Fonterra Kapuni Air and Water Monitoring Programme Annual Report 2012-2013

Technical Report 2013–106

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Taranaki Regional Council
Private Bag 713
STRATFORD

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Executive summary

Fonterra operates a lactose manufacturing factory and inhalation grade lactose plant located on Manaia Road at Kapuni, in the Kaupokonui catchment. The plant processes whey and permeate from dairy product manufacture around the North Island. This report for the period July 2012-June 2013 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

The Company holds a total of 19 resource consents, which include a total of 157 conditions setting out the requirements that the Company must satisfy. The Company holds two consents to allow it to take and use water, six consents to discharge stormwater and cooling water into the Kaupokonui River and Motumate (cooling water only) Stream, three consents to discharge wastes to land, seven land use consents, and one consent to discharge emissions into the air at this site.

The Council's annual monitoring programmes for the year under review together included 12 inspections, 168 water samples collected for physico-chemical analysis, two bio-monitoring surveys of receiving waters, and five ambient air quality analyses.

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

Temperature increase limits on cooling water discharged to the Kaupokonui River were complied with throughout the review period, with minor exceptions. Riparian planting was maintained on the factory site and a donation was received by the Taranaki Tree Trust as per consent conditions.

Irrigation onto the three dairy farms was, in general, well managed. No effect from irrigation was found from biological monitoring of the Kaupokonui River and Waiokura Stream. A 20-metre buffer was maintained to the bank of water courses during irrigation.

Effects on the groundwater in the vicinity of the farms were varied, but most showed some impact on both mineral and organic component levels. This has been addressed through extension of the irrigation disposal system and by more intensive wastewater and groundwater monitoring. The monitoring results show a substantial reduction in nitrogen loading on irrigation areas and indicate an improvement in groundwater quality.

No effects were noted on the Kaupokonui River as a result of the stormwater discharges from the Inhalable Grade Lactose plant and stormwater detention pond. Sample results were within those prescribed by consent conditions. In relation to the northern stormwater catchment of the main plant, the lower pH range limit for the discharge was breached on one occasion. The cause was attributed to aerial deposition of lactose during a long dry period. There was no adverse effect found in the receiving water.

Levels of suspended solids in the septic tank discharge continued to be higher than consent conditions allow, however these were not high in regard to a discharge of this nature. The Company has been advised that the discharge to land would be a permitted activity under the Regional Freshwater Plan, provided certain conditions are met, such as the disposal area being directly associated with the plant.

Particulate deposition from air emissions was similar to the previous monitoring periods. Visual inspections found no evidence of depositions, and odour surveys continued to note low levels of odour off site, with some odour observed around the effluent tank and in the vicinity of this depending on the direction of the wind.

Overall, during the year under review, the Company demonstrated a good level of environmental performance and compliance with the resource consents. There were two unauthorised incidents during the period under review, with no significant effects.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2013-2014 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 the combined Annual Reports for the period July 2012-June 2013 by the Taranaki Regional Council on the monitoring programme associated with resource consents held by Fonterra Cooperative Group Limited, Kapuni (Fonterra). The Company operates a whey processing facility situated on Manaia Road at Kapuni, in the Kaupokonui catchment (Figure 1).

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

One of the intents of the Resource Management Act (1991) 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 Taranaki Regional 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 twenty-first combined annual report and twenty-fifth water-related report by the Taranaki Regional 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 compliance monitoring under the Resource Management Act and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by Fonterra, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in 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 interpretation, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2013-2014 monitoring year.

