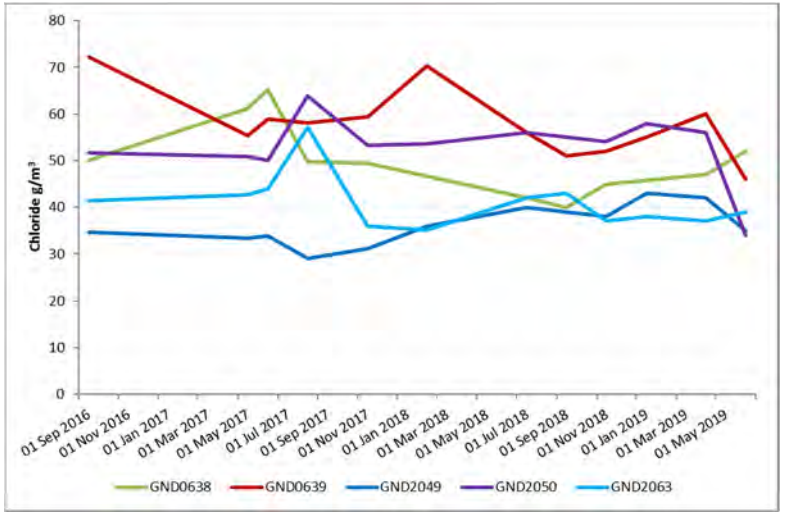

Figure 48 Groundwater chloride concentration at Farm 2 bores, June 2016 to date

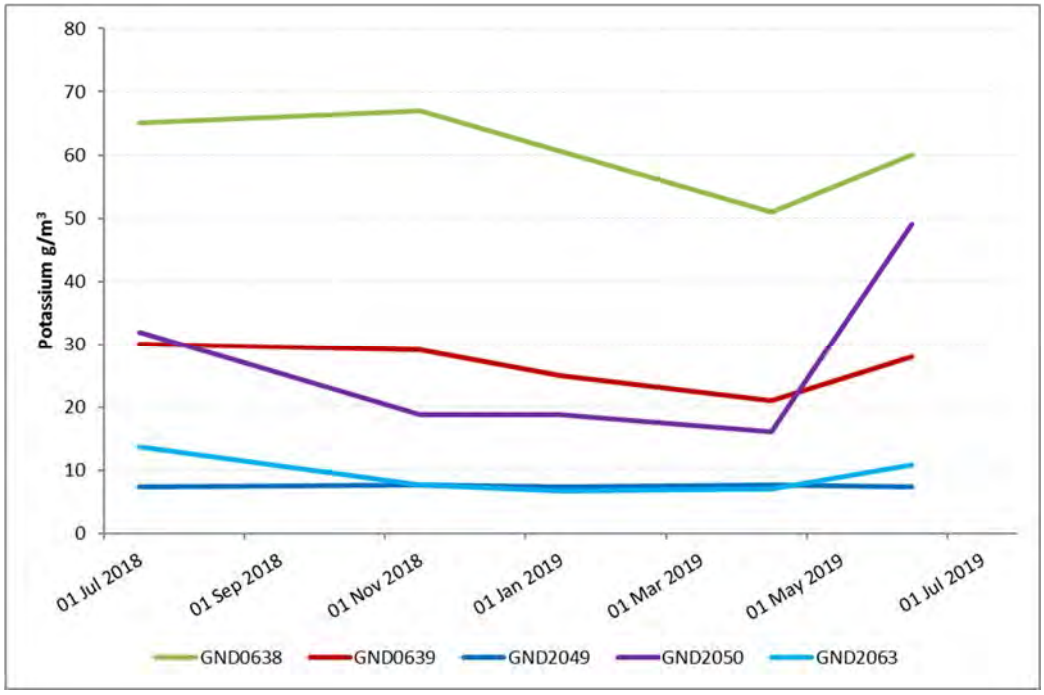

Figure 49 Groundwater potassium concentration at Farm 2 bores, June 2018 to date

2.1.5.3 Farm 3 groundwater

The results of groundwater monitoring on this farm during the period under review are summarised in Table 23. The full set of results is available upon request.

The control bore for Farm 3, GND2051, was drilled in March 2008, on the northern boundary above Motumate Stream. This replaced the original control bore, GND0640, which was situated beside Manaia Road on the western boundary down-gradient of the extended farm area, and was damaged by farm activities in May 2007.

Another impact monitoring bore (GND2052) was also drilled in March 2008, on the southern boundary to the west of Motumate Stream, immediately down-gradient of recently installed fixed in-ground irrigators. The existing impact bore, GND0700, to the east of Motumate Stream, was maintained. An old impact monitoring bore, GND0641, situated between the main access track and Motumate Stream, which had at times been dry, was reinstated in the programme in August 2008. This was not able to be sampled for a number of years due to a bailer becoming stuck inside the bore in May 2013. Given that:

- the location of this bore is close to the banks of the Motumate Stream, and
- the historical data shows that the nitrate concentrations in the groundwater at this monitoring location were fluctuating between 8 and 15.5 g/m^3, and
- the results were often above both the drinking water guideline (11.3 g/m^3) and the National Objective Frameworks bottom line (9.8 g/m^3 annual 95 percentile and 6.9 g/m^3 annual median),

further attempts were made to re-instate this bore and routine sampling recommenced in July 2018.

Monitoring of the Motumate Stream, provisionally provided for in the programme to monitor potential effects from the discharge of cooling water, was also initiated in November 2018 to monitor for potential effects on the stream from irrigation activities given the extension in the irrigation area that had occurred after the increase in the area of Farm 3.

Table 23 Results of groundwater quality sampling on Farm 3

Parameter	Unit	Control (GND2051)			Impact (GND0700)			Impact (GND0641)			Impact (GND2052)		
		No.	Range	Median	No.	Range	Median	No.	Range	Median	No.	Range	median
Alkalinity Total	g/m³ CO_3	6	40 - 51	46	6	81 - 117	104	6	84 - 107	97	6	75 - 88	84
Ammoniacal nitrogen	g/m³N	6	<0.010 - 0.117	0.015	6	<0.010 - 0.027	<0.01	6	<0.01 - 0.013	0.010	6	<0.010 - 0.130	0.010
Bicarbonate @ 25'C	g/m³	6	49 - 62	56	6	98 - 143	126	6	102 - 131	118	6	92 - 108	103
Calcium	g/m³	6	14.4 - 21.0	17.1	6	12.9 - 18.0	14.0	6	18.9 - 29.0	21.0	6	11.5 - 18.6	16.0
COD	g/m³	6	<6 - <6	<6	6	<6 - 10	<6	6	<6 - 54	9.5	6	<6 - <6	<6
Chloride	g/m³	6	40 - 66	46	6	59 - 159	79	6	58 - 70	60	6	44 - 54	46
Conductivity @ 25'C	mS/m	6	35.2 - 53.2	37.6	6	38.8 - 92.8	63.8	6	50.9 - 65.8	54.0	6	32.4 - 49.6	43.0
DRP	g/m³P	6	0.008 - 0.030	0.012	6	0.004 - 0.029	0.022	6	<0.004 - 0.026	0.008	6	0.020 - 0.046	0.03
Hardness Total	g/m³ CO_3	6	88 - 145	103	6	72 - 117	86	6	88 - 125	101	6	59 - 97	80
Magnesium	g/m³	6	12.6 - 22	14.8	6	9.7 - 17.5	12.3	6	9.8 - 13.1	11.8	6	7.4 - 12.2	9.7
Nitrate nitrogen	g/m³N	6	4.9 - 21	7.2	6	0.25 - 12.1	4.3	6	5.9 - 9.1	7.0	6	0.01 - 4.3	1.93
Nitrite nitrogen	g/m³N	6	<0.002 - 0.019	<0.002	6	<0.002 - <0.002	<0.002	6	<0.002 - <0.002	<0.002	6	<0.002 - <0.002	<0.002
Nitrite+nitrate	g/m³N	6	4.9 - 21	7.2	6	0.25 - 12.1	4.3	6	5.9 - 9.1	7.0	6	0.01 - 4.3	1.9
pH		6	6.6 - 6.9	6.6	6	6.8 - 7.1	6.9	6	6.8 - 7.1	6.8	6	6.6 - 6.9	6.8
Potassium	g/m³	6	8.2 - 16.9	10.5	6	12.2 - 48.0	26.0	6	31.0 - 43.0	32.5	6	8.3 - 11.4	9.9
Sodium	g/m³	6	24 - 33	28	6	44 - 113	78	6	43 - 54	48	6	37 - 60	48
Sulphate	g/m³	6	29 - 31	30	6	9.1 - 52	40	6	35 - 47	38	6	5.2 - 49	37
Sum of Anions	meq/L	6	3.1 - 4.8	3.3	6	3.5 - 8.5	5.5	6	4.6 - 5.7	4.9	6	2.9 - 4.6	4.0
Sum of Cations	meq/L	6	3.1 - 4.7	3.6	6	3.7 - 8.5	5.8	6	4.5 - 5.8	4.95	6	3.0 - 4.7	4.0
Temperature	˚C	6	14.2 - 14.7	14.5	6	14.3 - 15.0	14.0	6	14.2 - 15.1	14.5	6	14.3 - 15.0	14.6
Un-ionised ammonia	g/m³	6	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01	6	<0.01 - <0.01	<0.01
Water Level	m	6	2.67 - 4.33	3.48	6	1.30 - 2.92	2.44	6	1.71 - 2.96	2.41	6	2.02 - 3.20	2.74

The impact of wastewater irrigation upon the old impact bores (GND0700 and GND0641) was reflected in elevated sodium, chloride, conductivity and potassium levels (Figure 50, Figure 51, Figure 52, and Figure 53).

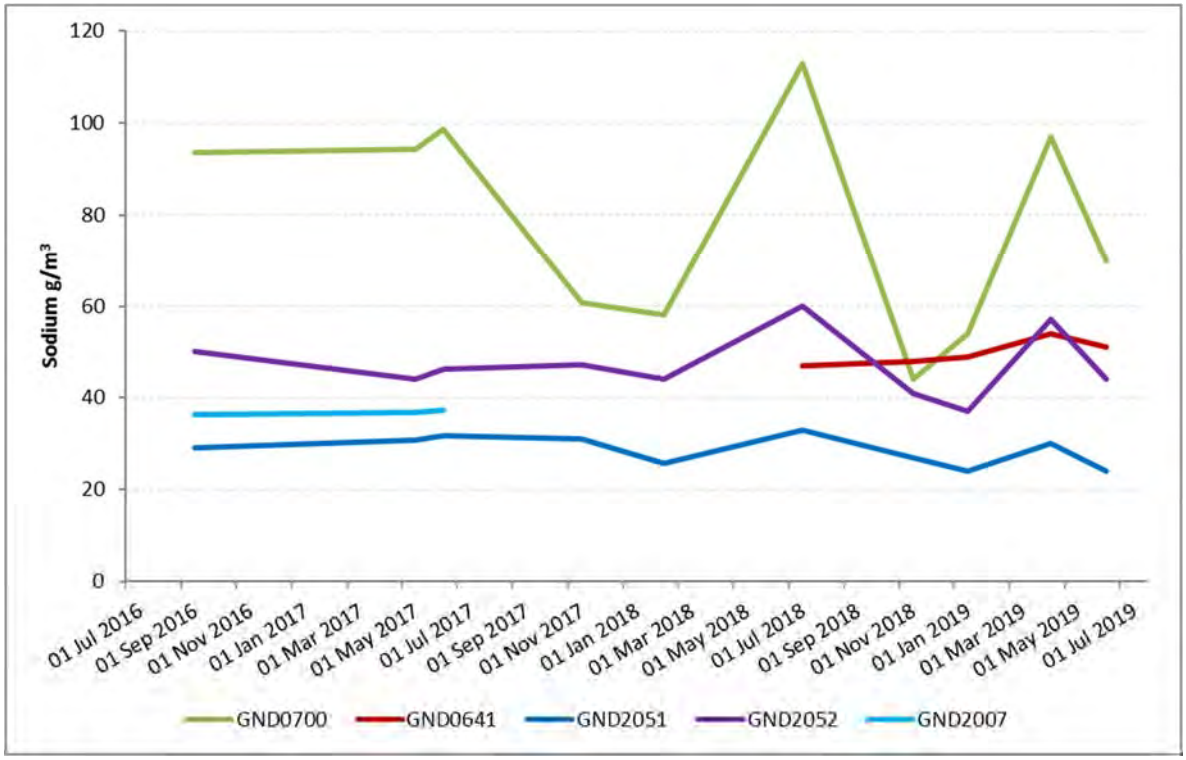

Figure 50 Groundwater sodium concentration at Farm 3 bores, June 2016 to date

It is noted that the chloride concentration and conductivity of the new control bore GND2051 has also been elevated at times, although not during the year under review.

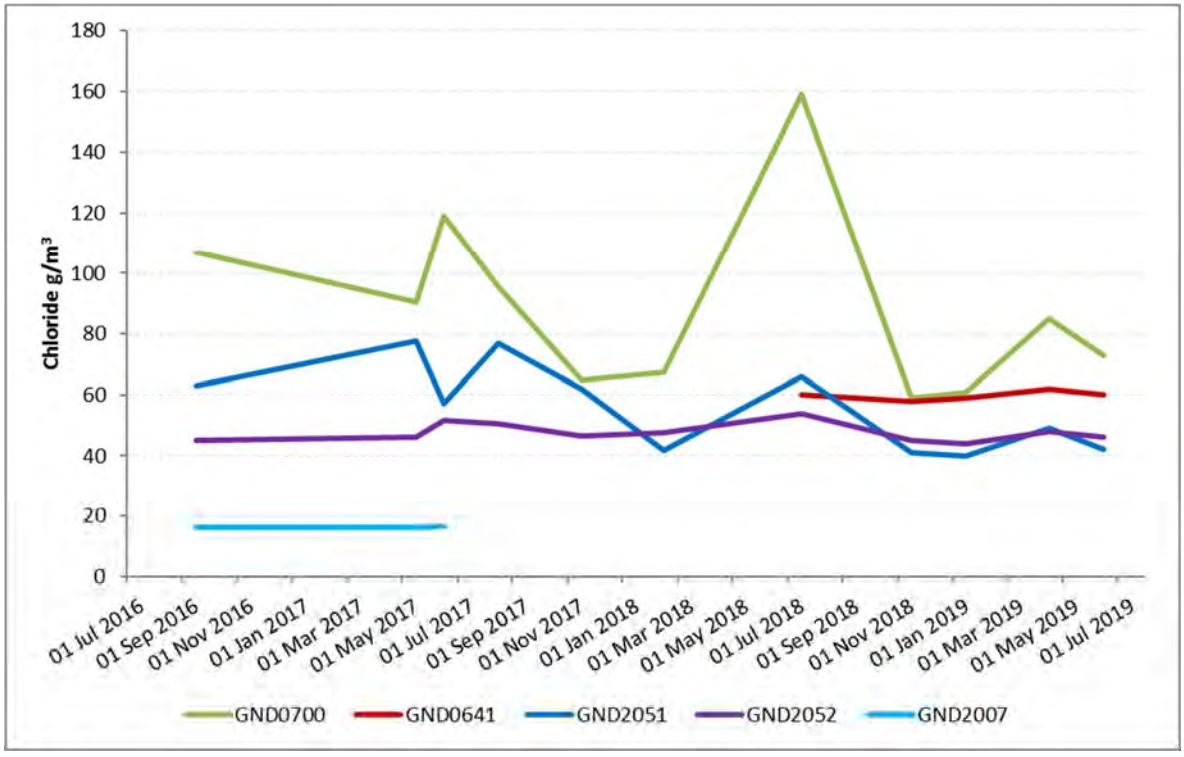

Figure 51 Groundwater chloride concentration at Farm 3 bores, June 2016 to date

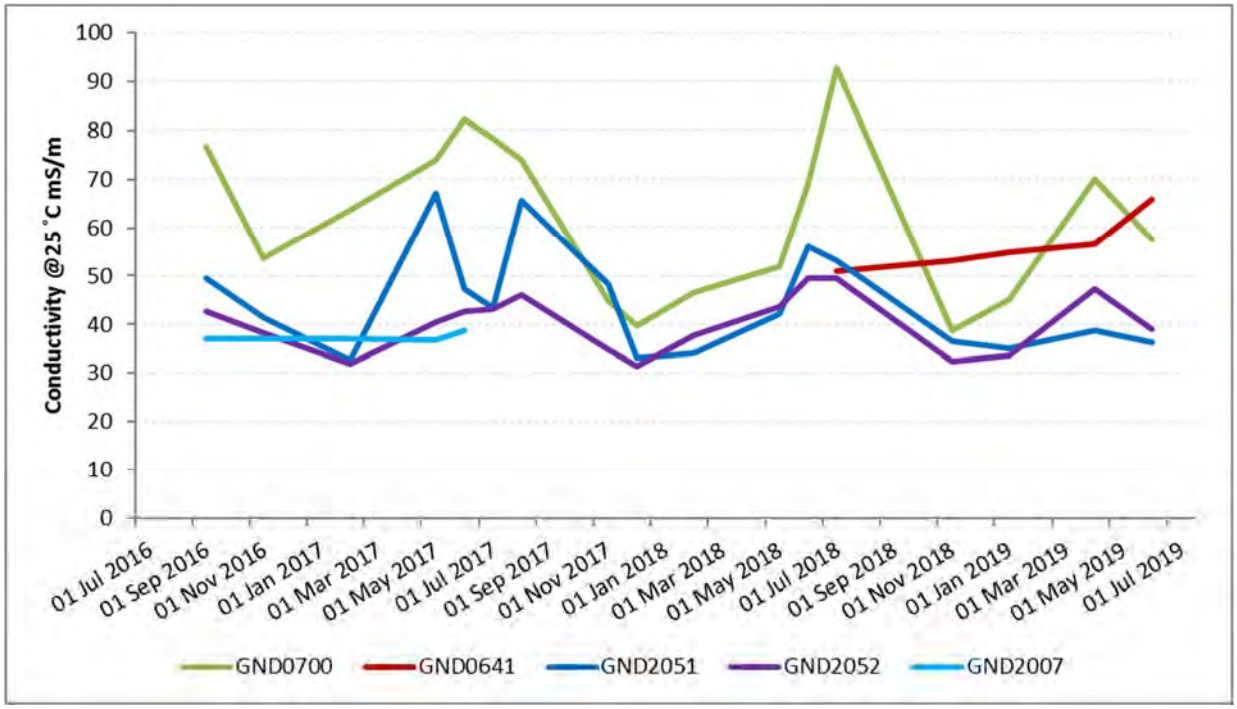

Figure 52 Groundwater conductivity at Farm 3 bores, June 2016 to date

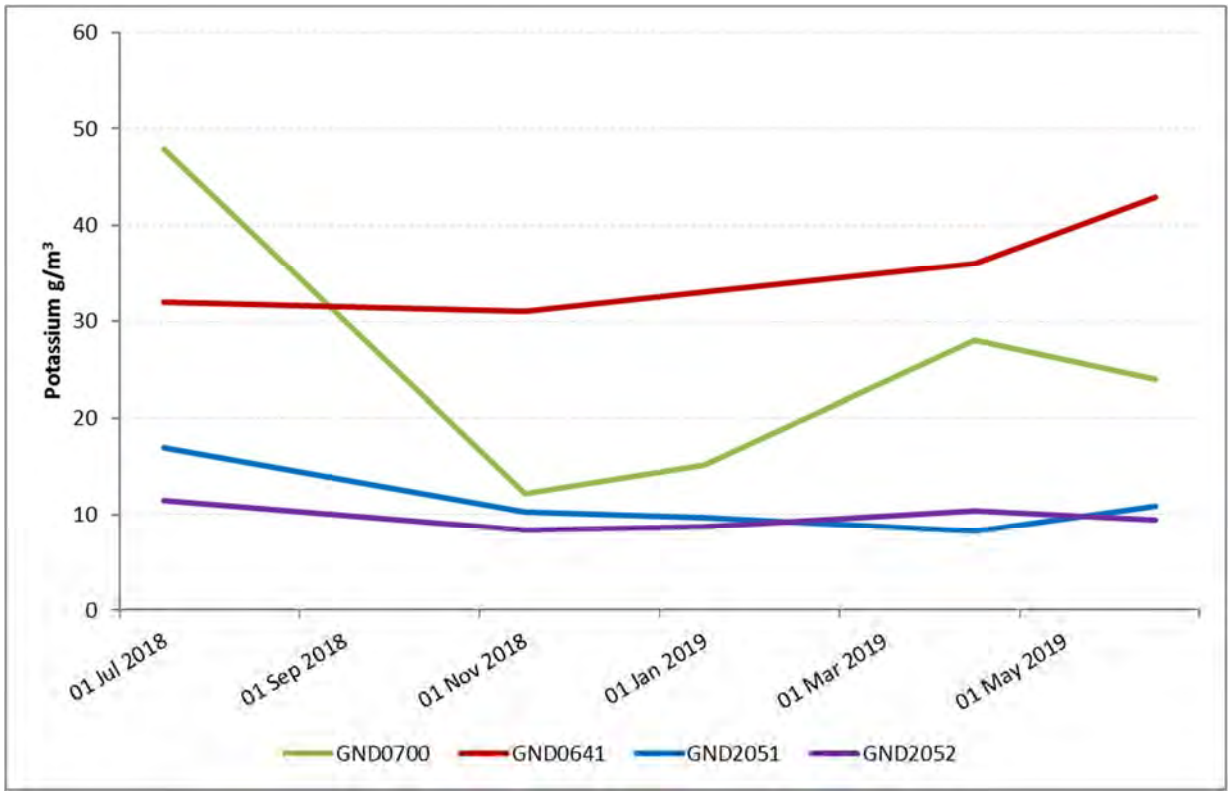

Figure 53 Groundwater potassium concentration at Farm 3 bores, June 2018 to date

Figure 54 compares trends in groundwater nitrate-N levels at the two current impact bores, GND2052 and GND0700, and the reinstated impact bore, GND0641 (between 2008-2013 and June 2018-July 2019), with the old and new control bores, GND0640 (until 2007) and GND2051.

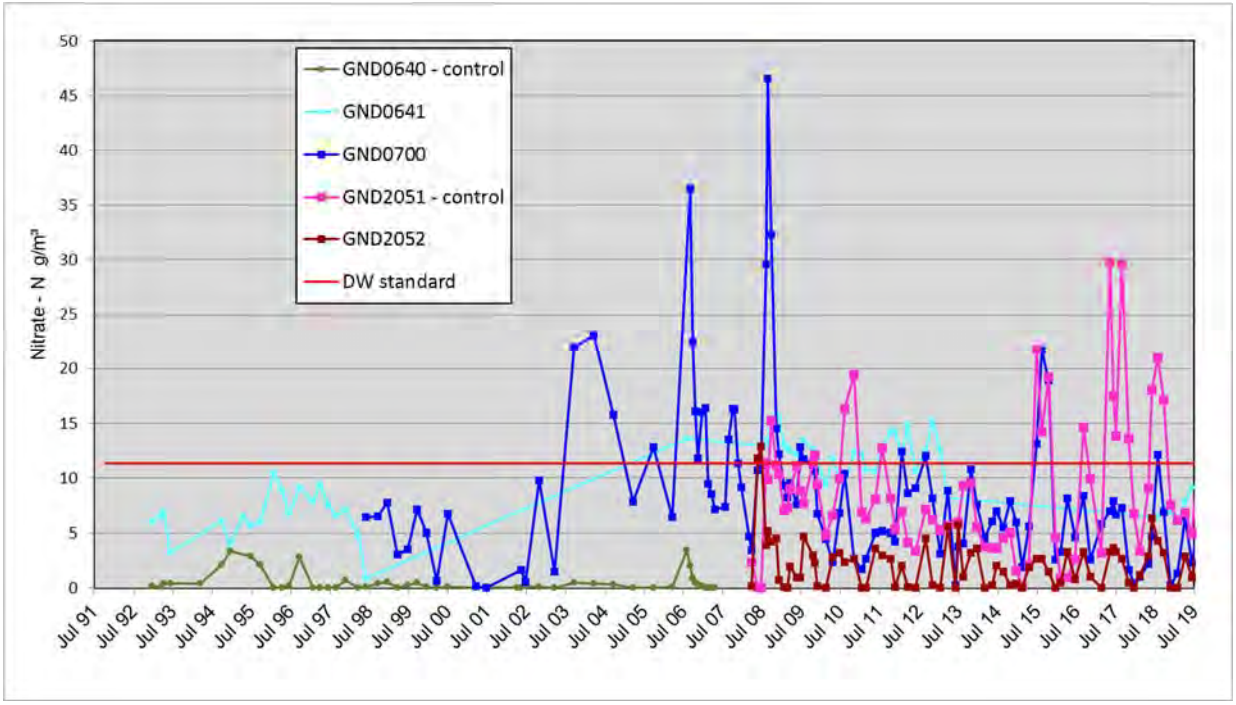

Figure 54 Trends in groundwater Nitrate-N concentration at Farm 3

At the new control bore (GND2051), nitrate-N values were still elevated but to a lesser extent than in the preceding two years, with a reduced median value of 7.2 g/m^3 (compared to 13.6 g/m^3 in 2017-2018, 14.6 g/m^3 in 2016-2017 and 3.6 g/m^3 in 2015-2016). However, the maximum nitrate-N concentration during the year under review was still high (21.0 g/m^3) coinciding with higher groundwater levels found at the time of the sampling survey on in July 2018. This nitrate-N concentration is the fourth highest on record for this monitoring location. The older impact bore GND0700 yielded lower levels of nitrate-N, with a median value of 4.3 g/m^3. Although there was a smaller increase in concentration with the increased groundwater level in GND0700, nitrate-N concentration in this bore also exceeded the drinking water standard on this sampling occasion.