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

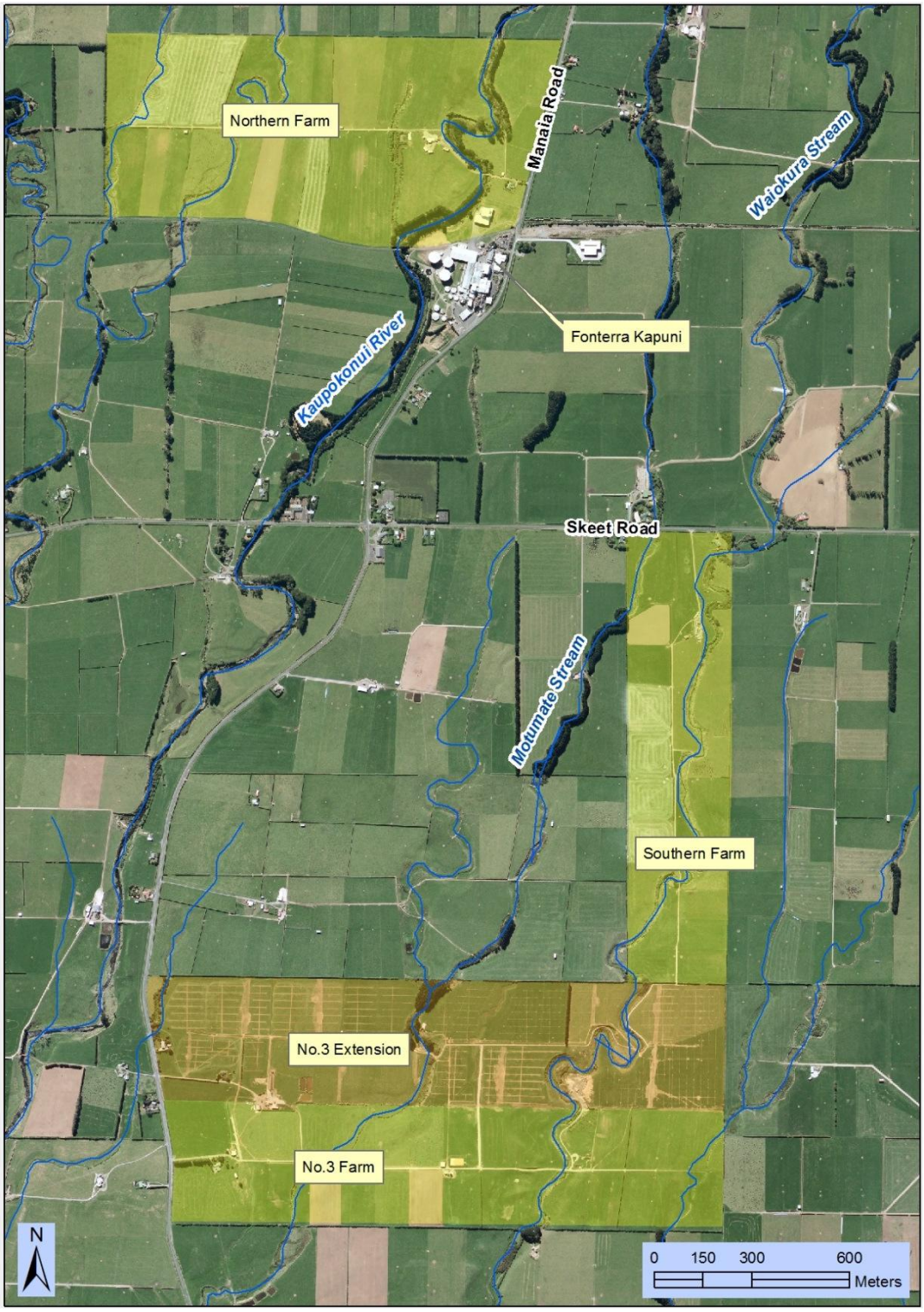

Figure 1 Fonterra Kapuni lactose factory, North, South and (extended) No 3 farms and the Kaupokonui River, Motumate and Waiokura Streams

1.1.3 The Resource Management Act (1991) and monitoring

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

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

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Taranaki Regional Council is recognising the comprehensive meaning of `effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, (covering both activity and impact) monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users, particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the Company during the period under review, this report also assigns an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential (such as data supplied after a deadline) non-compliance with conditions.

- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the monitoring period were negligible or minor at most, or, the Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any inconsequential non-compliances with conditions were resolved positively, co-operatively, and quickly.

- **improvement required (environmental**) **or improvement required (administrative compliance**) (as appropriate) indicates that the Council may have been obliged to record a verified unauthorised incident involving measureable environmental impacts, and/or, there were measureable environmental effects arising from activities and intervention by Council staff was required and there were matters that required urgent intervention, took some time to resolve, or remained unresolved at end of the period under review, and/or, there were ongoing issues around meeting resource consent conditions even n the absence of environmental effects. Abatement notices may have been issued.

- **poor performance (environmental)** or **poor performance (administrative)** indicates generally that the Council may have been obliged to record a verified unauthorised incident involving significant environmental impacts, or there were material failings to comply with resource consent conditions that required significant intervention by the Council even in the absence of environmental effects. Typically there were grounds for either a prosecution or an infringement notice.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

The manufacturing of lactose is based on the processing of whey permeate, the by-product of the production of cheese and casein. Whey permeate contains most of the lactose present in the original milk source, and, through a process which includes evaporation and crystallization, lactose is extracted out and purified. 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 River for the evaporator condensers. Once water has passed through the condensers it is returned to the river via the cooling tower system. In the summer, the increased river water temperature may not be suitable for cooling the refined and edible crystallisers in the required time, so bore water is 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 condensers is discharged to the river via spray nozzles that reduce the temperature of the condenser cooling water so as to minimise temperature rises in the river.