The new impact bore GND2052 had a much lower median nitrate-N value (1.78 g/m^3) during the year under review when compared to the 2017-2018 and 2016-2017 year (2.71 g/m^3 and 6.94 g/m^3 respectively).

At the re-instated impact bore GND0641 the nitrate-N concentrations were elevated, however the annual median of 7.05 g/m^3 was lower than the historical median (10.7 g/m^3), with no results exceeding the drinking water standard.

Overall, with the exception of the sample collected from GND0700 on 26 July 2018, the results showed that the impact bores were experiencing only minor effects and indicate generally good management of nitrogen application rates in the vicinity of these three bores. However, the nitrate-N results obtained for the new control bore (GND2051) indicate that the groundwater on the northern boundary of Farm 3 may be experiencing similar effects to those seen at the Farm 2 control bore (GND2049). Again, for the assessment of environmental effects to accompany the consent renewal application, the Company was asked to investigate whether the nitrate comes from farming activities up-gradient, from "mounding" of factory effluent applied down (the ground surface) gradient, or by some other mechanism.

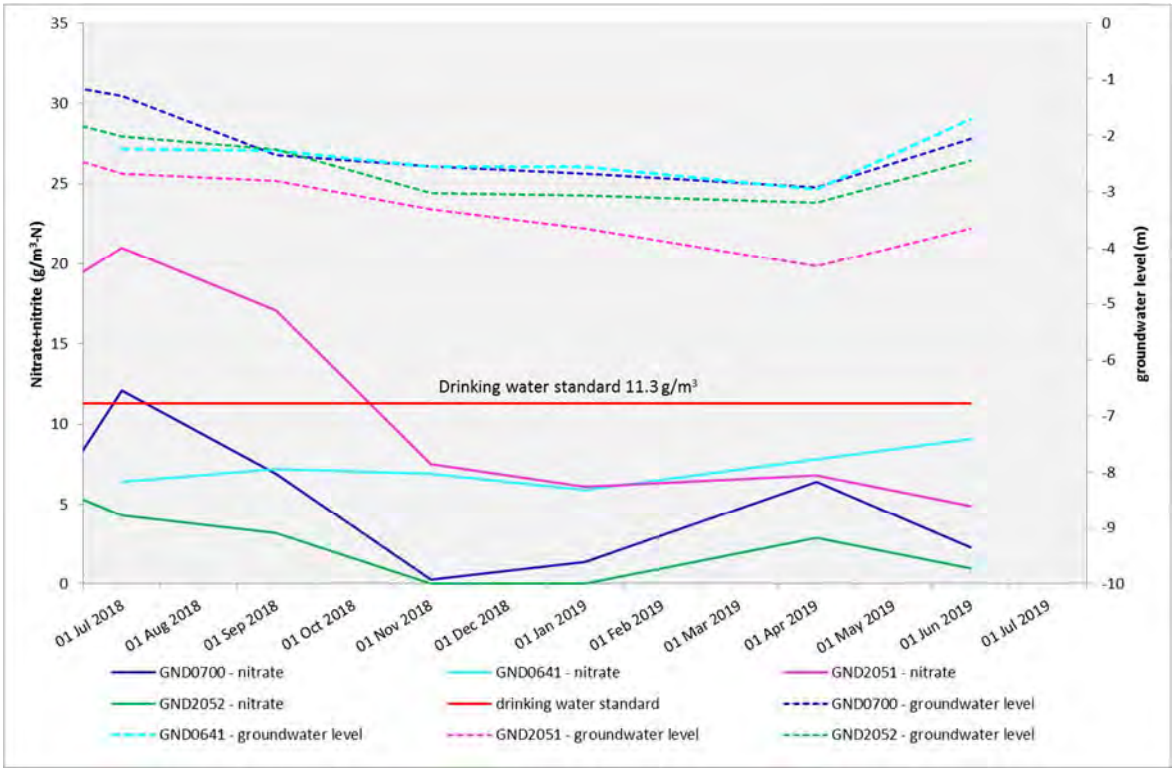

Figure 55 Farm 3 groundwater levels and nitrate + nitrite nitrogen concentrations during the year under review

Historically, GND2049 and GND2051 show elevations in chloride, conductivity, and to a lesser extent sodium, in the surveys that elevations in nitrate-N occur.

However, the relative contaminant concentrations are different in the other impact bores. It is noted that this is a complex system, and the relative contaminant concentrations would depend on when irrigation was last undertaken in the vicinity of each of the bores, the component concentrations of the wastewater as these vary according to wastewater type and site activities, and the mobility of the various contaminants in the soil/groundwater.

2.1.5.4 General

The use of all three farms for spray irrigation of wastewater has impacted on shallow groundwater to varying degrees, raising sodium and conductivity levels and altering nitrate levels.

The main parameter of concern is nitrate level, given the NZ Drinking Water Standard of 11.3 g/m^3 (as nitrate-N) has been exceeded frequently during this and previous monitoring periods. There are no known shallow groundwater water users in the immediate vicinity of the spray irrigation area, because of the availability and usage of the Waimate West Rural Water Supply Scheme. A summary of the groundwater nitrate monitoring results is given in Table 24. It is noted that during the year under review, the minimum, maximum and median values obtained for GND2049 increased, as did those for GND0638, but a lesser extent.

Table 24 Summary of groundwater nitrate concentrations at monitoring bores during the year under review

Property	Site code	Bore location	Designation	Number of samples	Nitrate & Nitrite-N, g/m³	
					Range	Median
Farm 1	GND0636	North	Control	6	7.0 - 9.2	7.45
	GND0637	South	Impact	6	5.0 - 10.2	8.6
Farm 2	GND2049	North	Control (new)	6	**19.2** - **27.0**	**25.0**
	GND0638	West	Impact	5	8.6 - **13.8**	9.4
	GND0639	South-west	Impact	6	10.4 - 11.2	10.8
	GND2050	South-west	Impact (new)	6	0.028 - 6.7	0.306
	GND2063	South-east	Impact	6	6.6 - **11.4**	10.6
Farm 3	GND2051	North	Control (new)	6	4.9 - **21.0**	7.2
	GND0641	Central	Impact	6	5.9 - 9.1	7.0
	GND2052	South-west	Impact (new)	6	0.01 - **4.3**	1.9
	GND0700	South-east	Impact	6	0.25 - **12.1**	4.3
New Zealand Drinking Water Standard					**11.3**	

In recognition of the potential for adverse effects on soil and groundwater quality, and in order to enable better combination of wastewater disposal and farming operations, the Company in 2006 purchased an additional 60 ha of land between Farm 2 and Farm 3, bringing the total farmed area to 244 ha. Consent **0923-3** was varied to provide for a planned 41% increase in spray irrigation area, from 120 to 169 ha (5 ha on original Farm 3). Work started in January 2007 on the extension, which comprised a 4.1 km pipeline from the factory to a storage and control facility on Farm 3, and the installation of fixed in-ground irrigators. The new system was commissioned in time for the 2007-2008 processing season.

The effect of the additional irrigation area on groundwater nitrate level was predicted, using the AgResearch Overseer model in combination with the water balance for the site. The annual average nitrogen loading used in the model was 523 kgN/ha/y (average over the previous 6 years, based on the November/December 2005 wastewater composition study) for the existing area. Assuming average rainfall of 1,200 mm, evapo-transpiration of 450 mm, and wastewater application of 383 mm, the drainage was estimated at 1,133 mm. The concentration of nitrate-N in the leaching water was predicted to be about 25 g/m^3. This value is similar to the levels that were found in some of the impact monitoring bores in previous monitoring periods. The introduction of the new farm was predicted to reduce the nitrogen load to about 371 kgN/ha/y. The concentration of percolate (leaching water) was predicted to reduce to 17 g/m^3, a factor of 39%.

It is noted that there has been a slight increase in the recognised areas irrigated on each of the farms of between 3 and 5 ha, increasing the total area irrigated from 164 to 171 ha across all three farms. This was as a result of more accurate mapping of the area.

In 2018-2019, a total metered volume of 469,461 m^3 of factory effluent was generated, which had a (time-based) average total nitrogen concentration of 84.6 g/m^3 (46 samples, range 0.13-149 g/m^3), giving a total nitrogen mass of 42,066 kg. When applied to 171 ha, at an average depth of 221 mm, this amounted to an overall annual nitrogen application rate of 246 kg/ha. The calculated annual nitrogen application rates for Farm 1 (55 ha), Farm 2 (29 ha) and Farm 3 (92 ha) are 201, 241 and 264 kg/ha, respectively, assuming that

the effluent has been evenly distributed across the available irrigation area on all three farms. The average rate for Farms 2 and 3 was 252 kg/ha.

For dairy shed effluent, on Farm 1, a total metered volume of 12,034 m^3 was irrigated over 12 months, which had an average total nitrogen concentration of 80 g/m^3 (39 samples, range 44-156 g/m^3), giving a total mass of 1,078 kg. When applied to 55 ha, at an average depth of 22 mm, this amounted to an overall annual nitrogen application rate of 21 kg/ha.

For dairy shed effluent, on Farms 2 and 3, a total metered volume of 13,276 m^3 was irrigated over 11 months, which had an average total nitrogen concentration of 304 g/m^3 (29 samples, range 116–815 g/m^3), giving a total mass of 3,273 kg. When applied to 120 ha, at an average depth of 11 mm, this amounted to an overall annual nitrogen application rate of 27 kg/ha.

The total mass of nitrogen from DSE irrigated increased from 3,986 kg in 2017-2018 to 4,352 kg in 2018-2018; an increase of 366 kg. The factory wastewater annual nitrogen mass however, reduced by 2,578 kg. The DSE total nitrogen amounted to 9.4% of nitrogen mass irrigated.

The combined nitrogen loading rate for 2018-2019 from irrigation of factory wastewater and DSE was 221 kg/ha on Farm 1 and 286 kg/ha on Farms 2 and 3. A comparison of the nitrogen application rates in recent years are given in Table 25.

Table 25 Farm nitrogen application rates

Monitoring year	Farm 1 nitrogen application rate (kg/ha/y)	Farms 2 and 3 nitrogen application rate (kg/ha/y)	Comments
2018-2019	221	286	Factory wastewater and DSE fully implemented at Farms 1, 2 & 3
2017-2018	230	326	Factory wastewater and DSE fully implemented at Farms 1, 2 & 3
2016-2017	288	379	Factory wastewater and DSE fully implemented at Farms 1, 2 & 3
2015-2016	283	353	Factory wastewater plus DSE (2 months only Farm 1) (9 months Farms 2 & 3)
2014-2015	270	382	Factory wastewater only, no DSE
2013-2014	259	309	Factory wastewater only, no DSE
2012-2013	244	321	Factory wastewater only, no DSE

In comparison, the respective loadings in 2014-2015 from factory wastewater alone were 270 and 382 kg/ha. Although the nitrogen loading rates had increased between that year and 2016-2017, they decreased again during the year under review. Based on these calculations the addition of the DSE has not had a significant effect on the loadings and they are still considerably less than the average value of 523 kg/ha/y estimated for the period before the irrigation area was extended (2006-2007 processing season).

The calculated nitrogen mass and annual loadings need to be treated with caution as there can be significant discrepancies in the median wastewater and DSE analysis data between individual nitrogen species and total nitrogen (refer Table 8 and Table 9), along with relying on the assumption that the waste has been irrigated uniformly across all paddocks. In addition, there were larger variations in the total nitrogen concentrations of the wastewaters than usual throughout the year under review.

Four additional groundwater monitoring bores were drilled in March 2008 to provide for the new irrigation area; to replace the two bores damaged during the 2006-2007 monitoring period; and to install a proper control for Farm 2.

On Farm 1 during the 2018-2019 year, it appears that, overall, the base nitrate levels under the irrigation areas may have decreased for the second year, following the increase observed in the 2016-2017 year. During the year under review none of the nitrate-N concentrations in GND0637 were found to be above the drinking water standard. This compares to 46% of the total dataset for this bore. At the control site (GND0636) there were also none of the six samples containing nitrate-N concentrations at or above the drinking water standard. It is noted that although there were higher nitrate-N levels found at the control bore than at the impact bore on occasion, the annual median concentration was lower at the control bore than at the impact bore. The median values obtained for the year under review for both sites were lower than their respective historical medians.

The findings on Farm 2 during the year under review were similar to the 2016-2017 and 2017-2018 years. It continues to appear that the nitrogen loadings have been better managed since the beginning of the 2013-2014 year, with only two of the impact bore samples (one at GND0638 and one at GND2063) being at, or above, the drinking water standard. However, it is noted that the annual median nitrate-N concentration at GND0638 has increased from 7.71 g/m^3 in 2017-2018 to 9.40 g/m^3 in the 2018-2019 year, and at GND2063 it has increased from 7.78 g/m^3 in 2017-2018 to 10.6 g/m^3 in the 2018-2019 year. In addition to this, concentrations at the control bore (GND2049) continued to increase, with all samples again being above the drinking water standard, and a further increase in the annual median from 14.4 g/m^3 in 2016-2017 to 19.7 g/m^3 in 2017-2018 and then to 25.0 g/m^3 in the 2018-2019 year.

On Farm 3, it had appeared that nitrate levels under the irrigation areas had decreased and were stabilising in response to the increase in irrigated area. During the year under review, it was found that the annual medians were all similar to or lower than the historical medians, with the 2018-2019 annual medians also lower than the 2017-2018 annual medians in bores GND2051 and GND2052. In bore GND0700, the 2018-2019 annual median was approximately double that found in 2017-2018. On a survey basis, it is noted that that the nitrate levels in the control bore (GND2051) have continued be elevated (above the drinking water standard of 11.3 g/m^3) on occasion in the 2018-2019 year. However, the maximum value of 21.0 g/m^3 was lower than the historical maximum value of 29.8 g/m^3, which was recorded during the 2016-2017 year, and 2017-2018 maximum value of 29.6 g/m^3. However, the maximum recorded for this site during the year under review is still close to double the drinking water standard.

In the past, there have been spikes in groundwater nitrate concentrations that have occurred at most monitoring bores, both impact and control, that have coincided with recent heavy rainfall events and/or increased groundwater levels. The likely mechanism considered for these occurrences was the flushing of nitrate-N in the subsurface soils into the groundwater by the rainfall, combined with the groundwater "collecting" any subsurface nitrate-N in the soil as it rises. There were again a spikes in nitrate level observed during the year under review. Bore GND0637 (Farm 1 impact bore), all Farm 2 bores except GND0249 (control bore) and all Farm 3 bores except GND0641 and GND2052 (both impact bores) had spikes in the nitrate-N that coincided with the higher groundwater levels that were apparent in all of the bores in the winter and/or spring surveys. It is noted that the effects were not as pronounced as in the previous two monitoring periods, however it is also noted that the changes in groundwater levels were also less pronounced and remained generally lower during the year under review. This continues to be consistent with the above theory.

In contrast, bores GND0637 (Farm 1 impact bore) and GND0638 (Farm 2 impact bore) both had their highest nitrate-N concentrations at times when the groundwater levels were lowering in these bores (November 2018). As in the 2017-2018 year, during the year under review, the Farm 2 control bore (GND2049) was found to have consistently high nitrate-N concentrations (greater than 25 g/m^3) through

the period November 2018 to April 2019, while groundwater levels were lower. It is also noted that these levels were approximately 5 g/m^3 higher than in the 2017-2018 year through the same time of year.

The results for the two relatively new control bores, at the upslope boundaries of Farm 2 and Farm 3, have continued to show significant increases in groundwater nitrate-N levels in excess of the drinking water standard. During the year under review, only one result obtained at the site on the Farm 2 up gradient boundary (GND2049) was below the maximum concentration recorded in the previous year, and the concentrations found were more than double the drinking water standard on all but one survey. This may be as a result of activities on adjacent farms, or of groundwater mounding that can occur as a result of an elevated localised hydraulic loading due to irrigation. As stated in the 2016-2017 and 2017-2018 annual reports, it had been signalled to the Company that the Assessment of Environmental Effects (AEE) for the consent renewal would need to include paddock by paddock irrigation data, continuous groundwater level and rainfall data to support the investigation and reasoning for the elevated nitrate-N levels in the bores on the up gradient boundaries of Farms 2 and 3. This information was not provided in detail, but the above continuous and daily data will be required by the replacement consents.

2.1.6 Motumate Stream surface water quality

In combination with groundwater monitoring, some spatial synoptic surface water monitoring was conducted at four sites on the Motumate Stream adjacent to and downstream of the Company's farms (Figure 39, Table 26). Three of these sites were previously monitored from November 2009 to April 2013, with approximately bi-monthly sampling recommencing in November 2017. A new site, MTM000057, was added further upstream during the current monitoring period due to the elevated level of contaminants observed in this stream and in the groundwater monitoring site at the control sites on the site boundary.

Table 26 Water quality monitoring sites in the Motumate Stream

Site	Site code	Description	Map reference, NZTM	
			Easting	Northing
1	MTM000057	Motumate Stream at railway line	1698475	5629820
2	MTM000075	Motumate Stream upstream of Skeet Road	1698445	5628959
3	MTM000120	Motumate Stream, Farm 3, Fonterra Kapuni	1697413	5626971
4	MTM000125	Motumate Stream at Hicks Road	1697046	5626558

These sites were chosen to monitor any possible effects on surface water from the spray irrigation of wastes on the Company's Farms 2 and 3. The results from the 2018-2019 monitoring period are presented in Table 27, and a summary of the monitoring previously performed is presented in Table 28.

Table 27 Results of Motumate Stream quality sampling for the year under review

Parameter	Unit	MTM000057			MTM000075			MTM000120			MTM000125		
		No.	Range	Median	No.	Range	Median	No.	Range	Median	No.	Range	median
Bicarbonate	g/m^3 at 25°C	5	62 - 118	79	6	64 - 120	83	6	73 - 104	84	6	77 - 118	92
Chloride	g/m^3	5	34 - 47	36	6	36 - 51	38	6	28 - 52	46	6	40 - 50	46
Dissolved Calcium	g/m^3	5	20 - 23	21	6	21 - 23	21	6	15 - 23	22	6	20 - 24	21
Dissolved Magnesium	g/m^3	5	7.4 - 9.8	8.4	6	8.0 - 10.7	8.8	6	6.5 - 11.4	9.6	6	9.0 - 12.0	9.4
Dissolved Potassium	g/m^3	5	13.9 - 28.0	15.7	6	14.3 - 17.8	16.2	6	7.9 - 18.1	15.6	6	14.4 - 20.0	16.2
DRP	g/m^3-P	5	0.026 - 0.660	0.048	6	0.026 - 0.126	0.054	6	0.020 - 0.137	0.034	6	0.032 - 0.134	0.050
Dissolved Sodium	g/m^3	5	22 - 26	24	6	22 - 39	25	6	24 - 40	32	6	30 - 39	34
Electrical Conductivity	mS/m	5	33.4 - 40.0	35.5	6	34.6 - 44.2	36.8	6	27.0 - 43.3	41.1	6	38.4 - 47.0	41.3
Free Ammonia as N	g/m^3	5	0.0002 - 0.0032	0.00027	5	0.00025 - 0.0026	0.0005	5	0.00016 - 0.00048	0.00036	5	0.00044 - 0.0137	0.00092
Nitrate-N	g/m^3-N	5	2.7 - 7.1	4.0	6	2.4 - 8.9	6.4	6	1.45 - 8.3	6.0	6	1.38 - 8.1	5.75
Nitrate-N + Nitrite-N	g/m^3	5	2.7 - 7.1	4.0	6	2.5 - 8.9	6.4	6	1.47 - 8.4	6.0	6	1.41 - 8.1	5.8
Nitrite-N	g/m^3	5	0.005 - 0.048	0.014	6	0.008 - 0.164	0.024	6	0.008 - 0.044	0.014	6	0.013 - 0.12	0.024
pH	pH Units	5	7.5 - 7.7	7.6	6	7.5 - 7.8	7.5	6	7.3 - 8.0	7.5	6	7.4 - 7.7	7.6
Sample Temperature	°C	4	11.3 - 19.2	13.2	6	11.3 - 18.4	12.7	6	11.5 - 19.9	13.1	6	11.3 - 16.5	13.0
Sulphate	g/m^3	5	17.3 - 23.0	19.4	6	17.1 - 23.0	20.5	6	10.1 - 26.0	25	6	16.4 - 26.0	25.5
Total Alkalinity	g/m^3 as $CaCO_3$	5	51 - 97	65	6	53 - 99	68	6	60 - 86	69	6	63 - 97	76
Total Ammoniacal-N	g/m^3	5	0.019 - 0.330	0.032	5	0.033 - 0.240	0.043	6	0.012 - 0.065	0.032	6	0.054 - 1.44	0.068
Total anions	meq/L	5	2.9 - 3.9	3.1	6	3.1 - 4.1	3.3	6	2.5 - 4.0	3.6	6	3.3 - 4.3	3.6
Total cations	meq/L	5	2.9 - 3.8	3.2	6	3.1 - 4.1	3.2	6	2.5 - 4.3	3.7	6	3.5 - 4.4	3.7
Total BOD	g O_2/m^3	5	0.8 - 10	0.9	5	<0.4 - 5	1.7	4	<0.4 - 4.2	1.2	5	0.8 - 2.7	1.3
Total Hardness	g/m^3 as $CaCO_3$	5	81 - 98	88	6	87 - 97	90	6	64 - 105	93	6	90 - 108	93
Turbidity	NTU	5	5.8 - 92	6.2	6	9.1 - 44	10.0	6	4.2 - 15	7.4	6	6.2 - 10.9	9.1

The results for the 2018-2019 monitoring period indicate that bicarbonate and alkalinity increase slightly in a downstream direction. Chloride, dissolved magnesium, potassium and sodium and sulphate are generally similar at sites MTM000057 and MTM000075, with a slight increase between this site and MTM000120. MTM000125 is generally similar to MTM000120 for these parameters. (Table 27). None of the changes were such that they would be considered a significant adverse environmental effect.

The nitrate-N concentration showed a large seasonal fluctuation, varying from about 1.5 g/m^3 in summer to 9 g/m^3 in winter. This is a larger variation than was observed in the Waiokura Stream, which was in the range of approximately 1.5 to 4.4 g/m^3. This is in comparison to the NPS bottom line of 9.8 g/m^3 (annual 95th percentile). On all occasions the nitrate-N results increased between MTM000057 and MTM000075 and then generally decreased in a downstream direction. An exception to this was in the survey on 28 January 2019, when the highest result of the survey (4.0 g/m^3) was observed at MTM000125. During the year under review, there were no obvious trends in the ammoniacal nitrogen. Continued monitoring will provide further information so that an assessment can be made regarding any possible environmental effects to surface water from the spray irrigation of wastewater on Farms 2 and 3, especially when paddock by paddock irrigation information is available. Adding total nitrogen to the analysis suite would help ascertain whether there are any nitrogen inputs or uptakes occurring through the stretch of the stream monitored.

In terms of a comparison between the Motumate Stream and the Waiokura Stream it is noted that, in addition to the higher base nitrate-N concentrations, the conductivity, and minerals were consistently higher in this water body during the year under review than in the Waiokura Stream. It is noted that there has been a shift in the range of nitrate-N concentrations observed in the Motumate Stream between monitoring undertaken in the 2009 to 2013 years (up to 5.9 g/m^3) and recent monitoring (up to 9.6 g/m^3). It is proposed that if these higher levels continue in the 2019-2020 year, that consideration is given to re-establishing periodic biomonitoring in the Motumate Stream. A recommendation to this effect is included in this report.

Table 28 Summary of Motumate Stream water quality data from the Council surveys during the period November 2009 to April 2013 and 2017-2018

Parameter	Unit	MTM000075			MTM000120			MTM000125		
		No.	Range	Median	No.	Range	Median	No.	Range	Median
Biochemical oxygen demand	g/m^3	16	<0.5 - 500	1.45	15	<0.5 - 13	2.4	4	0.7 - 1.7	1.4
Conductivity @20˚C	mS/m	16	28.7 - 64.1	32.0	15	34.2 - 61.7	37.7	5	38.4 - 47.0	41.6
Dissolved reactive phosphorus	g/m^3	7	0.040 - 0.154	0.066	7	0.047 - 0.380	0.0.076	4	0.056 - 0.107	0.070
Sodium	g/m^3	9	21.9 - 32	25.5	9	30.9 - 40.8	34.9	2	11.6 - 20.0	36.4
Ammoniacal nitrogen	g/m^3 N	10	0.028 - 7.26	0.060	10	0.034 - 2.90	0.28	5	0.091 - 3.38	0.113
Nitrate + nitrite	g/m^3 N	13	0.95 - 9.6	4.7	13	1.02 - 8.8	4.53	4	0.98 - 8.12	5.63
pH		16	7.4 - 7.8	7.6	15	7.1 - 7.8	7.4	5	7.4 - 7.6	7.4
Temperature	˚C	15	10.8 - 19.9	13.8	15	11.3 - 19.6	14.1	5	11.6 - 20.0	15.8
Turbidity	NTU	9	4.0 - 100	9.6	8	5.9 - 36	12	4	5.2 - 8.2	7.4

2.1.7 Waiokura Stream surface water quality

Some spatial synoptic surface water monitoring was conducted at three sites on the Waiokura Stream adjacent to and downstream of the Company's farms (Figure 39, Table 29). This was carried out approximately bi-monthly.