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.

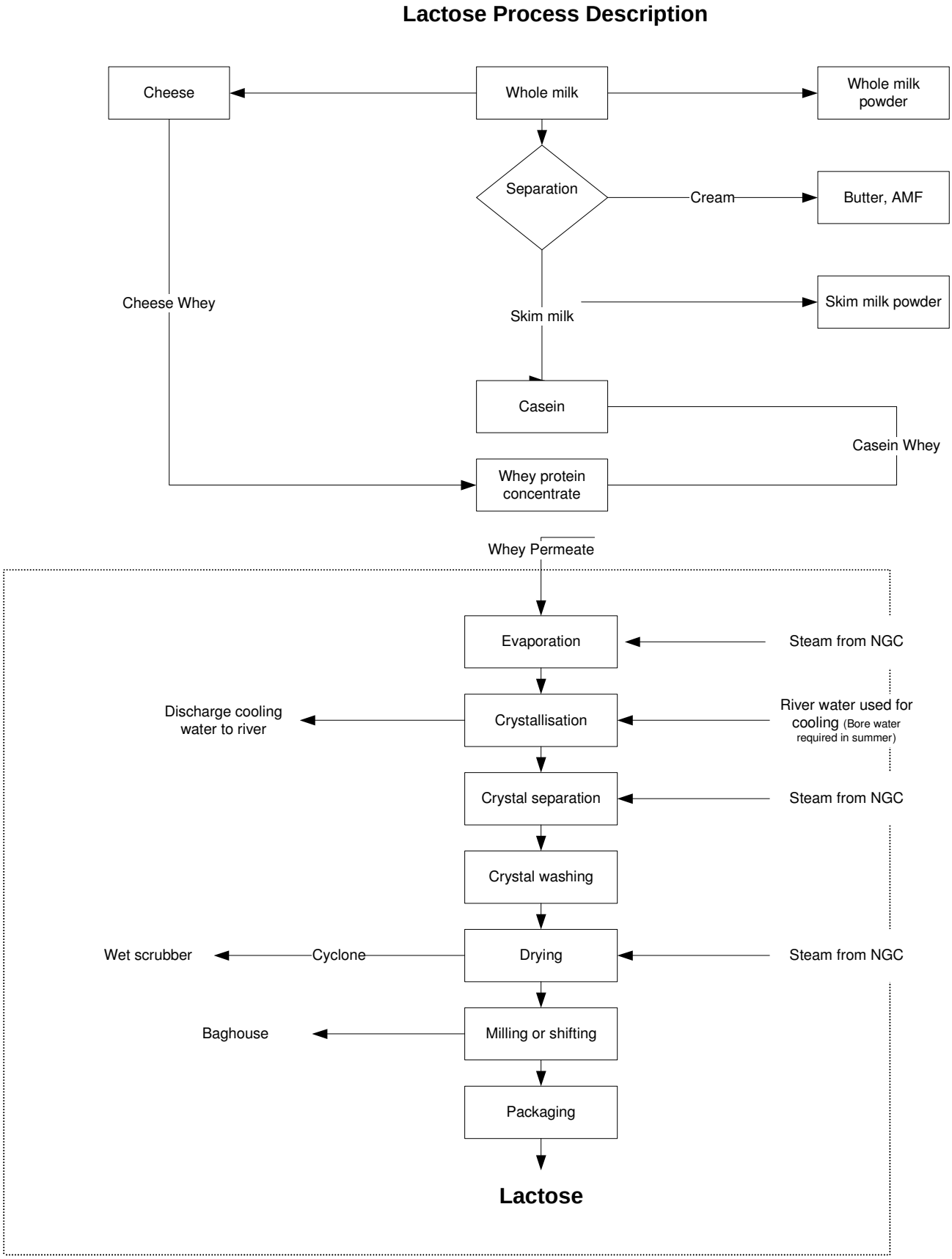

Figure 2 Lactose process diagram

Plant washdown and other process wastes are disposed of by an irrigation system, that is, the wastewater is irrigated onto Fonterra's three farms, in the vicinity of the Fonterra site. There is a 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 Fonterra Kapuni lactose factory, North, South and (extended) No. 3 farms, and the Kaupokonui River, and Motumate and Waiokura Streams, which are referred to throughout this report.

1.3 Resource consents

A summary of the consents held by Fonterra in relation to activities at its Kapuni plant is given in Table 1 below, and the consents are discussed in Sections 1.3.1 to 1.3.5. A copy of each of the consents can be found in Appendix I.

Table 1 Summary of resource consents held by Fonterra for the lactose plant at Kapuni

Consent number	Purpose	Volume	Next review date	Expiry date
0302-3	Take from Kaupokonui	19,500 m^3/day (225 L/s)	2014	2019
0919-3	Discharge cooling water to Kaupokonui	19,500 m^3/day	2014	2019
0920-3	Take from bore	700 m^3/day	-	2017
0921-3	Discharge cooling water to trib. of Motumate Stream	850 m^3/day	-	2017
0922-3	Discharge processing wastes, etc to land (North)	2,600 m^3/2 days	2014	2019
0923-3	Discharge processing wastes, etc to land (South)	3,750 m^3/2 days	2014	2019
0924-3	Discharge storm & cooling water to Kaupokonui	1,440 m^3/day	2014	2019
4032-5	Discharge emissions to air		2014	2019
4235-2	Discharge stormwater during factory shutdown periods	240 m^3/day	-	2017
4604-2	Discharge stormwater from extension to Kaupokonui	280 L/s	-	2017
4623-2	Structures for spray, stormwater, irrigation and take		-	2017
5368-1	Structure over Little Dunn's Creek		-	2017
5629-1	Discharge treated domestic effluent into land	7.5 m^3/day	-	2017
6422-1	Structure for stormwater outlet (IGL plant)		-	2017
6423-1	Discharge stormwater to Kaupokonui Str. (IGL plant)		-	2017
6885-1	Structure for stormwater (pond) outlet		-	2017
6948-1	Structure for pipeline over Motumate and Waiokura		2017	2023
7276-1	Install bore		-	-
9546-1	Install culvert in Waiokura Stream		2017	2029

m^3/day = cubic metres per day: L/s = litres per second

1.3.1 Water abstraction permits

Section 14 of the Resource Management Act stipulates that no person may take, use, dam of 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.

Fonterra hold water permit **0302** 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. This permit was issued by the Taranaki Regional Council on 9 June 1999 under Section 87(d) of the Resource Management Act. It is due to expire on 1 June 2019.

There are three special conditions attached to the consent.

Condition 1 requires that the consent holder, in conjunction with the Council, undertake ecological monitoring associated with the abstraction.

Condition 2 stipulates that the consent holder records the daily rates of abstraction and make these records available to the Council.

Condition 3 deals with review procedures.

Fonterra also holds water permit **0920** 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. This permit was issued by the Taranaki Regional Council on 4 February 1999 under Section 87(d) of the Resource Management Act. It is due to expire on 1 June 2017.

There are three special conditions attached to the consent.

Condition 1 requires the consent holder to record groundwater levels and rates of abstraction and make these records available to the Council.

Condition 2 stipulates that the consent holder allows the Council access to the bore for inspection or sampling purposes.

Condition 3 deals with review procedures.

1.3.2 Water discharge permits

Section 15(1)(a) of the Resource Management Act 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.

Fonterra holds water discharge permit **0919** to cover the discharge of 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. This permit was issued by the Taranaki Regional Council on 9 June 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2019.

There are eleven special conditions attached to the consent.

Condition 1 requires the consent holder to undertake physicochemical and ecological monitoring of the wastes and receiving waters.

Condition 2 describes effects which the discharge shall not give rise to in the receiving waters.

Condition 3 stipulates that the biochemical oxygen demand (BOD) shall not rise above 2g/m^3 below the discharge.

Condition 4 requires that the discharge does not alter the temperature of the receiving water by more than 2 degrees Celsius for 90% of the time, and by more than 3 degrees at all times.

Condition 5 stipulates that the temperature of the receiving water shall not increase above 25 degrees.

Condition 6 requires the consent holder to continuously monitor the temperature of the receiving waters, and to forward this information to the Council.

Condition 7 allowed the Council to review conditions 4 and 5 of the consent in June 2001 for the purpose of evaluating the performance of the cooling system.

Condition 8 stipulates that the discharge not give rise to a thermal barrier to fish or any visible bacterial and/or fungal slime growths.

Condition 9 requires that no anti-corrosion agents, biocides, anti-flocculants or other chemicals be added to the cooling water without permission of the Council.