Table 29 Water quality monitoring sites in the Waiokura Stream

Site	Site code	Description	Map reference, NZTM	
			Easting	Northing
0	WKR000485	Waiokura Stream approx. 400 m u/s Skeet Road	1698819	5629373
1	WKR000500	Waiokura Stream at Skeet Road	1698807	5628892
2	WKR000630	Waiokura Stream 1.5 km, u/s of Hicks Road (~ 150m upstream of Farm 3's southern boundary)	1698126	5626926
3	WKR000650	Waiokura Stream at Hicks Road	1697735	5625026

These sites were chosen to monitor any possible effects on surface water from the spray irrigation of wastes on the Company's Farms 2 and 3. The results from the 2018-2019 monitoring period are presented in Table 31, and a summary of the monitoring previously performed is presented in Table 30.

Although the medians show little change between sites during the year under review (Table 31), the results for the 2018-2019 monitoring period again indicate a slight increase in conductivity and the sodium levels in the samples downstream of the control site (WKR000500) during each of the surveys. However, the changes observed are not significant enough to be considered an environmental effect. Nitrate-N concentration showed a seasonal fluctuation, varying from about 4.4 g/m^3 in spring to 1.5 g/m^3 in summer. This was again much less of a fluctuation than was observed in the 2016-2017 year (6.8 to 2.0 g/m^3). The median nitrate-N concentration for 2018-2019 at all three long established sites were similar to the respective long-term median values, as were the median sodium concentrations.

Continued monitoring over future periods will provide further assessment of any possible environmental effects to surface water from the spray irrigation of wastewater on Farms 2 and 3, especially when paddock by paddock irrigation information is available.

Table 30 Summary of Waiokura Stream water quality data from the Council surveys during the period March 2001 to June 2018

Parameter	Unit	Site 1 (WKR000500)			Site 2 (WKR000630)			Site 3 (WKR000650)		
		No.	Range	Median	No.	Range	Median	No.	Range	median
Conductivity @20˚C	mS/m	123	16.6 - 30.4	21.1	125	17.0 - 25.3	22.4	124	15.0 - 27.4	23.2
Dissolved reactive phosphorus	g/m^3	69	0.012 - 0.172	0.035	70	0.013 - 0.095	0.034	69	0.016 - 0.444	0.033
Sodium	g/m^3	122	14.8 - 25.4	19.6	123	9.4 - 24.9	21.4	122	13.9 - 62.4	22.6
Nitrate + nitrite	g/m^3-N	111	1.27 - 4.13	2.72	111	1.03 - 6.51	2.94	111	1.03 - 4.27	2.87
pH		89	6.6 - 8.0	7.6	91	6.9 - 8.2	7.6	89	7.0 - 8.1	7.7
Temperature	˚C	125	7.1 - 18.0	12.3	126	8.3 - 20.2	12.7	125	8.1 - 19.6	12.7

Table 31 Results of Waiokura Stream quality sampling for the year under review

Parameter	Unit	WKR000485			WKR000500			WKR000630			WKR000650		
		No.	Range	Median	No.	Range	Median	No.	Range	Median	No.	Range	median
Bicarbonate	g/m³ at 25°C	6	53 - 81	68	6	54 - 80	70	6	57 - 83	70	6	57 - 83	70
Chloride	g/m³	6	24 - 26	24	6	23 - 27	25	6	26 - 28	26	6	26 - 28	26
Dissolved Calcium	g/m³	6	12.4 - 15.3	14.4	6	13.1 - 15.8	14.7	6	13.2 - 15.9	14.8	6	13.2 - 15.9	14.8
Dissolved Magnesium	g/m³	6	4.9 - 6.8	5.9	6	5.2 - 6.9	6.2	6	5.4 - 7.3	6.4	6	5.4 - 7.3	6.4
Dissolved Potassium	g/m³	6	5.7 - 7.6	6.5	6	5.7 - 8.2	6.7	6	6.4 - 8.0	7.0	6	6.4 - 8.0	7.0
DRP	g/m³-P	6	0.027 - 0.158	0.051	6	0.025 - 0.196	0.047	6	0.027 - 0.072	0.034	6	0.027 - 0.072	0.034
Dissolved Sodium	g/m³	6	16.6 - 22.0	19.6	6	16.9 - 22.0	20.0	6	18.7 - 24.0	21.5	6	18.7 - 24.0	21.5
Electrical Conductivity	mS/m	6	22.3 - 24.9	24.2	6	23 - 25.3	24.8	6	24.4 - 26.9	25.8	6	24.4 - 26.9	25.8
Free Ammonia as N	g/m³	6	< 0.00012 - 0.0037	0.00016	6	0.00011 - 0.0041	0.00026	6	< 0.00009 - 0.0005	0.00021	6	< 0.00009 - 0.0005	0.00021
Nitrate-N	g/m³-N	6	1.44 - 3.7	2.6	6	1.77 - 4.2	3.0	6	1.76 - 4.2	3.0	6	1.76 - 4.2	3.0
Nitrate-N + Nitrite-N	g/m³	6	1.45 - 3.8	2.65	6	1.78 - 4.2	3.0	6	1.77 - 4.2	3.0	6	1.77 - 4.2	3.0
Nitrite-N	g/m³	6	0.003 - 0.016	0.008	6	0.004 - 0.015	0.008	6	0.006 - 0.013	0.006	6	0.006 - 0.013	0.006
pH	pH Units	6	7.6 - 7.8	7.6	6	7.5 - 7.8	7.6	6	7.6 - 7.9	7.8	6	7.6 - 7.9	7.8
Sample Temperature	°C	6	11.1 - 17.3	13.8	6	11.1 - 17.0	13.5	6	11.2 - 17.6	14.0	6	11.2 - 17.6	14.0
Sulphate	g/m³	6	7.2 - 10.3	8.8	6	7.1 - 10.6	9.2	6	8.9 - 12.2	10.7	6	8.9 - 12.2	10.7
Total Alkalinity	g/m³ as $CaCO_3$	6	44 - 67	57	6	44 - 66	58	6	47 - 68	58	6	47 - 68	58
Total Ammoniacal-N	g/m³	6	<0.010 - 0.40	0.01	6	0.015 - 0.52	0.018	6	< 0.010 - 0.023	0.013	6	< 0.010 - 0.023	0.013
Total anions	meq/L	6	2.0 - 2.3	2.2	6	2.1 - 2.4	2.3	6	2.2 - 2.4	2.4	6	2.2 - 2.4	2.4
Total cations	meq/L	6	1.9 - 2.4	2.25	6	1.98 - 2.5	2.4	6	2.1 - 2.6	2.35	6	2.1 - 2.6	2.4
Total BOD	g O_2/m³	6	<2 - 2	<2	6	<2 - 3	<2	6	<2 - <2	<2	6	<2 - <2	<2
Total Hardness	g/m³ as $CaCO_3$	6	51 - 66	60	6	54 - 68	62	6	55 - 70	63.5	6	55 - 70	64
Turbidity	NTU	6	4.4 - 12.8	7.6	6	4.0 - 15.4	7.8	6	3.0 - 13.4	7.2	6	3.0 - 13.4	7.2

2.1.8 Biomonitoring

2.1.8.1 Fish passage temperature compliance in mixing zone

The Council installed and maintained two water temperature data loggers in the Kaupokonui Stream during the 1994-1995 monitoring period. These loggers were sited toward the left and right banks of the stream flow channel at the downstream periphery of the spray cooling water discharge zone. The purpose of these temperature recorders was to monitor compliance with Special Condition 8 of consent **0919-3** and 9 of consent **0924-3** which require that these discharges shall not give rise to a thermal barrier preventing the movement of fish species within the designated mixing zone of the wastes with the Kaupokonui Stream.

The presence of a significant water temperature differential across the stream within the spray discharge zone was established during the temperature surveys of March 1993, March 1994 and January 1995. These surveys recognised that only a gradual rise in water temperature occurred toward the true right bank of the stream during spray cooling water discharges, and that this gradual increase would not be expected to present a thermal barrier preventing fish passage through the spray discharge or 150 m mixing zone of the stream. The across-stream temperature differences measured at the periphery of the spray zone were 9.5˚C, 3.7˚C, and 2.1˚C at the time of the 1993, 1994 and 1995 surveys respectively, although variation in disposal systems, weather, stream flow conditions and factory production contributed to these differences in results.

In January 2011, the Council stopped monitoring temperature differential across the width of the stream, after continuous monitoring (at 15-minute intervals with very occasional disruption) since August 1993. The record is depicted in Figure 56. The monitoring ceased for two reasons. First, there was an unacceptable risk to the safety of the personnel who climbed down the stream bank and waded to the monitoring sites. Secondly, while temperature measurement along the length of the mixing zone was continued by the Company, at the time it was considered that transverse monitoring was no longer considered necessary, as disruption to fish passage was not expected to occur. This was based on the fact that significant periods of cooler water conditions had been demonstrated towards the right bank of the stream and there was gradual mixing of the cooling water discharges with the receiving water. The assumption was made that the fish would make use of the cooler flow corridor close to the true right bank. The current temperature conditions within the mixing zone and the validity of this assumption will be investigated by the Company during the preparation of the AEE for the renewal of the cooling water discharge consent(s).

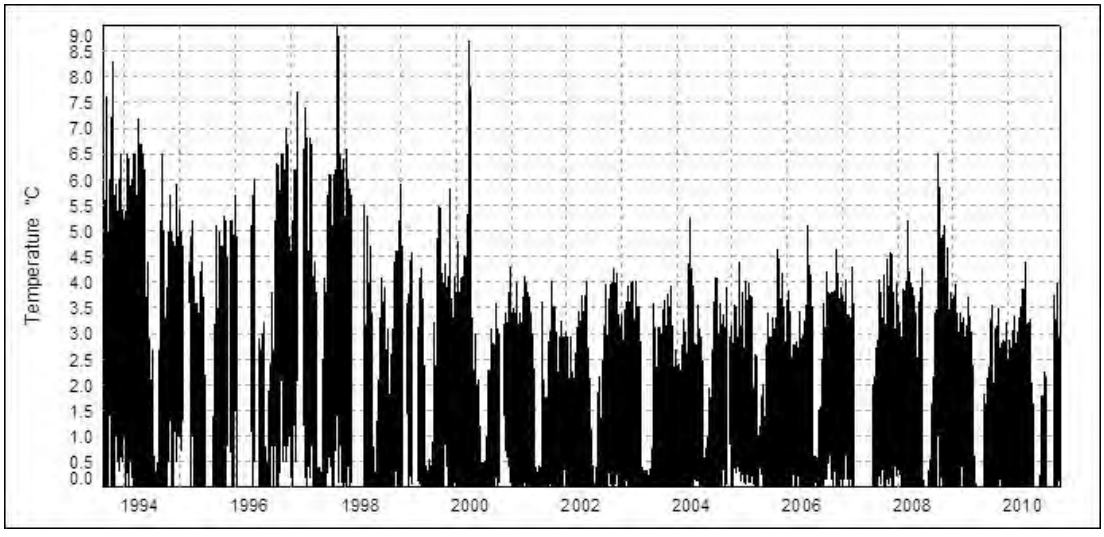

Figure 56 Kaupokonui Stream water temperature differential (LB-RB) records at the periphery of the Fonterra Ltd spray cooling water discharge zone, 1993-2010

Instead, a programme of (triennial) fish monitoring was instituted, to assess both the influence of the cooling water discharge on fish passage, and the effectiveness of the fish pass at the water abstraction weir about 100 metres upstream. The first fish monitoring survey was conducted in January 2014. A second survey was carried out in June 2017 and is discussed below in section 2.1.8.3. The next survey is due in the 2019-2010 year.

Kaupokonui Stream flow records for the monitoring period for the Glenn Road recording station are presented in Figure 57.

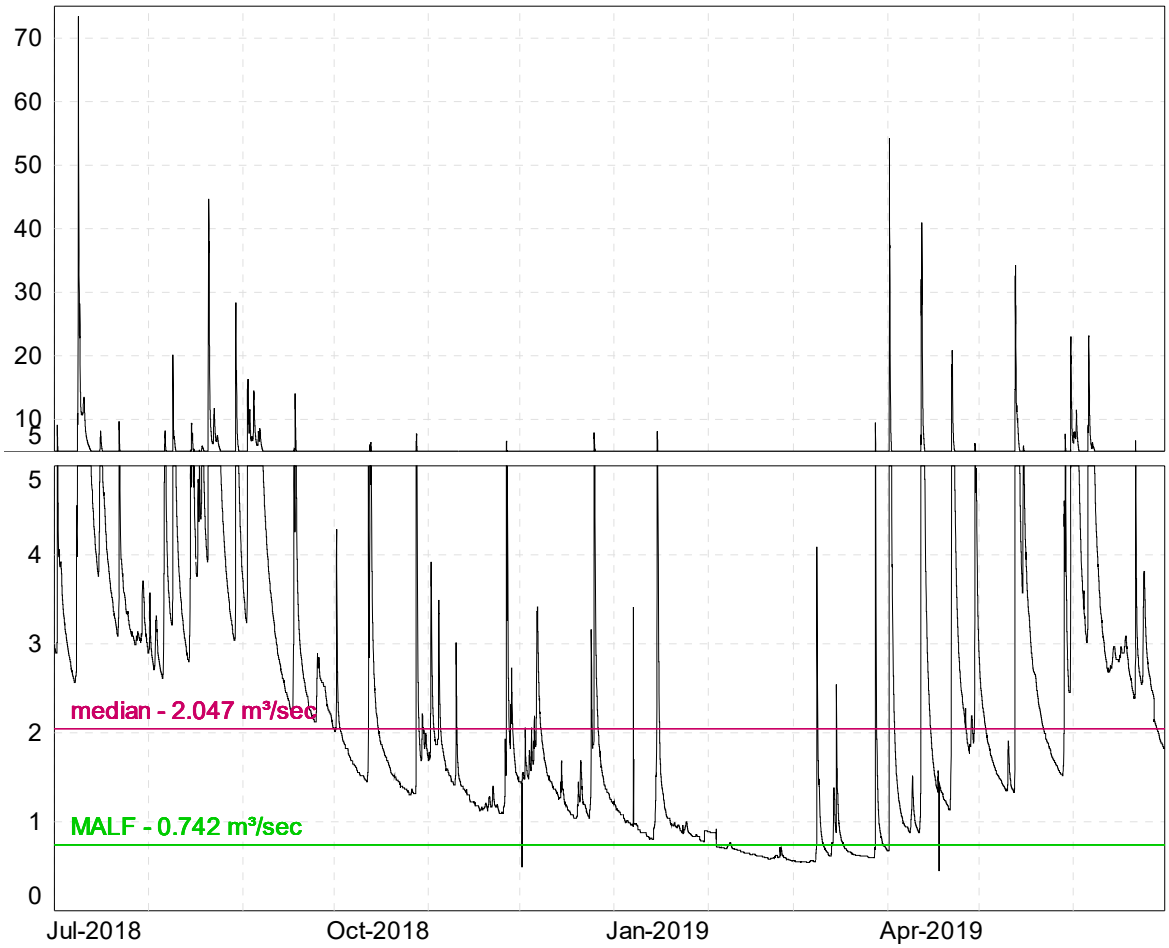

Figure 57 Kaupokonui Stream at Glenn Road flow record (m^3/s) for the year under review

2.1.8.2 Lower stream water temperatures

Two additional water temperature data loggers remained in place in the lower reaches of the Kaupokonui Stream for the duration of the year under review period to provide ambient stream temperature data over the 14 km reach downstream of the factory to the coast. These loggers are sited in the stream at Upper Glenn Road, about 9.8 km downstream of the lactose plant discharge, and above the tidal influence, approximately 1.4 km upstream of the stream mouth. The loggers were installed in July 1999, with the agreement of the Company, in response to concerns expressed by submitters to consents **0919-3** and **0924-3** to discharge cooling water from the lactose plant.

Water temperature records for these two sites are illustrated in Figure 58 and Figure 59.

A monthly summary of these data is included in Table 32.

During the year under review, the stream temperature at Glenn Road reached a maximum of 25.7˚C on 31 January 2018 from 16:15 to 17:30 NZDT. The logger at the Beach site had been out of the water on this

date and therefore there is no comparative data for this period. The maximum temperatures at the beach were 25.0˚C on 11 January 2019 from 15:00 to 15:30 NZDT and the temperature at Glen Road on this date was 24.7˚C .These temperatures are approximately 1.5 to 3˚C lower than the maximum temperatures observed during the 2016-2017 year.

On 31 January the temperature of the Kaupokonui Stream upstream of the Company's site peaked at 23.9˚C, however this was much later in the day, between 17:30 and 19:00. The temperatures prior to 16:15 reached a maximum of 23.5˚C upstream of the sprayers. The temperature downstream of the sprayers peaked at 23.7˚C between 18:45 and 19:45. The temperature prior to 16:15 reached a maximum of 23.3˚C. It is noted that the stream temperature at Glenn Road and the coast often peaks somewhere between approximately two to three and a half hours earlier than in the vicinity of the lactose plant. In the hours leading up to the peak Glenn Road and beach temperatures, the maximum cooling water discharge temperature was 26.5˚C at an approximate discharge rate of 40 to 60 L/s.

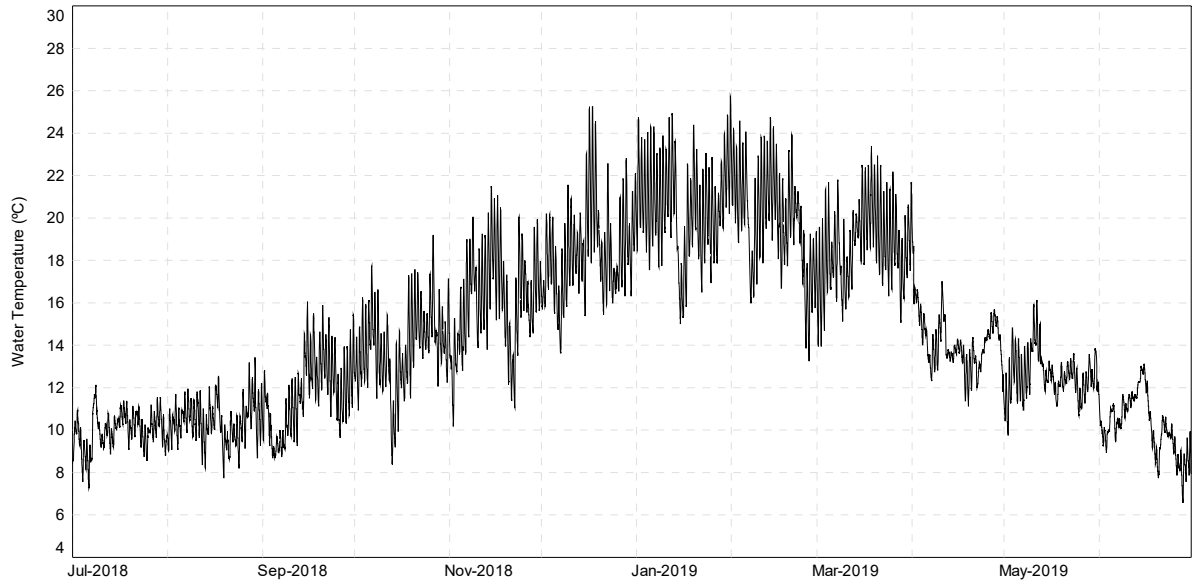

Figure 58 Water temperature (°C) records for the Kaupokonui Stream at Glenn Rd during the year under review

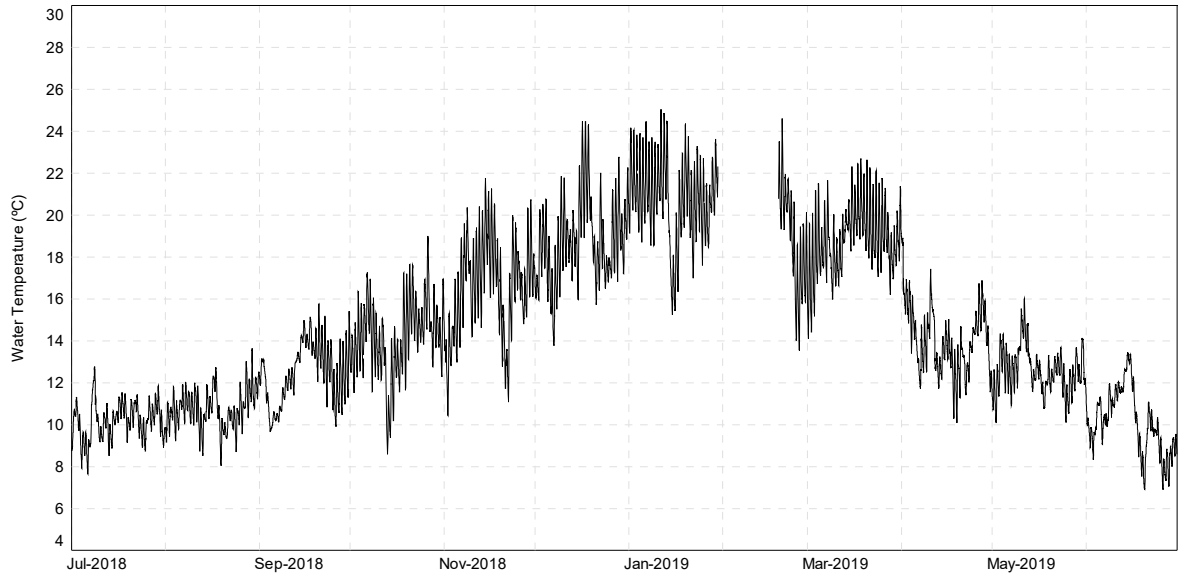

Figure 59 Water temperature (°C) records for the Kaupokonui Stream at beach during the year under review

Table 32 Monthly Kaupokonui Stream water temperature data for Glenn Road and the coast during the year under review.

Site	Upper Glenn Road			Near Coast		
	Min	Max	Mean	Min	Max	Mean
July 2018	7.3	12.1	10.0	7.6	12.8	10.2
August 2018	7.8	13.4	10.4	8.1	13.6	10.8
September 2018	8.7	16.1	11.7	9.7	15.8	12.5
October 2018	8.4	19.2	13.9	8.6	19.0	14.1
November 2018	10.2	21.5	16.1	10.4	21.8	16.5
December 2018	13.6	25.3	18.4	13.8	24.5	18.8
January 2019	15.0	25.8	20.5	15.3[a]	25.0[a]	20.7[a]
February 2019	13.3	24.8	19.9	13.5[b]	20.9[b]	21.6[b]
March 2019	13.9	23.4	18.8	14.1	22.7	18.9
April 2019	11.1	19.4	14.1	10.1	19.0	14.0
May 2019	9.8	16.1	12.6	10.1	16.0	12.6
June 2019	6.6	13.1	10.2	6.9	13.5	10.1

Key a – approximately 2 days affected by missing data
b – approximately 19 days affected by missing data
Both due to the temperature logger being lifted out of the water due to collapse of a stream bank

An analysis of the stream water temperature data for each site over the year under review indicated that 20˚C, above which trout start to become stressed, was exceeded for approximately 13% of the year at Glenn Road and 11% of the year near the mouth (with approximately 21 days affected by missing data), while the annual median water temperatures were 13.8˚C at Glenn Road and 13.7˚C near the mouth. During the warmer months of November to March, the temperatures exceeded 20˚C for approximately 31% of the time at Glenn Road and 30% of the time at the coast. The median temperatures during this period were 18.8˚C and 18.8˚C respectively.

The highest recorded temperature in the lower Kaupokonui River is 29.0°C, for Glenn Road on 9 January 1994 at 1500 NZST.

Instream temperatures continue to increase beyond the periphery of the mixing zone. It is not clear whether the increase in stream temperature due to the lactose plant's cooling water discharge introducing a step change that is cumulative, or whether stream temperatures below the lactose plant drop back to the upstream temperatures before natural heat fluxes take effect, and whether the reduction in flow due to the water consumption at the plant contributes to this in any way. This will be a matter for further investigation during the processing of the replacement consent applications.

2.1.8.3 Evaluation of fish passage

An assessment of the effectiveness of the fishpass on the Kaupokonui Stream weir at the Company's plant (consent **0302-3**) was performed by Council staff using night spotting techniques at six sites in the Kaupokonui Stream in April 1999. These results were reported in the 1998-1999 Annual Report by Council (TRC 1999) which contained a recommendation for further fish investigations in the Kaupokonui Stream upstream of the Company's weir. The purpose of the proposed investigations was to determine the upstream extent of red-finned bully migration within the stream. This information was required to determine whether or not passage for native fish needed to be specifically addressed in the design of a new

fish pass. However, new fish data recorded in the lower section of the Kaupokonui Stream in October 1999 demonstrated that passage for native fish needed to be given specific consideration in the design of a new fish pass.

In October 2000 the Council recorded torrentfish in the lower section of the Kaupokonui Stream. Torrentfish migrate up and down waterways several times throughout the year and have been recorded in Taranaki streams up to an altitude of 440 m. However, they are poor climbers and are not currently able to negotiate the hydrological control weir in the Kaupokonui Stream at Glenn Road, at an altitude of 50 m. With the construction of a new fish pass at this weir to enable the passage of torrentfish and other native species over the weir, torrentfish are expected to migrate upstream to the Company's site, at an altitude of 160 m.

In September 2000, Fish and Game Taranaki wrote to the Council recommending that a 'constructed stream' type fish pass be built over the Company's Kapuni weir, similar to the one recently built on Cold Creek for South Taranaki District Council. Such a pass would allow for the passage of both trout and native fish. A deep channel in the centre of the pass would allow for the passage of trout. Rough, shallow zones on the edge of the pass would allow for the passage of native fish. It was suggested that a local engineering firm develop a design, and that a recognised fish pass expert evaluate the design. The Council concurred with this proposal.

In December 2000, the Council's Freshwater Biologist met onsite with Company and Fish and Game Taranaki staff, and Mr Charles Mitchell, a fish pass consultant. The weir was visited and options for the fish pass to provide passage for native fish (targeting torrentfish), and trout were discussed.

A report dated May 2001 prepared by Charles Mitchell and Associates was forwarded to the Council. This report outlined two possible options for upgrading fish passage past the weir. In November 2001, the Company advised the Council of the proposed works to construct the fish pass. The Council advised that it was appropriate to undertake the works in accordance with the conditions of consent 4623, and that no change to the consent was required.

Construction of the fish pass was subsequently completed in late March 2004, and the pass was commissioned in early April 2004. Council and Fish and Game Taranaki assisted with the construction, particularly the placement of rocks within the pass. Visual inspections have indicated the pass is functioning well, and trout have been observed immediately upstream that may have used the pass. However, in November 2010, during a routine biomonitoring survey, it was noted that a cut-out had formed in the side of the lower section of the pass, through which a significant amount of the water flow was escaping. Repairs to the upper and central sections were made in May 2013. Further work on the bottom section was carried out in summer 2013-2014.

2.1.8.3.1 Fish survey

The fish survey was not scheduled to take place in the year under review. It is next scheduled for the 2019-2020 year. A discussion of the results of the most recent survey are included below for reference.

During the year under review there were three trout observed as being present around the intake area (i.e. above the fishpass) at the time of the November site inspection.

A four-site fish survey was undertaken in the Kaupokonui Stream on 2 June 2017, in order to determine whether the activities of the Kapuni Lactose factory had had any impact on the fish communities of this stream. The fish communities were surveyed using the electric fishing technique, with all fish identified where possible, counted, and lengths estimated. The sites monitored are described in Table 33 and shown in Figure 60.

Table 33 Location and description of fish monitoring sites in relation to the Kapuni Lactose factory

Site	Site code	Site description	Grid reference	Distance to coast (km)	Approximate Altitude (m)
1	KPK000660	Upstream of intake weir	E1697613 N5629791	15.98	170
2	KPK000666	Between intake weir and cooling water discharge	E1697744 N5629658	15.5	160
3	KPK000677	Downstream of cooling water discharge	E1697644 N5629458	15.3	160
4	KPK000685	Skeet Rd	E1697221 N5628986	14.51	150

The two main activities that could potentially impact on the fish communities are the discharge of cooling water to the Kaupokonui Stream and the water intake weir, located just upstream of the cooling water discharge. In addition, it should be noted that some kilometres downstream of the factory is an orphaned structure, the Glenn Road weir, which currently does not have adequate fish passage provision.

Four fish species were recorded during this survey, being longfin and shortfin eel, redfin bully and brown trout. Redfin bully were recorded in very low abundance, reflecting the impact of the Glenn Road weir.

Upstream of the Kapuni Lactose weir, longfin and shortfin eels and redfin bully were recorded, providing no indication that this weir is posing a significant barrier to fish passage. Although the numbers of juvenile eels recorded was less than that recorded in 2014, this is considered to be due to the timing of the two surveys.

There were no significant differences between the fish communities recorded at site 3 (downstream of the cooling water discharge), and that recorded at the other three sites. Where differences were recorded, as with the previous survey which recorded a higher abundance of eels between 250 mm and 450 mm at site 3, these differences can largely be attributed to the variation in habitat between the sites.

Overall, it was considered that the activities of the Kapuni Lactose factory have not adversely affected the fish communities of the Kaupokonui Stream. It is hoped that as the riparian planting of the catchment matures, and passage remediation works at the Glenn Road weir are undertaken, that the diversity and abundance of fish in this stretch of stream will improve.

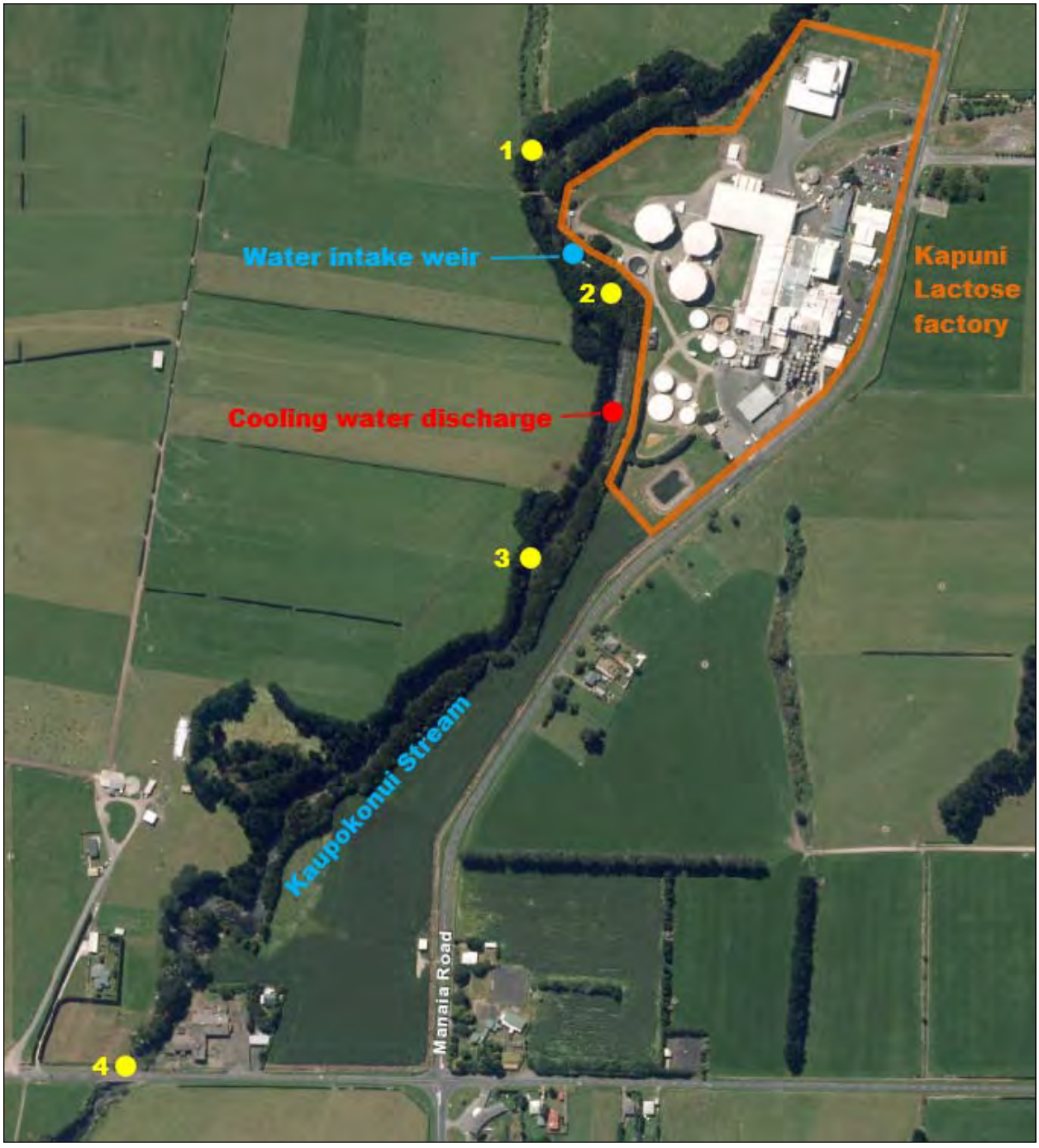

Figure 60 Fish monitoring sites sampled in the Kaupokonui River, in relation to the Kapuni Lactose factory

The 2014 survey was completed in January, during the elver migration period, while the 2017 survey was completed in June, when the elvers will have had more time to distribute further within the catchment.

Although there was no formal fish survey undertaken during the year under review, trout were observed upstream of the fish pass, around the weir, during the August and November 2018 inspections.

2.1.8.4 Macroinvertebrate surveys

The Council's standard 'kick-sampling' technique was used to collect streambed macroinvertebrates from five sites in the Kaupokonui Stream on 5 October 2018 and 5 March 2019. Two sites in the Waiokura Stream were also sampled in March 2018. Samples were sorted and identified to provide the number of taxa (richness), MCI and $SQMCI_s$ scores for each site. The samples were also microscopically scanned to

determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths"). The sites monitored are described in Table 34 and shown in Figure 62. Samples were sorted and identified to provide the number of taxa (richness), MCI and $SQMCI_s$ scores for each site. The report summaries are provided below. Copies of the full reports are available from the Council upon request.

Table 34 Biomonitoring sites in the Kaupokonui River and Waiokura Stream

Stream	Site No.	Site Code	Location
Kaupokonui River	3b	KPK000655	1 km u/s of railway bridge
	4	KPK000660	Railway, above factory
	5	KPK000679	160m below cooling water discharge zone
	6	KPK000685	Skeet Road
	7	KPK000880	Glenn Road
Waiokura Stream	U	WKR000500	Skeet Road
	D	WKR000650	At Hicks (Thomas) Road

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. It may be used in soft-bottomed streams to detect trends over time. The $SQMCI_s$ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either MCI or $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of discharges being monitored.

5 October 2018

In the October 2018 survey, the five sampling sites supported taxa richness of between 17 and 25 taxa. The sites were between one taxon higher (site 7) and six taxa fewer (sites 3b and 4) than recorded in the preceding survey. Taxa richness was generally relatively similar between sites, with the exception of site 6 which recorded the highest richness of 25 taxa, a substantial five taxa higher than any other site in this survey.

MCI scores ranged from 127 to 92 units in the current survey, indicating 'very good' to 'fair' macroinvertebrate community health throughout the surveyed reach. The upstream site, 3b, recorded its highest MCI score to date, and was significantly higher than all other sites except site 4. As is typical, MCI scores decreased in a downstream direction, with the middle three sites having similar MCI scores. The downstream site, 7, had a score significantly lower than all other sites. SQMCI scores ranged from 7.4 to 3.8, with scores being similar at sites 3b, 4 and 6, while site 5 had a score significantly lower than these three sites. Site 7 had a score significantly lower than any other site in this survey. At site 3b, the SQMCI score of 7.4 units was the highest recorded to date.

In some previous surveys, a decline in macroinvertebrate community health has been noted between sites 3b and 4, which may be attributable to the discharge of treated dairy shed effluent to an inflowing tributary a short distance upstream of site 4. No such deterioration was recorded in the current survey. Site 5 historically has had a lowered median MCI score, with some poor results in the 1980s and early 1990s caused by wastes entering the river via the cooling water discharges. Most surveys in more recent years had found no sign of the heterotrophic growths (mats of filamentous bacteria and protozoa) recorded by several surveys at this site in the 1980s and early 1990s. However, an extensive outbreak of heterotrophic growths occurred in this reach of the river during the autumn-winter months of 2007. Heterotrophic growths were again recorded in summer 2008, spring 2010 and spring 2014. An obvious deterioration in the macroinvertebrate community occurred in conjunction with the outbreak in 2008, and a more subtle

deterioration occurred in 2010. This indicated that a poor quality cooling water discharge had been occurring, but that it was not resulting in the same degree of deterioration in water quality as the discharges that occurred in the early 1990s. The October survey did not record any heterotrophic growths; neither did it indicate any change in macroinvertebrate communities caused by the cooling water discharge. Site 7 typically records the poorest macroinvertebrate communities, and this was the case in the October survey. This is owing in part to the influence of the Dunns Creek tributary, which joins the river between the two sites, and also to the large distance between the two sites. It is common to observe progressive downstream deterioration in ringplain rivers and streams. Occasionally, there had been little difference between sites 6 and 7, due to site 6 showing impacts from the cooling water discharge. However, there was no significant evidence of cooling water discharge influencing the macroinvertebrate community at site 6.

It may be concluded that the factory's cooling water discharges had not resulted in significant adverse effects on the macroinvertebrate communities, and that the communities were largely in average condition. Community composition showed similarities between all sites, with the largest change being between sites 6 and 7. The survey did not record the presence of heterotrophic growths, supporting a lack of impacts from the cooling water discharge. Further, the trend of improvement in communities adjacent to the factory observed in more recent years has continued to be recorded by the survey.

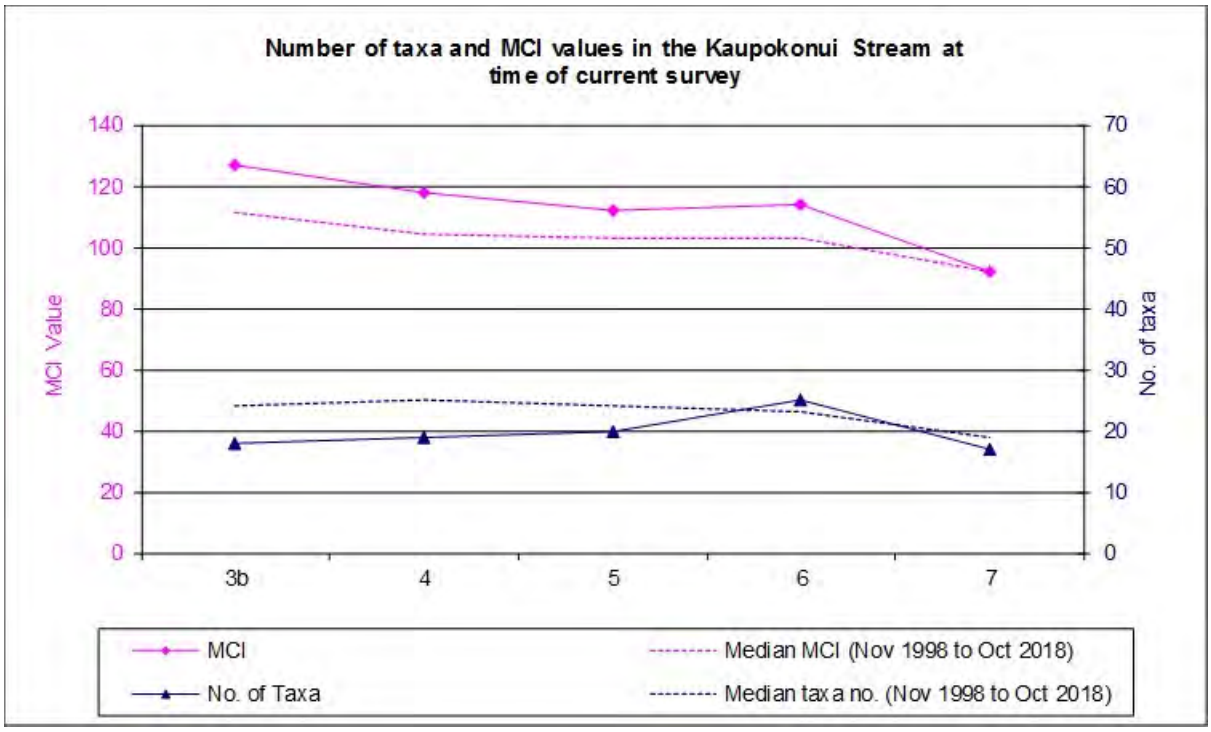

Figure 61 Numbers of taxa and MCI values recorded in the Kaupokonui River in this survey, together with median values from previous surveys (November 1998 to date)

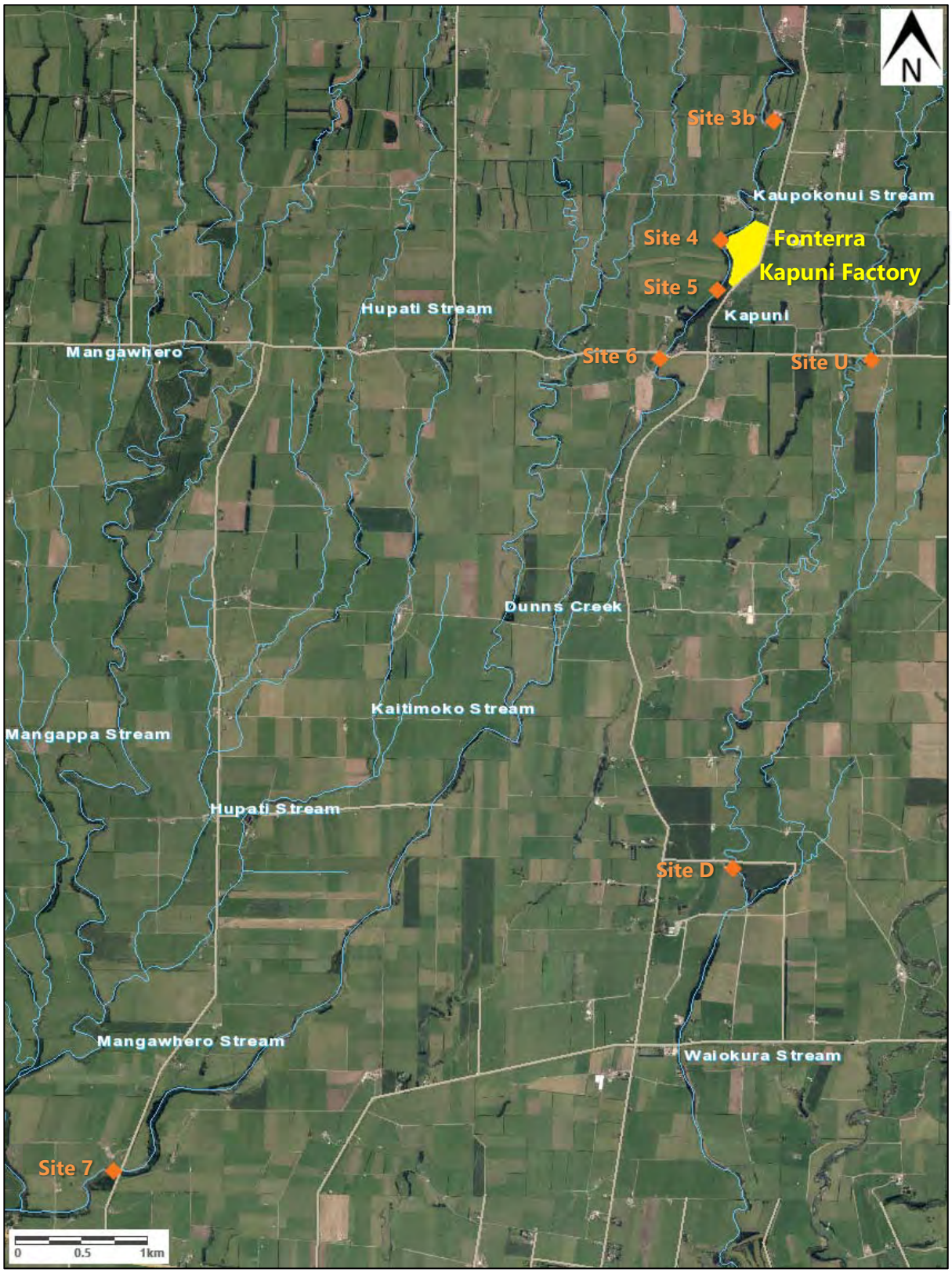

Figure 62 Biomonitoring sites in the Kaupokonui River sampled in relation to the Company's factory discharges

5 March 2019

In the March 2019 survey, the five sampling sites in the Kaupokonui Stream supported taxa richness of between 16 and 27 taxa. This range was comparable to the preceding survey, however at individual sites taxa richness was between nine taxa higher (site 3b) and seven taxa fewer (site 4) than the preceding survey. Taxa richness in the current survey was generally relatively similar between sites, with the exception of site 7 which recorded the lowest richness of 16 taxa, a substantial seven taxa fewer than any other site in the survey.

MCI scores ranged from 110 to 81 units, indicating 'good' to 'fair' macroinvertebrate community health throughout the surveyed reach. As is typical, MCI scores generally decreased in a downstream direction. The exception to this was the upstream site, 3b, which recorded a MCI score of 100, which was a non-significant ten units lower than recorded at site 4. Site 4 recorded a score significantly higher than site 5, and site 7 recorded a score significantly lower than any other site. SQMCI scores ranged from 5.1 to 3.0, with the highest score recorded at site 4 and the lowest recorded at site 7. SQMCI scores were generally congruent with MCI scores at these sites.

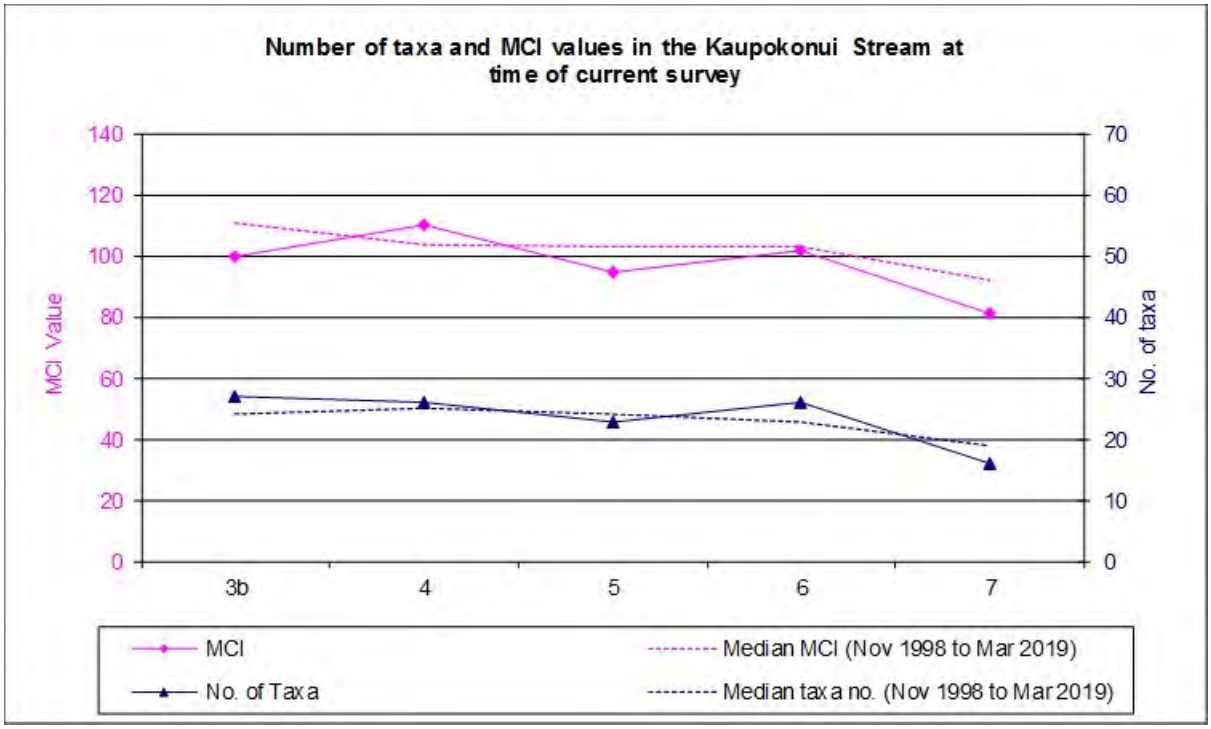

Figure 63 Numbers of taxa and MCI values recorded in the Kaupokonui River in this survey, together with median values from previous surveys (November 1998 to date)

In some previous surveys, a decline in macroinvertebrate community health has been noted between sites 3b and 4, which may be attributable to the discharge of treated dairy shed effluent to an inflowing tributary a short distance upstream of site 4. No such deterioration was recorded in the March 2019 survey. Site 5 historically has had a lowered median MCI score, with some poor results in the 1980s and early 1990s caused by wastes entering the river via the cooling water discharges. Most surveys in more recent years had found no sign of the heterotrophic growths (mats of filamentous bacteria and protozoa) recorded by several surveys at this site in the 1980's and early 1990's. However, an extensive outbreak of heterotrophic growths occurred in this reach of the river during the autumn-winter months of 2007. Heterotrophic growths were again recorded in summer 2008, spring 2010 and spring 2014. An obvious deterioration in the macroinvertebrate community occurred in conjunction with the outbreak in 2008, and a more subtle deterioration occurred in 2010. This indicated that a poor quality cooling water discharge had been occurring, but that it was not resulting in the same degree of deterioration in water quality as the discharges

that occurred in the early 1990's. The survey did not record any heterotrophic growths; neither did it indicate any change in macroinvertebrate communities caused by the cooling water discharge. Site 7 typically records the poorest macroinvertebrate communities, and this was the case in the March 2019 survey. This is owing in part to the influence of the Dunns Creek tributary, which joins the river between the two sites, and also to the large distance between the two sites. It is common to observe progressive downstream deterioration in ringplain rivers and streams. Occasionally, there had been little difference between sites 6 and 7, due to site 6 showing impacts from the cooling water discharge. However, there was no significant evidence of cooling water discharge influencing the macroinvertebrate community at site 6.