Condition 10 requires mitigation of the effects of the discharge by maintenance of existing riparian planting, and an annual donation to the Taranaki Tree Trust of $3000.

Condition 11 deals with review of the conditions of the consent.

Fonterra holds water discharge permit **0921** to cover the discharge of 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. This permit was issued by the Taranaki Regional Council on 4 February 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2017.

There are three special conditions attached to the consent.

Condition 1 describes effects which must not arise below the mixing zone in the receiving waters.

Condition 2 requires that the consent holder monitor the daily volume and temperature of the discharge.

Condition 3 deals with review of the conditions of the consent.

Fonterra holds water discharge permit **0924** to cover the discharge of up to 1,440 cubic metres/day of stormwater and cooling water from a lactose manufacturing plant through two outfalls into the Kaupokonui Stream. This permit was issued by the Taranaki Regional Council on 9 June 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2019.

There are twelve special conditions attached to the consent.

Condition 1 requires the consent holder to undertake physicochemical and ecological monitoring of the wastes and receiving waters.

Conditions 2 describes effects which the discharge shall not give rise to in the receiving water.

Condition 3 stipulates that the filtered BOD shall not rise above 2 g/m^3 below the discharge.

Condition 4 requires that the discharge does not alter the temperature of the receiving water by more than 2 degrees Celsius for 90% of the time and by more than 3 degrees at all times.

Condition 5 stipulates that the temperature of the receiving water not increase above 25 degrees.

Condition 6 requires the consent holder to continuously monitor the temperature of the receiving waters, and to forward this information to the Council.

Condition 7 allowed the Council to review conditions 4 and 5 of the consent in June 2001 for the purpose of evaluating the performance of the cooling system.

Condition 8 sets limits on levels of oil and grease, pH and suspended solids in the discharge.

Condition 9 stipulates that the discharge not give rise to a thermal barrier to fish or any visible bacterial and/or fungal slime growths.

Condition 10 requires that no anti-corrosion agents, biocides, anti-flocculants or other chemicals be added to the cooling water without the permission of the Council.

Condition 11 requires the consent holder to maintain a contingency plan outlining measures and procedures to prevent spillage and remedy or mitigate effects of such a spillage.

Condition 12 deals with review of the conditions of the consent.

Fonterra holds water discharge permit **4235** to cover the discharge of up to 240 cubic metres/day of stormwater from the factory site via the existing stormwater system into the Kaupokonui Stream only during factory shutdown periods. This permit was issued by the Taranaki Regional Council on 4 February 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2017.

There are five special conditions attached to the consent.

Condition 1 describes effects which must not arise below the mixing zone.

Condition 2 sets limits on levels of oil and grease, pH and suspended solids in the discharge.

Condition 3 requires the consent holder to prepare and maintain a contingency plan outlining measures and procedures to be undertaken to prevent a spillage and measures to remedy or mitigate environmental effects of such a discharge.

Condition 4 defines factory shut down as being when no whey is being processed.

Condition 5 deals with review of the conditions of the consent.

Fonterra holds water discharge permit **4604** to cover the discharge of up to 280 litres/second of stormwater from the factory extension site via a 525mm diameter pipe into the Kaupokonui Stream. This permit was issued by the Taranaki Regional Council on 4 February 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2017.

There are four special conditions attached to the consent.

Condition 1 describes effects which must not arise below the mixing zone.

Condition 2 sets limits on levels of oil and grease, pH and suspended solids in the discharge.

Condition 3 requires the consent holder to prepare and maintain a contingency plan outlining measures and procedures to be undertaken to prevent a spillage and measures to remedy or mitigate environmental effects of such a discharge.

Condition 4 deals with review of the consent conditions.

Fonterra holds water discharge permit **6423** to cover the discharge of stormwater from an inhalation grade lactose plant (IGL) site into the Kaupokonui Stream. This permit was issued by the Taranaki Regional Council on 13 July 2004 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2017.

Condition 1 requires the consent holder to prepare and maintain a contingency plan outlining measures and procedures to be undertaken to prevent a spillage and measures to remedy or mitigate environmental effects of such a discharge.

Condition 2 stipulates that the consent be conducted in accordance with the information submitted in support of the application.

Condition 3 requires that the consent holder adopt the best practicable option to prevent or minimise any adverse effects of the discharge on any water body.

Condition 4 sets limits on the levels of pH, suspended solids, and hydrocarbons in the discharge.

Condition 5 describes effects which must not arise below the mixing zone.

Conditions 6 and 7 deal with lapse of consent and review of consent conditions.

1.3.3 Air discharge permit

Section 15(1)(c) of the Resource Management Act 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.