It may be concluded that the factory's cooling water discharges had not resulted in significant adverse effects on the macroinvertebrate communities of the Kaupokonui Stream, and that the communities were largely in average condition. Community composition showed similarities between all sites, with the largest change being between sites 6 and 7. The survey did not record the presence of heterotrophic growths, supporting a lack of impacts from the cooling water discharge. Further, the trend of improvement in communities adjacent to the factory observed in more recent years has continued to be recorded by the survey.

The Waiokura Stream recorded moderate taxa richness of 19 taxa at both sites. Similar MCI scores of 104 and 97 units were recorded at the two sites, categorising site U as having 'good' and site D as having ' fair' macroinvertebrate community health. SQMCI scores of 6.6 and 4.9 were recorded at the two sites, showing a significant decrease in a downstream direction.

The Waiokura Stream communities indicated that conditions during the survey were fairly typical when compared with previous surveys at these two sites to date. The stream exhibited the usual slight deterioration in MCI score in a downstream direction. This is largely attributable to the distance between the sites and the marked habitat differences between sites, especially the predominance of macrophytes at site D, rather than to any effects from the application of wastes to land from the Fonterra factory. There were some subtle changes in macroinvertebrate community compositions between the sites, which were associated with differences in habitat, principally an increase in macrophytes and periphyton at the downstream site. These community differences were insignificant and not indicative of recent impacts of wastewater irrigation within the Waiokura Stream catchment.

2.2 Air

Officers of the Council carried out inspections in relation to air emissions, of the Kapuni lactose plant, during the 2018-2019 monitoring period. These inspections are an important part of the monitoring programme, and are incorporated as part of the monthly inspections and water sampling, allowing for discussion of air discharge management issues.

From an air emissions perspective, the plant appeared to be well managed and well maintained, with a high standard of housekeeping observed at the time of each inspection. During each inspection a survey of the site boundary and the surrounding neighbourhood was carried out for odours and lactose powder fallout. No evidence of any lactose powder fallout was found during any of these surveys. No objectionable odours or visible emissions were noted beyond the site boundary during any of the inspections, with only on-site odours noted on occasion during inspections.

2.2.1 Emission monitoring

A wet scrubber system was commissioned by the Company in October 1998. The wet scrubber system links the exhaust streams from the pre-drier stack and the refined fluid bed drier, with this emission source then referred to as the flash drier.

Table 35 is included for comparison of results prior to the installation of the wet scrubber system.

Table 35 Summary of the refined and pre-drier emission testing results prior to the installation of the wet scrubber (October 1998)

Stack	Date	Emission (mg/m^3)
Refined drier	26 November 1997	515
Refined drier	10 December 1997	215
Pre-drier	8 December 1999	158
Refined drier	21 January 1998	567

Isokinetic stack sampling and analysis of the exhaust from the flash drier stack for particulates was conducted on 21 September 2018 by CRL Energy, using USEPA method 17. In contrast to the previous year's results, the determination had returned to being an average result from three tests each conducted over approximately 60 minute periods, rather than the one approximately 60 minute period used during the 2017-2018 year. Again, no information was included in the report regarding the production rate at the time the test was undertaken, although the Council was informed by the Company that the site was at full production. The current consent does not contain any conditions specifying the methodology and reporting requirements for the stack testing required to confirm compliance with particulate emission rate limit. This will be addressed in the replacement consent.

The result is presented in Table 36 below, along with previous averaged CRL and Council results since 1998.

Table 36 Summary of isokinetic stack analysis of the flash drier for 1998-2018

Date	Production rate (t/hr)	Stack emission rate (dsm^3/hr)	Emission (mg/dsm^3)*	Comments
5 November 1998	-	-	<10	No visible emissions noticed
25 February 1999	-	-	<10	No visible emissions noticed
4 May 1999	-	-	<10	No visible emissions noticed
9 May 2000	-	-	<10	No visible emissions noticed
27 October 2000	-	-	<10	No visible emissions noticed
30 November 2000	-	-	21	No visible emissions noticed
29 November 2001	-	-	<10	No visible emissions noticed
21 January 2009	-	-	58	
6 February 2010	-	-	53	
20 January 2011	-	-	18	Mass emission rate 0.7 kg/hr
11 January 2012	-	-	67	Mass emission rate 3.0 kg/hr
9 January 2013	-	-	27	Mass emission rate 1.3 kg/hr
11 December 2013	-	-	18	Mass emission rate 0.9 kg/hr
17 December 2014	-	-	23	Mass emission rate 1.2 kg/hr
11 November 2015	-	-	18	Mass emission rate 0.9 kg/hr
21 September 2016	5.4	44891	17	Mass emission rate 0.8 kg/hr
25 October 2017	Not provided	46229	17.1	Mass emission rate 0.8 kg/hr
21 September 2018	Not provided	44408 to 45407	1.2	Mass emission rate 1.2 kg/hr

Key * mg/dsm^3 = milligrams per cubic meter of gas, at 0˚C, 1 atmosphere pressure and calculated as a dry gas

The emission monitoring performed after the installation and commissioning of the wet scrubber system clearly shows the success of the wet scrubber in abating powder emissions from the refined drier and pre-drier at the lactose plant. In view of the consistently low particulate emissions, Council in 2002 stopped emission monitoring but continued the ambient deposition monitoring and inspections. The Company instituted its own emission testing in 2009, as part of product loss monitoring.

The consent limit for emissions from the wet scrubber system is 125 mg/m³ of gas, adjusted to 0˚C, 1 atmosphere pressure and calculated as dry gas. Prior to the consent renewal (7 April 2000) the discharge limit was 250 mg/m³ of gas, adjusted to 0˚C, 1 atmosphere pressure and calculated as dry gas.

The results obtained in September 2018 were below consent limits.

The Company commenced voluntary particulate emissions monitoring of the other three emission sources on site in 2016. The results are presented in Table 37, Table 38 and Table 39. There are currently no consent limits on these sources, however the renewed consent will contain particulate emissions limits for each of these stacks. All average particulate emission rates during the year under review were below the 125 mg/m^3 limit that applies to the flash dryer. It is noted that in the testing conducted during the year under review, there was a wide variation within the three sample runs carried out on the small drier. The maximum emissions being 205 mg/dsm^3 and 4.7 kg/hr in the first of the three test runs and the second and third runs being much lower, at approximately 50 mg/dsm^3 and 1 kg/hr. The reason for the variability was not explained in the report provided.

Table 37 Summary of isokinetic stack analysis of the small drier, commenced in 2016

Date	Production rate (t/hr)	Stack emission rate (dsm^3/hr)	Particulate emission (mg/dsm^3)*	Particulate emission rate (kg/hr)
21 September 2016[a]	2.5	26428	66	1.8
25 October 2017[b]	Not provided	23478	70.3	1.65
21 September 2018[c]	Not provided	22992 to 23635	104	2.4

Key * mg/dsm^3 = milligrams per cubic meter of gas, at 0˚C, 1 atmosphere pressure and calculated as a dry gas
average of three test results using USEPA method 201A
single test result using USEPA method 17
average of three test results using USEPA method 17

Table 38 Summary of isokinetic stack analysis of the supertab north dryer, commenced in 2016

Date	Production rate (t/hr)	Stack emission rate (dsm^3/hr)	Particulate emission (mg/dsm^3)*	Particulate emission rate (kg/hr)
21 September 2016[a]	0.629 (combined with south)	18863	93	1.7
25 October 2017[b]	Not provided	20616	24.7	0.50
21 September 2018[c]	Not provided	20553 to 23635	87	1.9

Key * mg/dsm^3 = milligrams per cubic meter of gas, at 0˚C, 1 atmosphere pressure and calculated as a dry gas
average of three test results using USEPA method 201A
single test result using USEPA method 17
average of three test results using USEPA method 17

Table 39 Summary of isokinetic stack analysis of the supertab south dryer, commenced in 2016

Date	Production rate (t/hr)	Stack emission rate (dsm^3/hr)	Particulate emission (mg/dsm^3)*	Particulate emission rate (kg/hr)
21 September 2016[a]	0.629 (combined with north)	21831	138	3.0
25 October 2017[b]	Not provided	20208	47.4	0.98
21 September 2018[c]	Not provided	22527 to 22927	90	2.0

Key * mg/dsm^3 = milligrams per cubic meter of gas, at 0˚C, 1 atmosphere pressure and calculated as a dry gas
average of three test results using USEPA method 201A
single test result using USEPA method 17
average of three test results using USEPA method 17

2.2.2 Deposition gauging

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

Deposition gauges are basically buckets elevated on a stand to about 1.6 m. The buckets contain deionised water to ensure that any dust that settles out of the air is not re-suspended by wind. A copper sulphate solution at a concentration of 5 g/L acts as a preservative to prevent growth of algae and bacteria.

In the year under review, gauges were deployed at five sampling sites around the lactose plant for a period of approximately five weeks during summer. The contents of the gauges were analysed for COD (chemical oxygen demand). The COD results are compared with the theoretical value for lactose powder and a "total deposited powder" (TDP) value is calculated.

The descriptions and locations of the five air deposition monitoring sites are provided in Table 40 and Figure 64.

The Council guideline value for total particulate deposited to cause nuisance is 130 mg/m^2/ day, but the Council does not have a specific guideline value for lactose powder deposited. The lactose deposition survey determines deposition due to lactose powder only, not total deposition.

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

The deposition gauge results for the deployment period in the year under review are compared with previous results since 1997 in Figure 65 and Table 41.

Prior to the commissioning of the wet scrubber in October 1998, deposition rates of up to 1,300 milligrams per square metre were reported from surveys carried out surrounding the lactose factory site. There has been a significant reduction in deposition since the wet scrubber began operating. This is consistent with the decrease in stack emission concentrations measured (see section 2.2.2).

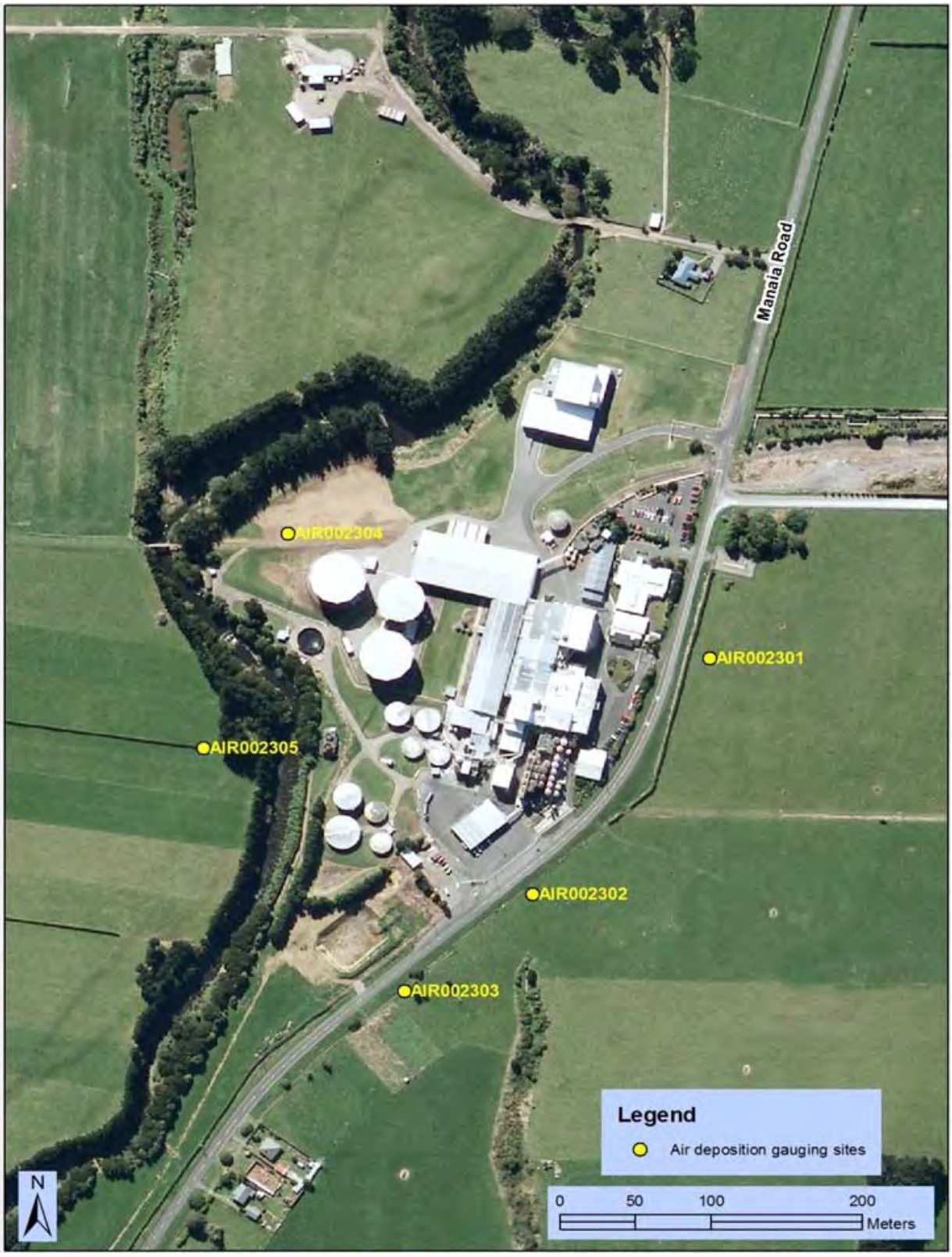

Figure 64 Location of air deposition gauging sites

Table 40 Description of the Fonterra Ltd air deposition sample sites

Site number	Description
AIR002301	east of plant, across Manaia Road adjacent to the plant
AIR002302	east of plant, opposite the tanker bay
AIR002303	south of plant
AIR002304	west of plant
AIR002305	south west of plant

Winds from the WSW to NW predominated (approximately 40% of the time) during the gauge deployment, NNE components were present 12% of the time, while SE components were for 10% of the time. The remainder were in the range of about <1 to 7% of the time.

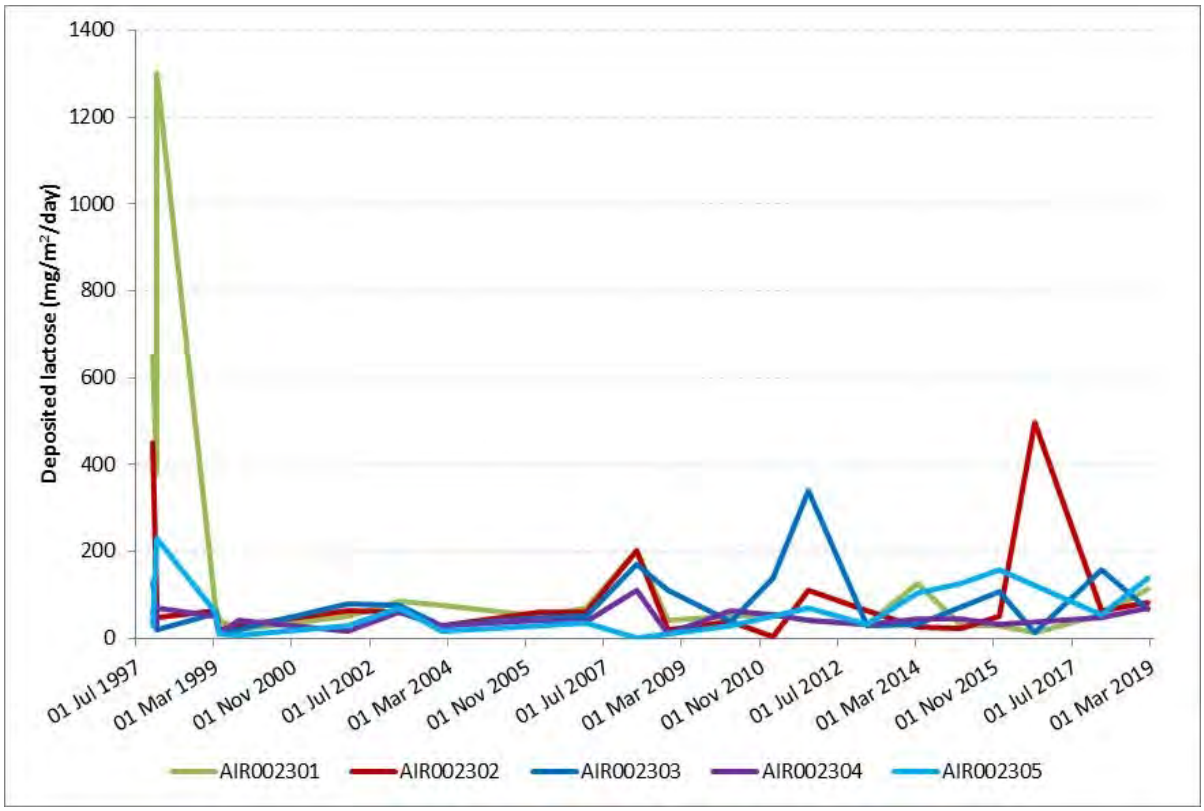

Figure 65 Deposition gauge results from 1997 to date

Table 41 Deposition gauge results from 1997 to date

Period	Number of days	Deposited lactose mg/m²/day				
		AIR002301	AIR002302	AIR002303	AIR002304	AIR002305
10 Nov to 24 Nov 1997	14	**650**	**450**	**130**	59	30
24 Nov to 9 Dec 1997	15	**380**	83	53	30	-
9 Dec to 22 Dec 1997	13	**1300**	46	20	68	**230**
4 Mar to 18 Mar 1999	14	71	63	56	50	60
12 Apr to 26 Apr 1999	14	40	20	<20	<20	<20
9 Sep to 29 Sep 1999	20	20	30	-	40	<10

Period	Number of days	Deposited lactose mg/m^2/day				
		AIR002301	AIR002302	AIR002303	AIR002304	AIR002305
9 Jan to 24 Jan 2002	16	50	63	78	<30	30
21 Jan to 3 Feb 2003	13	86	60	75	60	69
14 Jan to 29 Jan 2004	15	76	30	30	30	<30
11 Apr to 10 May 2005	29	-	-	-	-	-
10 Jan to 1 Feb 2006	22	50	59	47	40	30
11 Jan to 13 Feb 2007	33	70	59	49	37	34
15 Feb to 14 Mar 2008	28	**200**	**200**	**170**	110	-
20 Oct to 10 Nov 2008	21	40	20	110	<20	<20
12 Feb to 9 March 2010	25	52	38	39	63	30
25 Jan to 15 Feb 2011	21	21	<8	140	54	51
29 Sep to 17 Oct 2011	18	40	110	**340**	40	70
28 Jan to 15 Feb 2013	18	30	64	30	33	30
20 Feb to 17 Mar 2014	25	127	27	33	44	105
28 Jan to 18 Feb 2015	21	28	24	-	45	127
24 Nov to 15 Dec 2015	21	29	51	109	32	**159**
6 Sep to 27 Sep 2016	21	12	**498**	13	*	*
11 Jan to 2 Feb 2018	22	53	63	**158**	48	53
21 Jan to 26 Feb 2019	36	112	82	65	69	**139**

* gauge contents contaminated by bird/bird droppings

The deposition rates obtained during the periods under review were generally low and similar to the most recent monitoring periods, with the exception of site AIR02305. The lactose deposition rate recorded at this site was above the historical median for this monitoring location and about 7% higher than the guideline value. This gauge was downwind of the factory for almost half of the time during the survey and there were no reported issues relating to organic contamination of the gauge. However, it is noted that there were no complaints received regarding particulate deposition during the deployment period of the gauges, and the deposition rate is not limited by the Company's consent.

2.3 Incidents, investigations, and interventions

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. 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.

For all significant compliance issues, as well as complaints from the public, the Council maintains a database record. The record includes events where the individual/organisation concerned has itself notified the Council. Details of any investigation and corrective action taken are recorded for non-compliant events.

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 individual/organisation is indeed the source of the incident (or that the allegation cannot be proven).

Table 42 below sets out details of any incidents recorded, additional investigations, or interventions required by the Council in relation to the Company's activities during the 2018-2019 period. This table presents details of all events that required further investigation or intervention regardless of whether these were found to be compliant or not.

Table 42 Incidents, investigations, and interventions summary table

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
23-Oct-2018	Notification was received regarding a temporary breach of consent conditions with regards to the volume of water taken from the Kaupokonui Stream	N	N	Investigation found that for approximately 45 minutes the water taken averaged 835 m^3/hr, exceeding consent limits of 810 m^3/hr. The alarm which should have alerted the operator to the excessive take mistakenly informed the operator of a high temperature differential. At the time the stream was in moderate flow and because of the short duration, the effects were considered to be no more than minor. The system has since been repaired.
16-Nov-2018	An email was received confirming that the cooling water discharge flow recording device is not capable of achieving the accuracy required by agreement reached on 28 August 2015.	N	N	During analysis of data it was found that the location in which the equipment for recording the cooling water discharge flow rate was installed, resulted in the agreed accuracy and validation not being achievable, at the Fonterra site in Kapuni. As a written agreement with Fonterra brought this monitoring within the scope of condition 1 of consent 0919, this consent conditions was found to been contravened. A meeting was held with the Company. The Company undertook to install a suitable system by 30 September 2019, which has been done.

3 Discussion

3.1 Discussion of plant performance

Generally the onsite management and operation of the Kapuni lactose plant site was undertaken in a satisfactory manner. Continual liaison between the Company's staff and the Council has contributed to this performance. A number of improvements were made at the site during the year under review, including improvements in the cooling water discharge temperature, accuracy and precision of the instream temperature monitoring and electronic data provision, with data gaps now down to less than 3% for the whole year.

Contingency planning is in place in the form of the Site Stormwater Management Plan. It is a requirement of the consent that the plan is reviewed and updated (if required) annually. The latest plan on record at the Council was issued in June 2019. The whole document was reviewed with updates and/or clarifications added throughout the plan. A Spray Irrigation Plan is required by consents 0922-3.2 and 0923-3. The consent requires that this is updated annually with the updated plan to be provided to Council by 1 July each year. Council has been informed that the irrigation practices at the site have not changed, but that the irrigation management plan was updated to a whole farm management plan in June 2019. The plan integrates the irrigation management and the farm management practices to ensure that the operation of these two activities are themselves well integrated.

Data were collected by the Company and forwarded to the Council regarding the abstraction of water from the Kaupokonui Stream, temperature of the Kaupokonui Stream above and below the discharge of cooling wastes, and volume and composition of effluent sprayed to pasture on the two farms. Daily volumes and temperature maxima were reported monthly. Historically, this was all provided in the form of monthly reports, with the upstream and downstream temperatures being provided electronically on a daily basis and irrigation waste composition records forwarded annually upon request. More recently additional electronic data has been provided to Council for the water abstraction and discharge flow rates, and for the cooling water discharge temperature. Compliance with consent conditions was demonstrated for stream temperature and dairy effluent volume. However, following review of the electronic 2016-2017 data and temperature probe calibration records, it became apparent that the level of accuracy advised to Council in February 2016 was no longer being maintained. As discussed previously, in the absence of any specific consent requirements the monitoring should, and does, meet the requirements of the NEMS standard. During the year under review, the verification tolerances were reduced, with adjustments being made to the calibration if the probe is found to be out by more than ± 0.2°C, reducing potential errors of measurement on the temperature differential from ± 1.6°C to ±1.0°C. As with other thermal dischargers that undertaken their own temperature monitoring, a period of parallel temperature monitoring was undertaken. The results obtained showed a temperature difference of ≤0.1°C, confirming the accuracy of the Company's data and compliance with the downstream instream temperature limit.

Electronic transmission to Council of cooling water discharge volume data was instituted during the 2015-2016 year following an agreement by Council in July 2014 not to review the discharge consents, but to have this information provided by agreement, in order to have the information available to Council for water allocation purposes. This monitoring falls, which is within the scope of condition 1 of consents 0919 and 0924, required the installation of new flow monitoring equipment on the cooling water and cooling water/stormwater discharge lines. The provision of this data (originally due by 31 August 2015 and rescheduled to 30 September 2015) was delayed by more than three months (until January 2016), while landscaping was completed around new cooling towers, and data transmission processes were established. Transmission of electronic abstraction data already collected by the Company was established at the same time. (Electronic transmission of water temperature upstream and downstream in the Kaupokonui had been in place since March 2014). During the 2015-2016 and 2016-2017 and start of the 2017-2018 years there

were ongoing problems with transmission of the data, in terms of missing record and of accuracy. In the interim, the daily values that were supplied by the Company in its monthly report were used to determine consent compliance retrospectively on volumes and temperatures. Investigations in the 2017-2018 year allowed most of the missing data to be backfilled, and corrupt data to be corrected for the 2016-2017 year. However, further assessment of the data during the 2018-2019 year identified that there remained an issue with the accuracy of the flow meter for the cooling water discharge covered by consent 0919-3 during the year under review. Council was informed that the Company incorrectly installed the flow meter in a location that means it will not be capable of delivering, nor being certified as delivering, data of the agreed accuracy without significant further capital investment. The location also results in the discharge flow rate not capturing any losses at the cooling tower, which was thought to be the major source of water "usage" at the site. This was recorded as a non-compliance and the Company undertook to install an appropriate system by the end of September 2019. This was done.

The main cooling system was replaced in August 2015, in order to reduce the temperature of the discharge and ensure compliance with the temperature limit on consent 0919. During the year under review, the use of the pipe that can be used to divert a proportion of the cooling water around the cooling tower was discontinued and the cooling tower was run at maximum cooling capacity. This resulted in a reduction in the monthly median cooling water temperature upstream of the spray discharge system during the year under review to 20.5 to 25.3°C, down from the previous years 29 to 37°C. The effect of this on the instream temperature differential was a significant reduction the amount of time that the temperature differential exceeded 1°C from 37% of the time to only 26% of the time, with the temperature differential exceeding 2°C for less than 1% of the time. The reduced cooling water discharge temperature would also have also resulted in a significant reduction in temperature effects occurring within the approximately 200 m mixing zone. There is no temperature monitoring undertaken of the cooling water entering the stream or of the stream itself at the point of discharge, however a degree of further evaporative cooling is expected due to the discharge mechanism. There is a continuously monitored system (conductivity) on the crystallising condensers, which will enable detection of contaminants for informing the discharge to the cooling water system and stream and/or diversion to wastewater irrigation.

Two incidents were recorded; self-notification of a 45 minute marginal exceedance of the abstraction rate limit that would have had little, if any adverse effect due to the moderate flow of the stream at the time of the exceedance and the non-compliance with the monitoring condition (condition 1 of consent 0919 already discussed.

Recorded annual abstraction volume from Kaupokonui Stream decreased in the 2018-2019 back down to a level similar to that reported in the 2016-2017 year.

Across the whole season, the median measured strength of wastewater irrigated onto land increased for nitrogen species, but decreased for cations. There was also less consistency in the strength of the wastewater. This variability in the total nitrogen concentration, along with the 18% decrease in the volume of wastewater irrigated, resulted in a reduction in estimated total mass of nitrogen calculated on a kilogramme per hectare per year basis.

Disposal of DSE to land via the factory effluent spray irrigation system was established in 2015-2016, replacing the oxidation pond treatment systems which had discharged to a Kaupokonui tributary and Motumate Stream. This is in line with Council's policy of promoting discharges of DSE to land. The calculated estimate for the nitrogen application rate of the combined factory wastewater and DSE in the 2018-2019 year was 4% less than the previous year on Farm 1 and 12% less than the previous year on Farms 2 and 3. However, caution needs to be applied to these calculated estimates given the variability observed in the wastewater compositions (factory and DSE) throughout the year.

Two major projects were completed during the 2007-2008 reporting period which have had long-term beneficial effects on environmental performance: extension of the wastewater irrigation system, and construction of a stormwater detention system.

The 41% extension of irrigation area, from 120 to 169 ha in 2006, with little change in effluent volume and nitrogen mass has significantly reduced loading rates on soil and groundwater, and the use of automated in-ground irrigators has greatly improved the management of the combined waste disposal and farming operation.

The stormwater system to contain and control stormwater from the southern catchment of the factory site, designed to capture a 1 in 100 year flood volume, has provided additional security for the area where road tankers operate and process materials are stored. A similar system (northern pond) was put in place for the remainder of the site during the 2017-2018 year.

Riparian planting was maintained on the factory site. The financial contributions were not invoiced for during the year under review due to the expiry of the consent. Council systems have now been adjusted to ensure that consents under Section 124 protection are captured for invoicing financial contributions. Both the 2018-2019 and 2019 and 2020 contributions will be invoiced in the 2019-2020 year.

3.2 Environmental effects of exercise of consents

An assumption had previously been made that the abstraction for the cooling water was close to being non-consumptive. Following the resolution of the issues that affected the cooling water discharge rates provided for the 2016-2017 year, it was stated in the 2016-2017 Annual Report that assessment of the consumptive nature of the abstraction, and the impact this may be having on the flow of the Kaupokonui Stream could now be made once sufficient data was available, noting that any losses due to evaporation or wind drift at the point of discharge is additional to any measured water consumption through the plant. During the year under review, with more data at hand it was found that the data being supplied did not meet the agreed standards as far as accuracy was concerned, an Council was also informed that the flow meter was positioned upstream of the cooling towers, considered to be the main consumptive use at the site. As a result the consumptive nature of the water take, and potential effects on the stream cannot be reliably assessed from a water allocation perspective, and was a non-compliance with condition 1 of consent 0919 that had been resolved at the time of writing this report. It is noted that ecological monitoring did not find any significant adverse effects in regard to the abstraction of water from the Kaupokonui Stream for cooling water and general purposes during the year under review.

The discharge of cooling water did not have a visible effect on receiving waters during the monitoring period, and there was good compliance with discharge permit conditions. Biological monitoring of the Kaupokonui Stream during spring 2018 and summer 2019 did not show any significant adverse effect of the cooling or stormwater discharges to the stream on streambed communities.

A fish survey carried out in winter 2017 found no indication that the weir was posing a significant barrier to fish passage, or that cooling water had adversely affected the fish communities, and trout were seen above the weir on two of the site inspections and sampling surveys during the year under review. It is noted however, that the fish survey report states that only the best swimmers would be expected to be able to negotiate the Glenn Road weir. The next survey is due in summer 2020.

Temperature data supplied by the Company showed that the ambient temperature of the receiving water during the monitoring period was not increased by more than the amounts prescribed on consents **0919-3** and **0921-3**, that is, by less than 2˚C for 90% of the time with an upper limit of 3˚C. With the improvement in the measurement error of the Company's instream monitoring and the parallel monitoring undertaken, there is improved confidence in the accuracy and precision of the data provided. In the 2017-2018 year, due to the measurement error of the temperature probes, temperature reductions were measured for

approximately 16% of the time, with a maximum temperature drop of 2.2˚C reported to Council. This appears to be resolved, with temperature reductions of between 0.01 and 0.9˚C recorded for only 3% of the time. A reduction in the instream temperature differential was also found during the year under review due to the Company running the cooling tower at the maximum cooling capacity. Monitoring therefore showed this was effective at minimising effects, with a reduction of the temperature differential recorded most frequently of 0.6˚C. The lower cooling water discharge temperatures would also have resulted in a significant reduction in the temperature effects occurring within the approximately 200 m mixing zone.

The consent also prohibits downstream temperatures in excess of 25˚C downstream of the plant as a result of the cooling water discharges. This limit was also complied with.

Irrigation onto the dairy farms was, in general, well managed. At inspection it was found that a 20 m buffer to the bank of water courses was maintained. With no patches of dead grass noted at inspection.

Effects on the groundwater in the vicinity of the farms were varied, but most showed an adverse impact on both mineral and organic component levels. This was previously addressed through extension of the irrigation disposal system and by more intensive wastewater and groundwater monitoring. The monitoring results show that, since 2011-2012, total volume of factory wastewater irrigated had remained relatively stable, although there was a decreased volume during the year under review. There was a reduction in total nitrogen loading in 2012-2013, which increased back to the previous levels in 2014-2015, possibly as the result of a change in cleaning procedures. Since that year, there has been a decline in the total nitrogen loading each year, including in the year under review. The nitrogen application rates decreased by about 4% on Farm 1 and 12% on Farms 2 and 3, returning to similar application rates to those in 2012-2013. For the first time since the 2013-2014 year, there we no sampling occasions on which the nitrate concentration in the groundwater bore at the southern boundary of Farm 1 was above the drinking water standard. The samples collected from the Farm 1 control bore also remained below the drinking water standard, in contrast to the 2017-2018 year, when two samples were at or above the standard. The control bore for Farm 2 (GND2049) was again consistently above the drinking water standard and the control bore for Farm 3 (GND2051) was above the standard in two of the six samples collected. The reason for this elevation in the control bores is still to be fully investigated. The farm 2 impact bores where the drinking water standard was exceeded in some of the samples collected during the year under review were one of the sites near the Motumate Stream (GND0638 – two of five samples) and the site on the eastern boundary (GND2063 – one of six samples). Although the nitrate concentrations were elevated in the two Farm 3 impact bores at times, they remained below the drinking water standard with the exception of the July sample collected from the impact bore on the southern boundary to the east of the Motumate Stream.

Biological surveys found no effect on the stream communities of Kaupokonui Stream or Waiokura Stream in relation to land irrigation.

Discharges from both the southern and northern ponds complied with the conditions of their respective consents.

Particulate deposition from air emissions were generally similar to the previous monitoring periods, with all but one sites within the guideline target value set by the Council. The exception to this was site AIR002305, west of the site on the opposite side of the Kaupokonui Stream, which was downwind of the site for approximately half of the time during the survey and was about 7% higher than the guideline value. However, no complaints were received by Council in relation to deposited particulates and inspections found no evidence of depositions. No odours were noted off site during the year under review.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 43 to Table 60.

Table 43 Summary of performance for Consent 0302-3

Purpose: ***To take and use up to 19,500 cubic metres/day (225 litres/second) of water from the Kaupokonui Stream for cooling and general purposes associated with lactose manufacturing***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Undertake ecological monitoring	Biomonitoring surveys	Yes
2. Record daily rates of abstraction	Records received from the Company	Yes
3. Review of consent conditions	No further provision for review prior to expiry	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 44 Summary of performance for Consent 0919-3

Purpose: ***To discharge up to 19,500 cubic metres/day of cooling water from a lactose manufacturing plant via an outfall, cooling tower and/or spray system into the Kaupokonui Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Physicochemical and ecological monitoring of wastes and stream	Collection of samples and review of Company supplied data	**No. See Table 45**
2. Prohibited effects on receiving water	Site inspections, collection of samples, biological surveys	Yes
3. Limits on BOD level in receiving water	Collection of samples	Yes
4. Limits on temperature increase of receiving water	Temperature information supplied by the Company	Yes
5. Limit on downstream temperature of receiving water	Temperature data supplied by the Company and parallel temperature monitoring	Yes
6. Continuous monitoring of temperature of receiving water required	Temperature information supplied by the Company	Yes
7. Review of conditions 4 and 5	No further provision for review	N/A
8. No thermal barrier or growths as a result of discharge within the mixing zone	Temperature information, site inspections, fish survey in 2017	Yes
9. No anti-corrosion agents, biocides, anti-flocculants or other chemicals added to cooling water	Site inspections, sample collection	Yes

Purpose: *To discharge up to 19,500 cubic metres/day of cooling water from a lactose manufacturing plant via an outfall, cooling tower and/or spray system into the Kaupokonui Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
10. Maintenance of riparian zone and annual donation to Taranaki Tree Trust	Site inspections, donation not invoiced due to Council system omission that has now been rectified. 2018-2019 contributions invoiced in the 2019-2020 year	Yes
11. Review of consent conditions	No further provision for review prior to expiry	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		**Improvement required**

N/A = not applicable

Table 45 Summary of performance for agreed monitoring additional to consent 0919-3

Additional monitoring proposed by the Company that allowed the notice of review to be withdrawn in August 2014		
Agreed monitoring	**Status**	**Agreed monitoring standards met**
1. Installation and maintenance of a tamper-proof recording device measuring cooling water discharge rate and flow to accuracy of ± 5% by 31 August 2015	Deferred to 30 September 2015. First data provided 14 January 2016, but is upstream of cooling tower and continues to be affected by errors	**Data not to required standard of accuracy. Agreement reached to resolve by 30 September 2019**
2. Installation and maintenance of a tamper proof data logger recording cooling water discharge rate and flow at 15 minute intervals (NZST) by 31 August 2015	Deferred to 30 September 2015. First data provided 14 January 2016. Accuracy issues continuing	**Data not to required standard of accuracy. Agreement reached to resolve by 30 September 2019**
3. Provision document from qualified person certifying installation and maintenance is as per manufacturers' instructions, and is operating to an accuracy of ± 5% within 30 days, and at Council's request	As found and after re-installation calibration data and certification will be required to meet the intent of this agreed monitoring standard	**No certification received. Agreement reached to resolve by 30 September 2019**

Additional monitoring proposed by the Company that allowed the notice of review to be withdrawn in August 2014		
Agreed monitoring	**Status**	**Agreed monitoring standards met**
4. Flow recording devices accessible to Council for inspection, data retrieval and verification of accuracy	Council advised that verification is not possible	Not assessed
5. By 31 August 2015, agreed measurements to be transmitted to Council to maintain a real time record in a format suitable for auditing and registering "zero" when no discharge occurring	Deferred to 30 September 2015. First data provided 14 January 2016	**Daily data not auditable during the year under review due to errors. Agreement reached to resolve by 30 September 2019**
Overall assessment of consent compliance and environmental performance in respect of this agreement		**N/A**
Overall assessment of administrative performance in respect of this agreement		**Improvement required**

N/A = not applicable

Table 46 Summary of performance for Consent 0920-3

Purpose: ***To take up to 700 cubic metres/day from a bore in the Kaupokonui catchment for factory cooling water using plate heat exchangers***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Records of abstractions kept and supplied to Council	Records received – consent not exercised during monitoring period	Yes
2. Access to bore to be provided		Yes
3. Review of consent conditions	No further provision for review prior to expiry	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 47 Summary of performance for Consent 0921-3

Purpose: ***To discharge up to 850 cubic metres/day of cooling water from plate heat exchangers and plant cooling system into an unnamed tributary of the Motumate Stream at two different locations***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Effects discharge must not have on receiving water below mixing zone	Site inspections – consent not exercised during monitoring period	N/A

Purpose: *To discharge up to 850 cubic metres/day of cooling water from plate heat exchangers and plant cooling system into an unnamed tributary of the Motumate Stream at two different locations*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
2. Consent holder to monitor daily volume, temperature of discharge	Consent not exercised during monitoring period	N/A
3. Review of consent conditions	No further provision for review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A**
Overall assessment of administrative performance in respect of this consent		**N/A**

N/A = not applicable

Table 48 Summary of performance for Consent 0922-3.2

Purpose: *To discharge combined dairy effluent and factory wastewater (evaporator condensate, washings, processing wastes and stormwater) from a lactose manufacturing plant by spray irrigation onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Maintenance of effluent spray irrigation plan, with specific matters to be covered in plan	New whole farm plan provided dated June 2019. Awaiting review by Council	Not Assessed
2. Limit on maximum two day volumes	Records received	Yes
3. Consent exercised in accordance with procedures set out in effluent spray irrigation plan	Site and farm inspections	Yes
4. Provision for initiation of spray irrigation plan review, with plan reviewed plan by 1 July each year and upon two months' notice by Council	Plan reviewed and updated June 2019	Yes
5. Operation of spray irrigation plan, staff training	Site and farm inspections	Yes
6. No direct discharges of effluent into any watercourse	Farm inspections	Yes
7. No ponding	Farm inspections	Yes
8. 20 metre 'buffer zone' to watercourse	Farm inspections	Yes
9. Records available to Council on request of effluent produced, volume irrigated, area and hours pumped	Records viewed at inspection. Volumes irrigated daily provided to Council	Yes
10. Review of consent conditions	No further provision for review prior to expiry	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**

Table 49 Summary of performance for Consent 0923-3.3

Purpose: *To discharge combined dairy effluent and factory wastewater (evaporator condensate, washings, processing wastes and stormwater) from a lactose manufacturing plant by spray irrigation onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Consent holder to adopt BPO to prevent or minimise adverse effects	Site and farm inspections	Yes
2. Maintenance of effluent spray irrigation plan	New whole farm plan provided dated June 2019. Awaiting review by Council	Not Assessed
3. Limit on maximum two day volumes	Records received	Yes
4. Consent exercised in accordance with procedures set out in plan	Site and farm inspections	Yes
5. Provision for initiation of spray irrigation plan review, with plan reviewed plan by 1 July each year and upon two months' notice by Council	Plan reviewed and updated June 2019	Yes
6. Operation of system in accordance with plan. Staff training	Site and farm inspections	Yes
7. No offensive or objectionable odour	Farm inspections	Yes
8. No spray drift beyond boundaries	Farm inspections	Yes
9. No direct discharge to watercourses	Farm inspections	Yes
10. No ponding	Farm inspections	Yes
11. Spray 'buffer zone' limits	Farm inspections	Yes
12. Remediation in case of contamination of groundwater or roof water supply		N/A
13. Installation and maintenance of monitoring bores	Farm inspections	Yes
14. Records provided to Council of effluent produced, volume irrigated, area and hours pumped	Records received	Yes
15. Change of consent conditions	Not sought	N/A
16. Review of consent conditions	No further provision for review prior to expiry	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 50 Summary of performance for Consent 0924-3

Purpose: ***To discharge up to 1,440 cubic metres/day of stormwater and cooling water from a lactose manufacturing plant through two outfalls into the Kaupokonui Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Consent holder to undertake physicochemical and ecological monitoring	Consent holder and Council sampling. Old pipeline decommissioned and subsequently removed	Yes
2. Effects discharge must not have on receiving water below mixing zone	Site inspections	Yes
3. BOD of receiving water not to rise above 2 g/m^3	Samples collected	Yes
4. Temperature of receiving water not altered by more 2°C for 90% of time and not rise by more than 3°C	Consent holder data	Yes
5. Temperature of receiving water shall not increase above 25 degrees at the periphery of the mixing zone	Council data logger information, temperature information supplied by the Company. Parallel temperature monitoring	Yes
6. Consent holder to constantly monitor the temperature of the receiving waters	Consent holder maintains temperature probes instream, data forwarded to Council	Yes, with minor loss of record
7. Review of consent in June 2001 to evaluate performance of cooling system		N/A
8. Limits upon levels of contaminants in discharge	Sample collection	Yes
9. Discharge not to create barrier for fish, or undesirable growths within the mixing zone	Site inspections	Yes
10. No anti-corrosion agents, biocides, anti-flocculants or other chemicals added to cooling water	Site inspections, sample collection	Yes
11. Maintenance of contingency plan. Review and update (if required) annually	Review of Council records. Latest plan on record April 2018.	Yes
12. Review of consent conditions	No further provision for review prior to expiry	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**

*The consent specifies an average daily limit- ie a composite sample

N/A = not applicable

Table 51 Summary of performance for agreed monitoring additional to consent 0924-3

Additional monitoring proposed by the Company that allowed the notice of review to be withdrawn in August 2014		
Agreed monitoring	**Status**	**Agreed monitoring standards met**
1. Installation and maintenance of a tamper-proof recording device measuring cooling water discharge rate and flow to accuracy of ± 5% by 31 August 2015	Deferred to 30 September 2015. First data provided 14 January 2016. Flow diverted and line decommissioned early in the season, with pipe removed February 2018. Monitoring no longer required	N/A
2. Installation and maintenance of a tamper proof data logger recording cooling water discharge rate and flow at 15 minute intervals (NZST) by 31 August 2015	Deferred to 30 September 2015. First data provided 14 January 2016	N/A
3. Provision document from qualified person certifying installation and maintenance is as per manufacturers' instructions, and is operating to an accuracy of ± 5%within 30 days, and at Council's request	As found and after re-installation calibration data and certification will be required to meet the intent of this agreed monitoring standard	N/A
4. Flow recording devices accessible to Council for inspection, data retrieval and verification of accuracy		N/A
5. By 31 August 2015, agreed measurements to be transmitted to Council to maintain a real time record in a format suitable for auditing and registering "zero" when no discharge occurring	Deferred to 30 September 2015. First data provided 14 January 2016	N/A
Overall assessment of consent compliance and environmental performance in respect of this agreement		**N/A**
Overall assessment of administrative performance in respect of this agreement		**N/A**

N/A = not applicable

Table 52 Summary of performance for Consent 4032-5

Purpose: ***To discharge emissions to the air from the manufacture, drying, packaging and storage of lactose and associated processes and from the inhalation grade lactose plant***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Consent holder to adopt BPO to prevent or minimise emissions	Site inspections	Yes
2. Consent holder to fulfil obligations under the RMA	Site inspections	Yes

Purpose: *To discharge emissions to the air from the manufacture, drying, packaging and storage of lactose and associated processes and from the inhalation grade lactose plant*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
3. Limits of particulate from wet scrubber	Stack testing in September 2018	Yes
4. No alterations to plant or processes without prior consultation with Council	Site inspections	Yes
5. Discharge not to result in dangerous levels of airborne contaminants at or beyond the boundary	Not monitored during period under review	N/A
6. Discharge not to result in offensive or objectionable dust or odour at or beyond boundary	Site inspections	Yes
7. Change or cancellation of conditions		N/A
8. Discharge not to result in noxious or toxic levels of airborne contaminants at or beyond boundary	Not monitored during period under review	N/A
9. Review of consent conditions	No further provision for review prior to expiry	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 53 Summary of performance for Consent 4604-2

Purpose: *To discharge up to 280 litres/second of stormwater from the factory extension site via a 525 mm diameter pipe into the Kaupokonui Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Effects which must not arise below the 50 m mixing zone	Site inspections, samples, biomonitoring	Yes
2. Limits on oil & grease, pH and suspended solids in discharge	Sample collection	Yes
3. Contingency planning	Latest plan on record April 2018	Yes
4. Review of consent conditions	No further provision for review prior to expiry	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 54 Summary of performance for Consent 4623-3

Purpose: *To use a weir in the bed of the Kaupokonui Stream, and to dam water for water supply purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. States consent is for on-going use of existing structure Changes to the structure may need further authorisation under RMA	Inspection. No changes found	N/A
2. Structure to be maintained so it is safe and functions effectively	Inspection. No maintenance required	Yes
3. Required prior notice of commencement of maintenance work	Inspection, no works found or notified during the period the consent was in effect	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 55 Summary of performance for Consent 6423-1

Purpose: *To discharge stormwater from an inhalation grade lactose plant site into the Kaupokonui Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Contingency planning	Latest plan on record April 2018	Yes
2. Exercise of consent in accordance with application	Site inspections	Yes
3. Best practicable option to minimise environmental impacts	Site inspections	Yes
4. Limits on pH, suspended solids and hydrocarbons in the discharge	Sample collection	Yes
5. Effects which must not arise below the 50 mixing zone	Site inspections, stream sample collection, biomonitoring	Yes
6. Lapse of consent		N/A
7. Review of consent conditions	No further provision for review prior to expiry	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 56 Summary of performance of Consent 6948-1

Purpose: *To erect, place, maintain and use pipeline crossings over the Motumate and Waiokura Streams, for the purposes of conveying irrigation wastewater*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Best practicable option on adverse effects		N/A
2. Exercise in accordance with application	Inspection by Council	Yes
3. Notification prior to installation		N/A
4. Best practicable option to minimise contaminant discharge		N/A
5. Minimise disturbance of riverbed		N/A
6. Works resulting in downstream discolouration to be undertaken between November and April		N/A
7. Reinstatement of structure when no longer required		N/A
8. Lapse of consent		N/A
9. Review of consent conditions	No further opportunities for review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 57 Summary of performance of Consent 9546-1

Purpose: *To install a dual culvert in the Waiokura Stream, including the associated streambed and reclamation*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Notification prior to commencement of works	Liaison with Council. Work last undertaken June 2013	N/A
2. Culverts dimensions defined		N/A
3. Maximum depth of fill over culverts		N/A
4. Shaping of stream banks		N/A
5. Placement of rock rip-rap on upstream and downstream batters		N/A
6. Gradient of rock rip-rap in condition 5		N/A

Purpose: *To install a dual culvert in the Waiokura Stream, including the associated streambed and reclamation*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
7. Thickness of rock rip-rap on fill batters		N/A
8. Gradient of rock rip-rap in condition 7		N/A
9. Separation of concrete work from stream		N/A
10. Minimum period for curing of concrete in channel		N/A
11. No instream works between 1 June and 31 October	No maintenance undertaken during review period	N/A
12. Streambed disturbance minimised and reinstated		N/A
13. Fish passage not to be restricted	Inspection by Council	Yes
14. Pipes invert depth set		N/A
15. Gradient of culvert pipes not to exceed that of natural stream bed		N/A
16. Minimisation and mitigation of sediment discharged to stream	No maintenance undertaken during review period	N/A
17. Earthworks stabilisation to be as soon as practicable		N/A
18. Prevention of blockage and erosion responsibility of consent holder	Inspection by Council	Yes
19. Procedure on discovery of archaeological remains		N/A
20. Removal of structure when no longer required		N/A
21. Lapse of consent if not exercised	Consent exercised	N/A
22. Optional review provision for environmental effects	Next review date available 1 June 2023	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 58 Summary of performance of Consent 10214-1

Purpose: *To discharge solid farm dairy effluent onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Effluent and farm dairy definition		N/A
2. Maximum volume of discharge		N/A
3. Notification upon volume exceedance	Check of Council records. No notifications received	N/A
4. Best practicable option on adverse effects	No disposals observed at inspection but no evidence of effects found	N/A
5. Diversion of stormwater		N/A
6. Maintenance of buffer distances	No disposals observed at inspection	N/A
7. Limit on Nitrogen application rate	Not assessed	N/A
8. Keeping of records	Not assessed	N/A
9. Actions following unauthorised discharge	No effects observed at inspection	N/A
10. Optional review provision for environmental effects	Next review date available 1 June 2023	N/A
11. Optional review provision for Regional Plan		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A**
Overall assessment of administrative performance in respect of this consent		**N/A**

N/A = not applicable

Table 59 Summary of performance of Consent 10232-1

Purpose: *To discharge pond sludge from farm dairy effluent onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Effluent and farm dairy definition		N/A
2. Maximum volume of discharge	Checking of records. No information provided to Council	N/A
3. Notification upon volume exceedance	Checking of records. No information provided to Council	N/A
4. Best practicable option on adverse effects	No disposals observed at inspection	N/A
5. Diversion of stormwater	Assessment by Council Officers	Yes

Purpose: *To discharge pond sludge from farm dairy effluent onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
6. Maintenance of buffer distances	No disposals observed at inspection	N/A
7. Limit on Nitrogen application rate	Not assessed	N/A
8. Keeping of records	Not assessed	N/A
9. Actions following unauthorised discharge	Check of Council records for notifications received by Council. No notifications received	N/A
10. Optional review provision for environmental effects	Next review date available 1 June 2023	N/A
11. Optional review provision for Regional Plan		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 60 Summary of performance of Consent 10412-1

Purpose: *To install a dual culvert in the Waiokura Stream, including the associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Specifies culvert dimensions		N/A
2. Specifies depth of fill over		N/A
3. Notification required 2 days prior to commencement of works	Checking of records and observation at inspection. Works not started	N/A
4. Prohibits work on under water stream bed between 1 May and 31 October		N/A
5. All practicable steps to be taken to minimise streambed disturbance and effects, including specified measures		N/A
6. Gives rock riprap requirements including dimensions, batter and rock grading		N/A
7. Prohibits the restriction of fish passage		N/A
8. Specifies culvert invert		N/A

Purpose: *To install a dual culvert in the Waiokura Stream, including the associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
9. Specifies culvert gradient requirements		N/A
10. Specifies requirements for upstream and downstream stream banks		N/A
11. Specifies culvert maintenance requirements		N/A
12. Notification requirements if archaeological remains are found		N/A
13. Consent lases 31 March 2022 if not given effect to		N/A
14. Provisions for review of consent conditions	Next review opportunity June 2023	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A**
Overall assessment of administrative performance in respect of this consent		**N/A**

N/A = not applicable

The Company demonstrated a high level of environmental performance and compliance with resource consents as defined in Section 1.1.4.