Fonterra holds air discharge permit **4032** to cover the discharge of emissions to air from the manufacture, drying, packing and storage of lactose and associated processes and from the inhalation grade lactose plant.

This permit was issued by the Taranaki Regional Council on 17 April 2000 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2019. A change to the conditions of consent 4032 was made on 2 June 2004 to include the IGL plant.

There are nine special conditions attached to the consent.

Condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise emissions of particulate matter.

Condition 2 emphasises that the consent holder is bound by the obligations and duties specified in the Resource Management Act 1991.

Condition 3 stipulates that particulate from the wet scrubber system not exceed 125 milligrams per cubic metre of air.

Condition 4 requires that the consent holder consult with the Council prior to making alterations to the plant.

Conditions 5, 6 and 8 stipulate that the discharge not give rise to dangerous levels of airborne contaminants, offensive or objectionable dust or odour, or noxious levels of airborne contaminants at or beyond the boundary of the property.

Condition 7 allows the consent holder to apply for a change or cancellation to any of the conditions of the consent.

Condition 9 deals with review provisions.

1.3.4 Discharges of wastes to land

Sections 15(1)(b) and (d) of the Resource Management Act 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.

Fonterra holds discharge permits **0922** and **0923** to cover the discharge of evaporator condensate, washings, processing wastes and stormwater from a lactose manufacturing plant by spray irrigation onto pasture. Consent **0922** covers up to 2600 cubic metres/two consecutive days and refers to the Kaupokonui catchment, while **0923** covers the discharge of up to 3750 cubic metres/two consecutive days and refers to the Waiokura and Motumate catchments. Both permits were issued by the Taranaki Regional Council on 9 June 1999 under Section 87(e) of the Resource Management Act. They are due to expire on 1 June 2019. A change to the conditions of consent 0923 was made on 21 August 2006 to provide for extension of the land disposal area.

There are nine special conditions attached to consent **0922.**

Condition 1 requires the consent holder to maintain an effluent spray irrigation management plan (SIMP), and matters which it should address are listed. Condition 2 stipulates that the consent be exercised in accordance with the procedures set out in the SIMP.

Condition 3 allows the SIMP to be reviewed on two months' notice, either by the consent holder or Council. This condition also stipulates that the SIMP is reviewed annually by the consent holder.

Condition 4 requires that the operation of the spray irrigation system is carried out in accordance with the SIMP, that relevant staff are regularly trained on the content and implementation of the plan and staff are advised immediately of revisions or additions to the SIMP.

Condition 5 stipulates that there be no direct discharge of effluent to any watercourse.

Condition 6 requires that the system be operated in a manner which does not cause ponding.

Condition 7 stipulates that there be at least 20 metres from the edge of the spray zone to the bank of any watercourse.

Condition 8 requires the consent holder to monitor and collect various data on the spray irrigation system, with this is to be made available to the Council.

Condition 9 deals with review provisions.

There are fifteen special conditions attached to consent **0923,** nine of which were the same as those on consent **0922,** when the two consents were issued. The change of consent on 21 August 2006 added six conditions, that address: adoption of the best practicable option to minimise adverse effects (condition 1); prohibition of offensive or objectionable odour (condition 6); control of spray drift (condition 7); contamination of water supplies (condition 11); groundwater monitoring (condition 12); and change or cancellation of conditions (condition 14).
Fonterra holds discharge permit **5629** to cover the discharge of up to 7.5 cubic metres/day (114 litres/second) of treated domestic effluent from the Lactose New Zealand processing plant into land. This permit was issued by the Taranaki Regional

Council on 23 May 2000 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2017. Changes to consent conditions were made on 28 July 2000 to correct an ultra vires condition.

There are six special conditions attached to the consent.

Condition 1 required that the treatment system be installed according to the plans submitted in the application.

Condition 2 requires that the treatment system is maintained.

Condition 3 stipulates that the disposal field be located within the boundaries of the subject property, and that it does not adversely affect groundwater.

Condition 4 requires that the consent holder establish an access point for sampling of the discharge.

Condition 5 stipulates that an average of four samples in any 12 month period not exceed 33 g/m^3 total suspended solids.

Condition 6 deals with review provisions.

1.3.5 Land use consents

Section 13(1)(a) of the Resource Management Act stipulates that no person may use, erect, or place any structure in, on, under, or over the bed of any river, unless the activity is expressly allowed by a rule in a regional plan or by a resource consent.