With respect to the administrative performance, there were still ongoing issues with provision of accurate real time monitoring data that was due by 30 September 2015. A further agreement was made to resolve this issue by 30 September 2019 following the recording of this matter as a consent non-compliance. An improvement was therefore required in the Company's administrative performance during the year under review, as defined in Section 1.1.4.

3.4 Recommendations from the 2017-2018 Annual Report

In the 2017-2018 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of air emissions from the Company's Kapuni site in the 2018-2019 year continue at the same level as in 2017-2018.
2. THAT monitoring of abstractions and discharges at the Company's Kapuni site in the 2018-2019 year be amended from that in 2016-2017 by the inclusion of additional mineral and organic strength monitoring of the receiving waters in the vicinity of the Farm 2 and Farm 3 waste irrigation areas, and that a period of parallel stream temperature monitoring be undertaken.
3. THAT should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
4. THAT the Company investigate the increasing nitrate nitrogen concentrations in the Farm 2 and Farm 3 control bores for inclusion in the assessment of environmental effects that will accompany the consent renewal applications.

Recommendations 1 and 2 were implemented. Recommendation 3 was not necessary. In relation to recommendation 4, a report was provide detailing a theoretical explanation for these elevated levels, however the matter is still to be fully investigated.

3.5 Alterations to monitoring programmes for 2019-2020

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

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

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

It is proposed that for 2019-2020, the monitoring remains unchanged.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2019-2020.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the Company's Kapuni site in the 2019-2020 year continue at the same level as in 2018-2019.
2. THAT if the higher nitrate nitrogen levels in the Motumate Stream continue in the 2019-2020 year, that consideration is given to re-establishing periodic biomonitoring in the Motumate Stream in the 2020-2021 year.
3. THAT should there be issues with environmental or administrative performance in 2019-2020, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
4. THAT the Company investigate the reason for the elevated nitrate nitrogen concentrations in the Farm 2 and Farm 3 control bores.

Glossary of common terms and abbreviations

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

Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
Cl	Chloride.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25˚C and expressed in mS/m.
DSE	Dairy shed effluent.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Ha	Hectare. A unit of land area.
IGL	Inhalation grade lactose.
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.
K	Potassium.
kg/ha/y	Kilograms per hectare per year.
kg/hr	Kilograms per hour.
L/s	Litres per second.
m^3	Cubic metres, a measure of volume.
MALF	Mean annual low flow. A statistic that describes the average amount of water in a river during times of low flow.
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.
Mg	Magnesium.

mg/dsm^3	Milligrams per cubic meter as measured at (or converted to) 0˚C and 1 atmosphere of pressure.
$mg/m^2/day$	Milligrams per square meter per day.
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.
Na	Sodium.
NH_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia.
NO_2	Nitrite, 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 the 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.
SAR	Sodium adsorption ratio is a ratio of the concentration of sodium ions to the concentration of calcium plus magnesium ions. It is used to assess the likelihood that the amount of sodium present in irrigation water will cause permeability problems. An SAR greater than 10 to 15 can cause permeability problems in some soil types.
SIMP	Spray irrigation management plan.
SS	Suspended solids.
Temp	Temperature, measured in ˚C (degrees Celsius).
t/hr	Tonnes per hour.
TKN	Total Kjeldahl Nitrogen. A measure of the total concentration of organic nitrogen and ammonia, normally expressed in terms of the mass of nitrogen (N).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.

For further information on analytical methods, contact a Science Services Manager.

Bibliography and references

Aston, T and Zillwood, B., 2009, *Particulate Emission Report Wet Scrubber*. CPL 09-31701.

Blakemore, K. and Deegan, P., 2019, Biomonitoring of the Kaupokonui Stream in relation to the Fonterra Kapuni farm and factory, October 2018 (KB076).

Blakemore, K. and Deegan, P., 2019, Biomonitoring of the Kaupokonui Stream and Waiokura Stream in relation to the Fonterra Kapuni farm and factory, March 2019 (KB078).

Fowles, CR, 1993, *A water temperature survey of the Kaupokonui River to provide an assessment of a mixing zone and documentation of the effects of two cooling water discharges from the Lactose Company of New Zealand Ltd, 3 March 1993*. Taranaki Regional Council Internal Memorandum.

Fowles, CR, 1994, *A water temperature survey of the Kaupokonui River to provide an assessment of the mixing zone and documentation of the effects of the two re-positioned cooling water discharges from the Lactose Company of New Zealand Ltd, 29 March 1994*. Taranaki Regional Council Internal Memorandum.

Fowles, CR, 1995, *'Water temperature survey of the Kaupokonui River, 23 January 1995*'. Taranaki Regional Council Internal Memorandum.

Kingett, Mitchell & Associates, 1993, *Environmental effects on the Kaupokonui River, of the proposed modifications to the Kapuni Factory*. Report prepared for the Lactose Company of NZ Ltd.

Ministry of Health, 1995, *Drinking-water standards for New Zealand 1995*. Ministry of Health, 87pp.

Ministry for the Environment, 2010, *Resource Management (Measurement and Reporting of Water Takes) Regulations 2010*. Ministry for the Environment, 8 pp.

Ministry for the Environment. 2018. *Best Practice Guidelines for Compliance, Monitoring and Enforcement under the Resource Management Act 1991*. Wellington: Ministry for the Environment.

Ministry for the Environment, 2018: *A Guide to Attributes in Appendix 2 of the National Policy Statement for Freshwater Management (as amended in 2017)*. Wellington: Ministry for the Environment.

National Environmental Monitoring Standards (NEMS) Steering Group, *National Environmental Monitoring Standard - Water Temperature Measurement, Processing and Archiving of Water Temperature Data*, April 2017.

Taranaki Catchment Board, 1989, *Lactose Company of New Zealand – Water Rights Compliance Monitoring Programme Annual Report 1988/89*. Technical Report 89-18, Taranaki Catchment Board, Stratford.

Taranaki Regional Council, 1990, *Kaupokonui River Catchment Water Management Plan,* Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1990, *Lactose Company of New Zealand – Water Rights Compliance Monitoring Programme Annual Report 1989/90*. Technical Report 90-41, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1991, *Lactose Company of New Zealand Report 1990/91*. Technical Report 91-42, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1992, *Lactose Company of New Zealand: Compliance Monitoring Programme Annual Report 1991/92*. Technical Report 92-18, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1993, *Lactose Company of New Zealand: Monitoring Programme Annual Report 1992/93*. Technical Report 93-26, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1994, *Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1993/94*. Technical Report 94-26, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1995, *Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1994/95*. Technical Report 95-57, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1996, *Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1995/96*. Technical Report 96-23, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1997, *Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1996/97*. Technical Report 97-57, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1998, *Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1997/98*. Technical Report 98-57, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 1999:,*Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1998-1999*. Technical Report 99-52, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2000:,*Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 1999-2000*. Technical Report 2000-46, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2001, *Lactose Company of New Zealand: Air and Water Monitoring Programme Annual Report 2000-2001*. Technical Report 2001-41, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2003, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2001-2002*. Technical Report 2002-79, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2003, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2002-2003*. Technical Report 2003-38, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2004, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2003-2004*. Technical Report 2004-64, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2005, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2004-2005*. Technical Report 2005-107, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2006, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2005-2006*. Technical Report 2006-24, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2007, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2006-2007*. Technical Report 2007-107, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2008, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2007-2008*. Technical Report 2008-106, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2009, *Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2008-2009*. Technical Report 2009-41, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2010, *Fonterra Kapuni Stream Air and Water Monitoring Programme Annual Report 2009-2010*. Technical Report 2010-86, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2012, *Fonterra Kapuni Stream Air and Water Monitoring Programme Biennial Report 2010-2012*. Technical Report 2012-81, Taranaki Regional Council, Stratford

Taranaki Regional Council, 2013, *Fonterra Kapuni Stream Air and Water Monitoring Programme Annual Report 2012-2013*. Technical Report 2013-106, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2015, *Fonterra Kapuni Stream Air and Water Monitoring Programme Annual Report 2013-2015*. Technical Report 2015-111, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2016, *Fonterra Kapuni Stream Air and Water Monitoring Programme Annual Report 2015-2016*. Technical Report 2016-52, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2018, *Fonterra Kapuni Stream Air and Water Monitoring Programme Annual Report 2016-2017*. Technical Report 2017-92, Taranaki Regional Council, Stratford.

Taranaki Regional Council, 2019, *Fonterra Kapuni Stream Air and Water Monitoring Programme Annual Report 2017-2018*. Technical Report 2018-96, Taranaki Regional Council, Stratford.

Appendix I

Resource consents held by Fonterra Limited

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

Consent number	Purpose	Expiry date 1 June	Activity's consent status at 30 June 19	Document number	Change from previous year
0302-3	Take from Kaupokonui	2019	Expired - S.124 Protection	1509557	None
0919-3	Discharge cooling water to Kaupokonui	2019	Expired - S.124 Protection	1509459	None
0920-3	Take from bore	2017	Expired - S.124 Protection	1509239	None
0921-3	Discharge cooling water to trib. of Motumate Stream	2017	Expired - S.124 Protection	1509441	None
0922-3.0	Discharge factory wastewater and DSE to land (Farm 1)	2019	Expired - S.124 Protection	1540193	None
0923-3.3	Discharge factory wastewater and DSE to land (Farms 2 and 3) [Activity to be combined with 0922-4]	2019	Expired - S.124 Protection	1540202	None
0924-3	Discharge storm & cooling water to Kaupokonui [Activity to be combined with 6423-4]	2019	Expired - S.124 Protection	1509523	None
4032-5	Discharge emissions to air	2019	Expired - S.124 Protection	1509537	None
4235-2	Discharge stormwater during factory shutdown periods [Separate consent for this activity no longer required]	2017	Expired	1509118	Removed
4604-2	Discharge stormwater from extension to Kaupokonui [Activity to be combined with 6423-2]	2017	Expired - S.124 Protection	1509422	None
4623-2	Structures for spray, stormwater, irrigation and take	2017	Expired	1509296	Removed
4623-3	To use a weir in the bed of the Kaupokonui Stream, and to dam water for water supply purposes	2019	Expired - S.124 Protection	1982449	None
5368-1	Structure over Little Dunn's Creek	2017	Deemed permitted [22 Nov 2017]	1509201	Removed

Consent number	Purpose	Expiry date 1 June	Activity's consent status at 30 June 19	Document number	Change from previous year
6422-1	Structure for stormwater outlet]	2017	Deemed permitted [22 Nov 2017]	1509288	Removed
6423-1	Discharge stormwater to Kaupokonui (IGL plant) [Renewed consent to include stormwater previously under 0924-3 and 4604-2]	2017	Expired - S.124 Protection	1509712	None
6885-1	Structure for stormwater (pond) outlet	2017	Deemed permitted [22 Nov 2017]	1509312	Removed
6948-1	Structure for pipeline over Motumate and Waiokura	2023	Current	1509704	None
9546-1	Install culvert in Waiokura Stream	2029	Current	1509618	None
10214-1	Discharge solid dairy farm effluent to land	2041	Current	1637694	None
10232-1	Discharge pond sludge from farm dairy effluent to land	2041	Current	1637702	None
10412-1	Installation of a dual culvert in the Waiokura Stream	2023	Current	1832653	None

Water abstraction permits

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. Permits authorising the abstraction of water are issued by the Council under Section 87(d) of the RMA.

Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations. Permits authorising discharges to water are issued by the Council under Section 87(e) of the RMA.

Air discharge permits

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. Permits authorising discharges to air are issued by the Council under Section 87(e) of the RMA.

Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising the discharge of wastes to land are issued by the Council under Section 87(e) of the RMA.

Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Land use permits are issued by the Council under Section 87(a) of the RMA.

Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Coastal permits are issued by the Council under Section 87(c) of the RMA.

Water Permit

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

Name of Consent Holder:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	9 June 1999
Commencement Date:	9 June 1999

Conditions of Consent

Consent Granted:	To take and use up to 19,500 cubic metres/day [225 litres/second] of water from the Kaupokonui Stream for cooling water and general purposes associated with lactose manufacturing
Expiry Date:	1 June 2019
Site Location:	Kaupokonui Stream, Manaia Road, Kapuni Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697840E-5629660N
Catchment:	Kaupokonui

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 consent holder shall, in conjunction with the Taranaki Regional Council, undertake such ecological monitoring associated with the abstraction of water from the Kaupokonui Stream as deemed necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991.

2. That the consent holder shall operate and maintain a measuring device capable of accurately recording daily rates of abstraction and shall measure, record and make such records available to the Chief Executive, Taranaki Regional Council, on a monthly basis.

3. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004, June 2009 and/or June 2014, 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.

Transferred at Stratford on 13 April 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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	9 June 1999
Commencement Date:	9 June 1999

Conditions of Consent

Consent Granted:	To discharge up to 19,500 cubic metres/day of cooling water from a lactose manufacturing plant via an outfall, cooling tower and/or spray system into the Kaupokonui Stream
Expiry Date:	1 June 2019
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697740E-5629660N
Catchment:	Kaupokonui

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 consent holder shall, in conjunction with the Taranaki Regional Council, undertake such physicochemical and ecological monitoring of the cooling water wastes, and the receiving waters (Kaupokonui Stream) as deemed necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991.

2. That allowing for a mixing zone of 150 metres extending downstream of the periphery of the spray discharge zone, the discharge (in conjunction with any other discharges pertaining to the same site) shall not give rise to all or any of the following effects in the receiving water:

(a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
(b) any conspicuous change in the colour or visual clarity;
(c) any emission of objectionable odour;
(d) the rendering of fresh water unsuitable for consumption by farm animals;
(e) any significant adverse effects on aquatic life, habitats, or ecology;
(f) any visible bacterial and/or fungal growths in the receiving water.

3. That the discharge (in conjunction with any other discharges pertaining to the same site) shall not raise the average daily GFC (glass fibre) filtered five day biochemical oxygen demand of the receiving water above 2 gm^{-3} when measured at a site 150 metres downstream of the periphery of the spray discharge zone.

4. That the discharge (in conjunction with any discharges pertaining to the same site) shall not:

   a) alter the ambient temperature of the receiving water by more than 2 degrees Celsius for 90% of the time that the discharge is occurring on an annual basis; and

   b) alter the ambient temperature of the receiving water by more than 3 degrees Celsius at all times;

   when measured simultaneously immediately upstream and 150 metres downstream of the periphery of the spray discharge zone.

5. That the discharge shall not increase the temperature of the receiving water above 25 degrees Celsius at the periphery of the mixing zone defined in condition 2.

6. That the consent holder shall continuously monitor the temperature of the receiving waters in compliance with conditions 4 and 5, and forward the results of this monitoring to the Chief Executive, Taranaki Regional Council, at monthly intervals.

7. That the Taranaki Regional Council may review conditions 4 and 5 of this consent in June 2001, for the purpose of evaluating the performance of the cooling system in achieving compliance with these conditions.

8. That within the designated mixing zone, and including those waters of the Kaupokonui Stream directly receiving the cooling water discharge, the discharge (in conjunction with any other discharges pertaining to the same site) shall not give rise to:

   a) a thermal barrier preventing the movement of fish species; and/or
   b) any visible bacterial and/or fungal slime growths.

9. That no anti-corrosion agents, biocides, anti-flocculants or other chemicals shall be added to the cooling water without the written permission of the Chief Executive, Taranaki Regional Council.

10. That by the agreement of the consent holder, the consent holder shall mitigate the effects of the discharge by:

    a) the maintenance of existing riparian planting; and

    b) by donating annually to the Taranaki Tree Trust $3,000 (goods and services tax exclusive) for the purpose of providing long term riparian management in the Kaupokonui Stream catchment above the discharge. The amount shall be adjusted annually according to the consumer price index, or similar index, to account for the effects of inflation.

11. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice or review during the month of June 2004, June 2009 and/or June 2014, 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.

Transferred at Stratford on 13 April 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	4 February 1999
Commencement Date:	4 February 1999

Conditions of Consent

Consent Granted:	To take up to 700 cubic metres/day of water from a bore in the Kaupokonui catchment for factory cooling water using plate heat exchangers
Expiry Date:	1 June 2017
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697740E-5629660N
Catchment:	Kaupokonui

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 consent holder shall operate, to the satisfaction of the Chief Executive, Taranaki Regional Council, a measuring device capable of recording groundwater levels and daily and continuous rates of abstraction and shall make records available to the Chief Executive, Taranaki Regional Council.

2. That the consent holder shall allow the Taranaki Regional Council, its employees or agents, access to the bore at all reasonable times, for the purpose of inspecting the bore and/or taking samples of water or other material for analytical purposes.

3. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2005 and/or June 2011, 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 the time.

Transferred at Stratford on 13 April 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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	4 February 1999
Commencement Date:	4 February 1999

Conditions of Consent

Consent Granted:	To discharge up to 850 cubic metres/day of cooling water from plate heat exchangers and plant cooling system into an unnamed tributary of the Motumate Stream at two different locations
Expiry Date:	1 June 2017
Site Location:	Manaia Road Kapuni
Legal Description:	Pt Sec 14 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697930E-5629670N
Catchment:	Motumate

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 beyond a reasonable mixing zone extending to the confluence of the unnamed tributary and the Motumate Stream, the discharges shall not give rise to all or any of the following effects in the receiving water:

(i) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
(ii) any conspicuous change in the colour or visual clarity;
(iii) any emission of objectionable odour;
(iv) the rendering of freshwater unsuitable for consumption by farm animals, and;
(v) any significant adverse effects on aquatic life, habitats, or ecology.

2. That the consent holder shall monitor the daily volume and temperature of the discharge, to the satisfaction of the Chief Executive, Taranaki Regional Council, and shall make such records available to the Chief Executive, Taranaki Regional Council, on a monthly basis.

3. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2005 and/or June 2011, 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 the time.

Transferred at Stratford on 13 April 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:	Fonterra Limited PO Box 444 Hawera 4640
Decision Date (Change):	15 July 2015
Commencement Date (Change):	15 July 2015 (Granted Date: 9 June 1999)

Conditions of Consent

Consent Granted:	To discharge combined dairy effluent and factory wastewater (evaporator condensate, washings, processing wastes and stormwater) from a lactose manufacturing plant by spray irrigation onto and into land
Expiry Date:	1 June 2019
Site Location:	893-911 Manaia Road, Kapuni
Legal Description:	Lot 1 DP 4509 Sec 1 SO 11967 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697240E-5630126N
Catchment:	Kaupokonui

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 maintain an effluent spray irrigation management plan, to the satisfaction of the Chief Executive, Taranaki Regional Council, which shall address the following matters:

a) control of effluent application rate;
b) monitoring of the effluent (physicochemical);
c) monitoring of groundwater beneath the irrigated area (physicochemical);
d) monitoring of drainage water downslope of the irrigated area (physicochemical);
e) monitoring of the Kaupokonui Stream (physicochemical and biological);
f) livestock management;
g) irrigator maintenance and rotation;
h) farm management and operator training;
i) contingency events;
j) the dairy industry guidelines;
k) riparian planting and management; and
l) the inclusion of dairy effluent.

2. The maximum volume of discharge shall not exceed 2,630 cubic metres over two consecutive days, including a maximum 120 cubic metres per day of dairy effluent.

3. The consent shall be exercised in accordance with the procedures set out in the effluent spray irrigation management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and all other matters specified in the effluent spray irrigation management plan, except by the specific agreement of the Chief Executive, Taranaki Regional Council. In case of any contradiction between the effluent spray irrigation 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 1 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 1 July each year.

5. The consent holder shall ensure that:

   a) the operation of the spray irrigation system shall be carried out at all times in accordance with the requirements of the effluent spray irrigation management plan required in special condition 1 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 effluent spray irrigation management plan, the maximum period between training sessions being 12 months. Relevant 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 effluent spray irrigation management plan.

6. There shall be no direct discharge of effluent into any watercourse.

7. The spray irrigation system shall not be operated in a manner that causes ponding.

8. From the edge of the spray zone there shall be at least 20 metres to the bank of any watercourse.

9. The consent holder shall monitor and record on a daily basis the volume of effluent produced, the volume of effluent spray irrigated, the area spray irrigated and the hours the irrigation pumps are working; and shall make such records, together with groundwater monitoring data, available to the Chief Executive, Taranaki Regional Council, upon request.

10. The Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004 and/or June 2009 and/or June 2014, 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 15 July 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:	Fonterra Limited PO Box 444 Hawera 4640
Decision Date (Change):	15 July 2015
Commencement Date (Change):	15 July 2015 (Granted Date: 9 June 1999)

Conditions of Consent

Consent Granted:	To discharge combined dairy effluent and factory wastewater (evaporator condensate, washings, processing wastes and stormwater) from a lactose manufacturing plant by spray irrigation onto and into land
Expiry Date:	1 June 2019
Site Location:	560A & 586 Manaia Road & 1319 Skeet Road, Kapuni
Legal Description:	Lot 2 DP 5897 Lots 1 & 2 6039 Lot 6 DP 2903 Lot 3 DP 3601 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697811E-5627168N
Catchment:	Waiokura Motumate

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 consent.

2. The consent holder shall maintain an effluent spray irrigation management plan, to the satisfaction of the Chief Executive, Taranaki Regional Council, which shall address the following matters:

    a) control of effluent application rate and duration;
    b) application frequency
    c) designated application areas;
    d) prevention of runoff and ponding
    e) monitoring of the effluent (physicochemical);
    f) monitoring of groundwater beneath the irrigated area (physicochemical);
    g) monitoring of drainage water downslope of the irrigated area (physicochemical);
    h) monitoring of the Waiokura and Motumate Streams (physicochemical and biological);
    i) monitoring of soils and herbage (physicochemical);
    j) minimisation and control of odour effects offsite;
    k) livestock management;
    l) soil and herbage management;
    m) irrigator maintenance and rotation;
    n) farm management and operator training;
    o) contingency events;
    p) reporting monitoring data;
    q) notification to the council of non-compliance with conditions of this consent;
    r) the dairy industry guidelines;
    s) riparian planting and management; and
    t) the inclusion of dairy effluent.

3. The maximum volume of discharge shall not exceed 3,834 cubic metres over two consecutive days, including a maximum 168 cubic metres per day of dairy effluent.

4. The consent shall be exercised in accordance with the procedures set out in the effluent spray irrigation management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and all other matters specified in the effluent spray irrigation management plan, except by the specific agreement of the Chief Executive, Taranaki Regional Council. In case of any contradiction between the effluent spray irrigation management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.

5. 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 1 July each year.

6. The consent holder shall ensure that:

   a) the operation of the spray irrigation system shall be carried out at all times in accordance with the requirements of the effluent spray irrigation management plan required in special condition 2 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 effluent spray irrigation management plan, the maximum period between training sessions being 12 months. Relevant 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 effluent spray irrigation management plan.