Fonterra holds land use consent **4623** to erect, place, use and maintain various spray, stormwater, irrigation and intake structures in the bed of the Kaupokonui Stream. This permit was issued by the Taranaki Regional Council on 4 February 1999 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2017.

There are seven special conditions attached to the consent.

Condition 1 requires the consent holder to notify the Council at least 48 hours prior to undertaking significant maintenance works. Condition 5 stipulates that such works be carried out only between 1 November and 30 April.

Condition 2 stipulates that the structures are constructed generally in accordance with the application.

Condition 3 requires the consent holder adopt the best practicable option to minimise adverse effects on water quality.

Condition 4 stipulates that fish passage is not obstructed.

Condition 6 requires that if the structures are no longer required they are removed and the area reinstated.

Condition 7 deals with provisions for review.

Fonterra holds land use consent **5368** to erect, place, use and maintain a bridge over Little Dunn's Creek a tributary of Dunn's Creek in the Kaupokonui catchment for access purposes. This permit was issued by the Taranaki Regional Council on 21 July 1998 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2017.

There are six conditions attached to the consent.

Condition 1 addresses notification of works.

Condition 2 stipulates that construction and maintenance be according to the documentation submitted.

Condition 3 covers measures to prevent contamination of the watercourse.

Condition 4 requires that the structure is removed and the area reinstated, if and when it is no longer required.

Condition 5 prohibits the discharge of contaminated stormwater from the bridge or its approaches to the water course.

Condition 6 is a review provision.

Fonterra holds land use consent **6422** to erect, place, and maintain a stormwater outlet structure in the bed of the Kaupokonui Stream. This permit was issued by the Taranaki Regional Council on 13 July 2004 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2017.

There are seven special conditions attached to the consent.

Conditions 1 to 4 deal with construction and maintenance of the structure.

Condition 5 requires that the structure is removed and the area reinstated, if and when it is no longer required.

Conditions 6 and 7 deal with lapse and expiry of consent.

Fonterra holds land use consent **6885** to erect, place, use and maintain an outlet structure in the Kaupokonui Stream for stormwater discharge purposes. This permit was issued by the Taranaki Regional Council on 12 May 2006 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2017.

There are seven special conditions attached to the consent.

Condition 1 requires the consent holder to adopt the best practicable option to minimise effects on water quality.

Condition 2 stipulates that the consent is undertaken in accordance with documentation submitted in support of the application.

Condition 3 requires the consent holder to notify the Council prior to commencing installation.

Condition 4 stipulates that riverbed disturbance be kept to a minimum.

Condition 5 requires the structure(s) be removed when no longer required.

Condition 6 and 7 deal with expiry and review of the consent.

Fonterra holds land use consent **6948** to erect, place, use and maintain and use pipeline crossings over the Motumate and Waiokura Streams, for the purpose of conveying irrigation wastewater. This permit was issued by the Taranaki Regional Council on 18 September 2006 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2023.

There are nine special conditions attached to the consent.

Condition 1 requires the consent holder to adopt the best practicable option to minimise effects on water quality.

Condition 2 stipulates that the consent is undertaken in accordance with documentation submitted in support of the application.

Condition 3 requires the consent holder to notify the Council prior to commencing installation.

Condition 4 requires the adoption of the best practicable option to minimise discharge of silt and other contaminants, and to minimise riverbed disturbance.

Condition 5 deals with riverbed disturbance and reinstatement.

Conditions 6 and 7 relate to the timing and notification of works.

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

Fonterra holds land use consent **7276** to drill and construct an exploratory bore for general factory purposes.
This permit was issued by the Taranaki Regional Council on 11 April 2008 under Section 87(a) of the Resource Management Act. There is no expiry date.

There are 12 special conditions attached to the consent.

Condition 1 requires compliance with the New Zealand Environmental Standard for drilling soil and rock.

Condition 2 deals with prevention of interconnection between aquifers.

Condition 3 relates to protection of headworks.

Condition 4 relates to testing of bore water quality as to suitability for the intended purpose.

Condition 5 relates to disposal of drilling and construction wastes.

Conditions 6 to 9 relate to construction of the bore.

Condition 10 requires provision of a bore log.

Conditions 11 and 12 deal with lapse and review of consent.

Fonterra holds land use consent **9546** to install a dual culvert in the Waiokura Stream, including the associated streambed and reclamation. This permit was issued by the Taranaki Regional Council on 18 April 2013 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2029.

There are 22 conditions attached to the consent.

Condition 1 addresses notification of works.

Conditions 2 to 10, 14, 15, and 18 address the design, construction and maintenance of works.