7. There shall be no offensive or objectionable odour as a result of the exercise of this consent at or beyond the boundary of the property or properties on which spray irrigation is occurring.

8. There shall be no spray drift as a result of the exercise of this consent at or beyond the boundary of the property or properties on which spray irrigation is occurring.

9. There shall be no direct discharge of any type of effluent into any watercourse.

10. The spray irrigation system shall not be operated in a manner that causes ponding.

11. The edge of the spray zone shall be at least:

   (a) 20 metres from the bank of any watercourse;
   (b) 10 metres from any property boundary, except as detailed in c);
   (c) 20 metres from the boundary with the property described as Lot 1 DP3601, Blk XV, Kaupokonui SD, unless the written approval of the occupier has been obtained to allow the discharge at a lesser distance.

12. Should monitoring of the discharge under conditions 13 and 14 indicate, in the opinion of the Chief Executive, Taranaki Regional Council, contamination of local groundwater or a water supply from the roof of a dwelling house 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 wastewater irrigation management plan prepared under condition 2, or other such action reasonably required by the Chief Executive, Taranaki Regional Council;

    (b) shall review the wastewater 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.

13. The consent holder shall site, install and maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, monitoring bores for the purpose of determining groundwater quality in the vicinity of the discharge.

14. The consent holder shall monitor and record on a daily basis the volume of effluent produced, the volume of effluent spray irrigated, the area spray irrigated and the hours the irrigation pumps are working; and shall make such records, together with groundwater monitoring data, available to the Chief Executive, Taranaki Regional Council, upon request.

15. The consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of this consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take into account of operational requirements, the results of monitoring, or irrigation scheme expansion.

16. 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 2009 and/or June 2014, 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 15 July 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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	9 June 1999
Commencement Date:	9 June 1999

Conditions of Consent

Consent Granted:	To discharge up to 1,440 cubic metres/day of stormwater and cooling water from a lactose manufacturing plant through two outfalls into the Kaupokonui Stream
Expiry Date:	1 June 2019
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697740E-5629560N
Catchment:	Kaupokonui

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 consent holder shall, in conjunction with the Taranaki Regional Council, undertake such physicochemical and ecological monitoring of the stormwater and cooling water discharges, and the receiving waters (Kaupokonui Stream) as deemed necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991.

2. That allowing for a mixing zone of 150 metres extending downstream of the periphery of the spray discharge zone, the discharge (in conjunction with any other discharges pertaining to the same site) shall not give rise to all or any of the following effects in the receiving water:

a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

b) any conspicuous change in the colour or visual clarity;

c) any emission of objectionable odour;

d) the rendering of fresh water unsuitable for consumption by farm animals;

e) any significant adverse effects on aquatic life, habitats, or ecology;

f) any visible biological and/or fungal growths in the receiving water.

3. That the discharge (in conjunction with any other discharges pertaining to the same site) shall not raise the average daily GFC (glass fibre) filtered five day biochemical oxygen demand (BOD(5)) of the receiving water above 2 gm^{-3} when measured at a site 150 metres downstream of the periphery of the spray discharge zone.

4. That the discharge (in conjunction with any other discharges pertaining to the same site) shall not:

   a) alter the ambient temperature of the receiving water by more than 2 degrees Celsius for 90% of the time that the discharge is occurring on an annual basis; and

   b) alter the ambient temperature of the receiving water by more than 3 degrees Celsius at all times;

   when measured simultaneously immediately upstream and 150 metres downstream of the periphery of the spray discharge zone.

5. That the discharge shall not increase the temperature of the receiving water above 25 degrees Celsius at the periphery of the mixing zone defined in condition 2.

6. That the consent holder shall continuously monitor the temperature of the receiving waters in compliance with conditions 4 and 5, and forward the results of this monitoring to the Chief Executive, Taranaki Regional Council, at monthly intervals.

7. That the Taranaki Regional Council may review conditions 4 and 5 of this consent in June 2001, for the purpose of evaluating the performance of the cooling system in achieving compliance with these conditions.

8. That the discharge shall comply with the following limits at all times:

a)	oil and grease (Freon extractable)	<15 gm^{-3}
b)	pH (within the range)	6.0 - 8.5
c)	suspended solids	<100 gm^{-3}

9. That within the designated mixing zone, and including those waters of the Kaupokonui Stream directly receiving the discharge (in conjunction with any other discharges pertaining to the same site) shall not give rise to:

   i) a barrier preventing the movement of fish species and/or;
   ii) any visible bacterial and/or fungal slime growths.

10. That no anti-corrosion agents, biocides, anti-flocculants or other chemicals shall be added to the cooling water without the written permission of the Chief Executive, Taranaki Regional Council.

11. That the consent holder shall maintain 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. This contingency plan shall be reviewed and updated (if necessary) on an annual basis.

12. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004, June 2009 and/or June 2014, 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.

Transferred at Stratford on 13 April 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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date (Change):	2 June 2004
Commencement Date (Change):	2 June 2004 (Granted Date: 17 April 2000)

Conditions of Consent

Consent Granted:	To discharge emissions into the air from the manufacture, drying, packaging and storage of lactose and associated processes and from the inhalation grade lactose plant
Expiry Date:	1 June 2019
Site Location:	Manaia Road, Kapuni
Legal Description:	Pt Lot 1 DP 6157 Lots 1-9 DP 6588 Lot 1 DP 9769 Blk XV Kaupokonui SD Lot 1 DP 4509 Sec 1 SO 11967 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697840E-5629860N

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 adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any emissions of particulate matter during loading, processing, unloading, packaging, drying, transport or any other site operation.

2. Nothing in these conditions shall remove from the consent holder the obligations, liabilities, duties and/or responsibilities specified in section 17 of the Resource Management Act 1991 or any other part of the Act.

3. The particulate from the wet scrubber system, which treats the exhaust streams from the pre-drier stack and the refined fluid bed drier, shall not exceed 125 milligrams per cubic metre of air, adjusted to 0 degrees Celsius, 1 atmosphere pressure and calculated as a dry gas.

4. No alteration shall be made to plant or process which may substantially change the nature or quality of contaminants emitted without prior consultation with the Chief Executive, Taranaki Regional Council.

5. The discharge shall not result in dangerous levels of airborne contaminants at or beyond the boundary of the property, including but not limited to any risk of fire or explosion.

6. The discharge shall not result in offensive or objectionable dust or odour at or beyond the boundary of the property.

7. 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.

8. The discharge shall not result in noxious or toxic levels of airborne contaminants at or beyond the boundary of the property.

9. Subject to the provisions of this condition, the Taranaki Regional Council may in June 2004 and/or June 2009 and/or June 2014, serve notice that it intends to review any condition of the resource consent, in accordance with section 128(1)(a) of the Resource Management Act 1991, for the purpose of:

   a) dealing with any significant adverse effect on the environment arising from the exercise of this consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; or

   b) further specifying the best practicable option to remove or reduce any adverse effect on the environment caused by any discharge to air; or

   c) to add limits on discharge or ambient concentration of any contaminant or contaminants.

Transferred at Stratford on 13 April 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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	4 February 1999
Commencement Date:	4 February 1999

Conditions of Consent

Consent Granted:	To discharge up to 280 litres/second of stormwater from the factory extension site via a 525 mm diameter pipe into the Kaupokonui Stream
Expiry Date:	1 June 2017
Site Location:	Factory Extension Site, Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697740E-5629860N
Catchment:	Kaupokonui

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 allowing for a reasonable mixing zone of 50 metres extending downstream of the discharge point, the discharge shall not give rise to all or any of the following effects in the receiving water:

(i) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
(ii) any conspicuous change in the colour or visual clarity;
(iii) any emission of objectionable odour;
(iv) the rendering of fresh water unsuitable for consumption by farm animals; and
(v) any significant adverse effects on aquatic life, habitats or ecology.

2. That the discharge shall not exceed the following parameters:

(i)	oil and grease	<15 g/m^3
(ii)	pH [within the range]	6.0 - 8.5
(iii)	suspended solids	100 gm^3

3. That prior to the exercise of this consent, the consent holder shall prepare a contingency plan to be approved by the Chief Executive, Taranaki Regional Council, 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.

4. 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 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 the time.

Transferred at Stratford on 13 April 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
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:	Fonterra Limited PO Box 444 Hawera 4640
Decision Date:	14 December 2017
Commencement Date:	14 December 2017

Conditions of Consent

Consent Granted:	To use a weir in the bed of the Kaupokonui Stream, and to dam water for water supply purposes
Expiry Date:	1 June 2019
Site Location:	879 Manaia Road, Kapuni
Grid Reference (NZTM)	1697665E-5629707N
Catchment:	Kaupokonui

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

General condition

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

Special conditions

1. This consent authorises the ongoing use of the weir existing at the time the application for this consent was lodged, and as described in the application. Any change to the nature or scale of the structure may therefore need to be authorised by a formal process in accordance with the Resource Management Act, 1991.

2. The consent holder shall maintain the structure in a safe and sound condition such that it continues to function effectively.

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to commencement of maintenance work that involves disturbance of, or deposition to the stream bed, or discharges to water. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

4. The weir shall not restrict the passage of fish.

Signed at Stratford on 14 December 2017

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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	13 July 2004
Commencement Date:	13 July 2004

Conditions of Consent

Consent Granted:	To discharge stormwater from an inhalation grade lactose plant site into the Kaupokonui Stream
Expiry Date:	1 June 2017
Site Location:	Manaia Road, Kapuni
Legal Description:	Lot 1 DP 4509 Sec 1 SO 11967 Blk XV Kaupokonui SD
Grid Reference (NZTM)	1697810E-5629840N
Catchment:	Kaupokonui

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. Prior to the exercise of this consent, the consent holder shall prepare a contingency plan to be approved by the Chief Executive, Taranaki Regional Council, 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.

2. The exercise of this consent shall be conducted in general accordance with the information submitted in support of application 3198, and to ensure that the conditions of this consent are met at all times. In the case of any contradiction between the documentation submitted in support of application 3198 and the conditions of this consent, the conditions of this consent shall prevail.

3. 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 of the discharge on any water body.

4. The following concentrations shall not be exceeded in the discharge:

Component	**Concentration**
pH (range)	6.5 - 8.5
suspended solids	100 gm^{-3}
total recoverable hydrocarbons [infrared spectroscopic technique]	15 gm^{-3}

This condition shall apply prior to the entry of the stormwater into the Kaupokonui Stream at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

5. After allowing for reasonable mixing, within a mixing zone extending 50 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the Kaupokonui Stream:

   a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
   b) any conspicuous change in the colour or visual clarity;
   c) any emission of objectionable odour;
   d) the rendering of fresh water unsuitable for consumption by farm animals;
   e) any significant adverse effects on aquatic life.

6. 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.

7. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 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 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.

Transferred at Stratford on 13 April 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	18 September 2006
Commencement Date:	18 September 2006

Conditions of Consent

Consent Granted:	To erect, place, maintain and use pipeline crossings over the Motumate and Waiokura Streams, for the purposes of conveying irrigation wastewater
Expiry Date:	01 June 2023
Review Date(s):	June 2017
Site Location:	Skeet and Manaia Roads, Kapuni
Legal Description:	Lot 6 DP 2903 Lot 3 DP 3601 Blk XV Kaupokonui SD, Lots 1 & 2 DP 6039 Blk III Waimate SD, Lot 2 DP 5897 Pt Secs 25 & 26 Blk III Waimate SD
Grid Reference (NZTM)	1697950E-5627960N
Catchment:	Motumate

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 consent.

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 4339. In the case of any contradiction between the documentation submitted in support of application 4339 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 seven days prior to the exercise of this consent.

4. The consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.

5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

6. Any disturbance of parts of the river bed covered by water and/or any maintenance works which may result in downstream discolouration of water shall be undertaken only between 1 November and 30 April except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.

7. The structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.

8. 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.

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 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.

Transferred at Stratford on 13 April 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
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:	Fonterra Limited PO Box 424 Hawera 4640
Decision Date:	18 April 2013
Commencement Date:	18 April 2013

Conditions of Consent

Consent Granted:	To install a dual culvert in the Waiokura Stream, including the associated streambed and reclamation
Expiry Date:	1 June 2029
Review Date(s):	June 2017, June 2023
Site Location:	586 Manaia Road, Kapuni
Legal Description:	Lot 1 DP 6039 Blk III Waimate SD (Site of structure)
Grid Reference (NZTM)	1698317E-5627432N
Catchment:	Waiokura

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 notify the Chief Executive, Taranaki Regional Council, in writing at least 2 working days prior to the commencement of work. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

2. Installation shall include two culvert pipes with a diameter no less than 1.35 metres, and a total length no greater than 17.5 metres.

3. The fill over the top of the twin culvert pipes shall be no deeper than 3 metres.

4. The stream banks shall be shaped both upstream and downstream of the twin culvert to form a gradual transition between the existing channel width and the twin culvert.

5. The consent holder shall ensure that rock rip rap armouring is placed on the reshaped channel batters and the streambed, for at least 5 metres, both upstream and downstream of the culvert.

6. The rock rip rap required by condition 5 shall be placed at a slope no steeper than 1.5 horizontal to 1 vertical, and shall have the following grading:

    - 100% less than 800 mm diameter
    - 50% greater than 600 mm diameter
    - 90% greater than 350 mm diameter

7. The consent holder shall ensure that a layer of rock rip rap, at least 500 mm thick, is placed on the batters of the fill embankment.

8. The rock rip rap required by condition 7 shall be placed at a slope no steeper than 1.5 horizontal to 1 vertical, and shall have the following grading:

    - 100% less than 450 mm diameter
    - 50% greater than 300 mm diameter
    - 90% greater than 310 mm diameter

9. Any concrete work carried out in the river bed shall be completely separated from running water, by a temporary coffer-dam and/or diversion using sand bags or some other form of contained of fill.

10. The consent holder shall ensure that any concrete placed in the channel is not exposed to flowing water for a period of 48 hours after it has been placed.

11. No instream works shall take place between 1 June and 31 October inclusive.

12. The consent holder shall ensure that the area and volume of stream bed disturbance is, as far as practicable, minimised and any areas that are disturbed are, as far as practicable, reinstated.

13. The culvert shall not obstruct fish passage.

14. The invert of each culvert pipe shall be set 300 mm below the natural streambed.

15. The gradient of each culvert pipe shall be no steeper than the natural gradient of the stream bed at the site.

16. 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.

17. All earthwork areas shall be stabilised as soon as is practicable immediately following completion of soil disturbance activities.

    Note: For the purpose of this condition "stabilised" in relation to any site or area means inherently resistant to erosion or rendered resistant, such as by using indurated rock or by the application of basecourse, colluvium, grassing, mulch, or another method to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and as specified in Taranaki Regional Council's Guidelines for Earthworks in the Taranaki Region, 2006. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by an Investigating Officer, Taranaki Regional Council, an 80% vegetative cover has been established.

18. The works shall remain the responsibility of the consent holder and be maintained so that:

    a. it does not become blocked and at all times allows the free flow of water through it;
    b. any erosion, scour or instability of the stream bed or banks that is attributable to the works carried out as part of this consent is remedied by the consent holder.

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

20. Except with the written agreement of the Chief Executive, Taranaki Regional Council, the culvert shall be removed and the area reinstated, if and when it is no longer required. A further resource consent may be required to authorise the removal of the structure, and the consent holder is advised to seek advice from the Council on this matter.

21. This consent shall lapse on 30 June 2018, 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.

22. 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.

Transferred at Stratford on 13 April 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:	Fonterra Limited PO Box 444 Hawera 4640
Decision Date:	5 February 2016
Commencement Date:	5 February 2016

Conditions of Consent

Consent Granted:	To discharge solid farm dairy effluent onto and into land
Expiry Date:	1 June 2041
Review Date(s):	June 2023, June 2029, June 2035 and in accordance with special condition 11
Site Location:	1291 Skeet Road; 560 A & B, 586 and 594 Manaia Road, Kapuni (Kapuni Farms)
Legal Description:	Lot 2 DP 5897 Lot 2 DP 6039 Blk III Waimate SD, Lot 6 DP 2903 Lot 3 DP 3601 Blk XV Kaupokonui SD (Discharge source & site)
Grid Reference (NZTM)	1698545E–5626837N; 1698551E–5627075N 1698184E–5627034N; 1697499E–5626999N 1698510E–5627964N; 1698564E–5628854N
Catchment:	Waiokura Motumate

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 authorises the discharge of pond sludge from farm dairy effluent onto land. For the purposes of this consent:

   a) Farm dairy includes every area of the dairy cow milking process and includes covered and uncovered areas where cows reside for longer than five minutes for the purpose of milking (including a stand-off pad or yard) but does not include raceways; and

   b) 'Effluent' includes slurry and solid forms. It also includes sand trap cleanings.

2. A maximum of 500 m^3/year of dried solid effluent shall be discharged to 9.23 ha of land.

3. The consent holder shall advise the Taranaki Regional Council by sending an email to consents@trc.govt.nz if the volume of dairy farm exceeds the amount authorised in condition 2. The email shall include the consent number or dairy supply number.

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

5. A stormwater diversion system and a sand trap system shall be installed, maintained and operated at the farm dairy. The diversion system shall prevent, as far as practicable, uncontaminated stormwater entering the effluent disposal system.

   Note. Farm dairy includes any stand-off pad or yard (see condition 1(a)).

6. No contaminants shall be discharged within:

   (a) 25 metres of any surface water body; or
   (b) 25 metres of any fenced urupa (burial ground) without the written approval of the relevant Iwi; or
   (c) 50 metres of any bore, well or spring used for water supply purposes; or
   (d) 150 metres of any dwelling that is not owned by the consent holder, or any marae, unless the written approval of the owner and occupier has been obtained to allow the discharge at a closer distance.

7. Over any 12 month period the Total Nitrogen applied to any hectare of land as a result of the discharge shall be no more than 200 kg.

   Advice Note: Any Nitrogen applied within effluent should be taken into account in the nutrient budget for that land.

8. The consent holder shall keep accurate records of effluent discharged including, but not necessarily limited to the:

   (a) effluent type (e.g. liquid, slurry, solid);
   (b) source of any solid effluent (e.g. anaerobic pond sludge, sand trap);
   (c) paddock and area (ha) that effluent was applied to; and
   (d) date the paddock received effluent.

   This information shall be provided to the Taranaki Regional Council upon request.

9. Where, for any cause (accidental or otherwise), effluent enters surface water or a subsurface drainage system, the consent holder shall:

   (a) immediately notify the Taranaki Regional Council on Ph. 0800 736 222 (notification must include either the consent number or farm dairy number); and
   (b) stop the discharge and immediately take steps to control and stop the escape of effluent to surface water; and
   (c) immediately take steps to ensure that a recurrence of the escape of effluent to surface water is prevented; and
   (d) report in writing to the Chief Executive, Taranaki Regional Council, describing the manner and cause of the escape and the steps taken to control it and to prevent it reoccurring. The report shall be provided to the Chief Executive within seven days of the occurrence.

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 2023 and/or June 2029 and/or June 2035, 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.

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 within a period of 12-months immediately following a Regional Plan, that includes rules relating to discharges of farm dairy effluent, becoming operative. Any such review would be for the purposes of ensuring that the consent conditions have appropriate regard to that plan.

Signed at Stratford on 5 February 2016

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:	Fonterra Limited PO Box 444 Hawera 4640
Decision Date:	5 February 2016
Commencement Date:	5 February 2016

Conditions of Consent

Consent Granted:	To discharge pond sludge from farm dairy effluent onto and into land
Expiry Date:	1 June 2041
Review Date(s):	June 2023, June 2029, June 2035 and in accordance with special condition 11
Site Location:	893, 901, 911 Manaia Road, Kapuni (Kapuni 1)
Legal Description:	Lot 1 DP 4509 Sec 1 SO 11967 Blk XV Kaupokonui SD, Lot 6 Pt Lot 5 DP 4509 Pt Lot 2 DP 6157 Secs 51 & 55 Blk XV Kaupokonui SD (Discharge source & site)
Grid Reference (NZTM)	1697477E–5629140N 1696786E–5630300N 1697978E–5630246N
Catchment:	Kaupokonui
Tributary:	Dunns Creek

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 authorises the discharge of solid farm dairy effluent onto land. For the purposes of this consent:

   a) Farm dairy includes every area of the dairy cow milking process and includes covered and uncovered areas where cows reside for longer than five minutes for the purpose of milking (including a stand-off pad or yard) but does not include raceways; and

   b) 'Effluent' includes slurry and solid forms. It also includes sand trap cleanings.

2. A maximum of 1000 m^3/year of the solid farm dairy effluent shall be discharged to 14.1 ha of land.

3. The consent holder shall advise the Taranaki Regional Council by sending an email to consents@trc.govt.nz if the volume of dairy farm exceeds the amount authorised in condition 2. The email shall include the consent number or dairy supply number.

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

5. A stormwater diversion system and a sand trap system shall be installed, maintained and operated at the farm dairy. The diversion system shall prevent, as far as practicable, uncontaminated stormwater entering the effluent disposal system.

   Note. Farm dairy includes any stand-off pad or yard (see condition 1(a)).

6. No contaminants shall be discharged within:

   (a) 25 metres of any surface water body; or
   (b) 25 metres of any fenced urupa (burial ground) without the written approval of the relevant Iwi; or
   (c) 50 metres of any bore, well or spring used for water supply purposes; or
   (d) 150 metres of any dwelling that is not owned by the consent holder, or any marae, unless the written approval of the owner and occupier has been obtained to allow the discharge at a closer distance.

7. Over any 12 month period the Total Nitrogen applied to any hectare of land as a result of the discharge shall be no more than 200 kg.

   Advice Note: Any Nitrogen applied within effluent should be taken into account in the nutrient budget for that land.

8. The consent holder shall keep accurate records of effluent discharged including, but not necessarily limited to the:

   (a) effluent type (e.g. liquid, slurry, solid);
   (b) source of any solid effluent (e.g. anaerobic pond sludge, sand trap);
   (c) paddock and area (ha) that effluent was applied to; and
   (d) date the paddock received effluent.

   This information shall be provided to the Taranaki Regional Council upon request.

9. Where, for any cause (accidental or otherwise), effluent enters surface water or a subsurface drainage system, the consent holder shall:

   (a) immediately notify the Taranaki Regional Council on Ph. 0800 736 222 (notification must include either the consent number or farm dairy number); and
   (b) stop the discharge and immediately take steps to control and stop the escape of effluent to surface water; and
   (c) immediately take steps to ensure that a recurrence of the escape of effluent to surface water is prevented; and
   (d) report in writing to the Chief Executive, Taranaki Regional Council, describing the manner and cause of the escape and the steps taken to control it and to prevent it reoccurring. The report shall be provided to the Chief Executive within seven days of the occurrence.

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 2023 and/or June 2029 and/or June 2035, 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.

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 within a period of 12-months immediately following a Regional Plan, that includes rules relating to discharges of farm dairy effluent, becoming operative. Any such review would be for the purposes of ensuring that the consent conditions have appropriate regard to that plan.

Signed at Stratford on 05 February 2016

For and on behalf of
Taranaki Regional Council

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A D McLay
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:	Fonterra Limited PO Box 444 Hawera 4640
Decision Date:	10 March 2017
Commencement Date:	10 March 2017

Conditions of Consent

Consent Granted:	To install a dual culvert in the Waiokura Stream, including the associated disturbance of the stream bed
Expiry Date:	01 June 2035
Review Date(s):	June 2023, June 2029
Site Location:	1319 Skeet Road, Kapuni
Grid Reference (NZTM)	1698599E - 5628827N
Catchment:	Waiokura

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 culvert pipe shall be made up of 2 pipes with diameters of no less than 1350 mm each and be no longer than 12 metres.

2. The fill over the top of the culvert pipe shall be no deeper than 1.5 metres.

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 2 working days prior to the commencement of work. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

4. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.

5. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:
   a) completing all works in the minimum time practicable;
   b) avoiding placement of excavated material in the flowing channel;
   c) keeping machinery out of the actively flowing channel, as far as practicable; and
   d) reinstating any disturbed areas as far as practicable.

6. A layer of rock riprap 1200 mm thick shall be installed in the stream bed. The riprap shall extend 5 metres downstream of the culvert outlet and 5 metres upstream of the culvert inlet, 1.5 metres up the banks on both sides of the stream and on the batter slope of the fill on both sides of the culvert. The batter shall be no steeper than 1.5 horizontal and 1 vertical. The rock shall have the following grading:
   - 100% less than 800 mm diameter;
   - 50% greater than 600 mm diameter;
   - 90% greater than 350 mm diameter.

7. The culvert shall not restrict fish passage.

8. The invert of the culvert shall be set below the existing stream bed by 250 mm so that it fills with bed material and simulates the natural bed.

9. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site.

10. On completion of works, the banks of the channel upstream and downstream of the culvert installation shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical.

11. The culvert shall remain the responsibility of the consent holder and be maintained so that:
    a) it does not become blocked, and at all times allows the free flow of water through both pipes; and
    b) the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes.

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

13. This consent shall lapse on 31 March 2022, 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.

14. 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 2023 and/or June 2029, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 10 March 2017

For and on behalf of
Taranaki Regional Council

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A D McLay
Director - Resource Management