Condition 11 prohibits works between 1 June and 31 October.

Condition 12 deals with riverbed disturbance and reinstatement.

Condition 13 prohibits the obstruction of fish passage.

Conditions 16 and 17 address the minimisation of sedimentation in the stream, and stabilisation of earthworks.

Condition 19 addresses the discovery of archaeological remains.

Condition 20 deals with removal of the structure.

Conditions 21 and 22 relate to lapse and review of the consent.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the Resource Management Act sets out an obligation for the Taranaki Regional Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

The Taranaki Regional 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 Fonterra 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 Taranaki Regional Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application:

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

1.4.3 Site inspections

The Fonterra site was visited twelve times during the monitoring year. 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 and land, including contaminated stormwater and process wastewaters. Air inspections focussed on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

The Taranaki Regional 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 sample was collected of both the spray cooling waste water and the combined stormwater/cooling water discharge on 10 occasions, and the samples analysed for BOD_5 (total and filtered), pH, conductivity and turbidity. The stormwater discharge was also analysed for oil and grease.

The Kaupokonui River was sampled on ten occasions at three sites, and the samples analysed for temperature, BOD_5 (total and filtered), pH, conductivity, turbidity and ammonia-N. The Waiokura Stream was sampled at three sites on five occasions, and the samples analysed for temperature, conductivity, nitrate and sodium.

Eight samples were collected from the stormwater outfall from the factory extensions, one sample was collected from the stormwater outfall from IGL plant and another two were collected from the outlet of the stormwater pond. Stormwater samples were analysed for total BOD_5, conductivity, pH, turbidity, suspended solids and oil and grease.

Samples were collected from the septic tank on four occasions and analysed for suspended solids.

Groundwater from nine bores on the three farms was sampled on six occasions and analysed for temperature, conductivity, pH, and nitrate. In addition, filtered COD, ammonia, sodium and chloride were tested for on three of the occasions.

Deposition gauges were placed at selected sites in the vicinity on one occasion, and the collected samples analysed for COD.

1.4.5 Biomonitoring surveys

A biological survey was performed on two occasions in the Kaupokonui River 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 river. One 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.

2. Results

2.1 Water

2.1.1 Review of consent holder's data

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

2.1.1.1 River abstraction records

Fonterra holds consent **0302** which allows the Company to abstract up to 19,500 cubic metres per day (225 litres/second average) from the Kaupokonui River. Special conditions attached to the consent require Fonterra to undertake daily monitoring of the water abstracted from the river, and to forward such monitoring data to the Taranaki Regional Council.

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

Abstraction rate is measured by a magnetic flow meter on the supply line from the river pumps to the factory that was commissioned on 24 December 2008. Previously, flow volumes were calculated based on crystalliser use.

Table 2 Summary of water abstraction volumes from the Kaupokonui River, 2012-2013

Month	Average daily abstraction (m^3/day)	Minimum daily abstraction (m^3/day)	Maximum daily abstraction (m^3/day)	Number of days per month daily abstraction >19 500 m^3
July 2012	343	0	4,670	0
August 2012	5,337	1,808	9,987	0
September 2012	11,405	9,868	14,443	0
October 2012	13,427	4,774	15,161	0
November 2012	14,734	13,027	17,775	0
December 2012	13,592	10,022	16,296	0
January 2013	11,928	8,634	15,328	0
February 2013	11,885	7,927	17,185	0
March 2013	14,772	11,692	14,772	0
April 2013	10,492	6,452	15,018	0
May 2013	7,443	5,495	11,753	0
June 2013	5,002	210	10,484	0

The daily river abstraction data summary in Table 2 illustrates that Fonterra continued to take a significant volume of water from the river during the 2012-2013 monitoring period.

The total volume of 3,650,730 m^3 exceeded that taken in 2011-2012 by 26%. All abstractions were within the consent limits, with the monthly average daily volume abstracted maintained well below the 19,500 cubic metres daily limit. In 2012-2013, a maximum daily abstraction of 17,775 cubic metres was recorded, for 14 November 2012.

Fonterra's abstraction of water from the Kaupokonui River was undertaken in a satisfactory manner and there were no obvious problems. The abstraction information supplied by Fonterra complied with the conditions of consent 0302-1 and the Resource Management Regulations, 2010. Telemetry of the abstraction data, directly to Council, is being arranged.

2.1.1.2 Bore abstraction records

In relation to the exercise of resource consent **0920**, Fonterra supplied the Taranaki Regional Council, on a monthly basis, monitoring data on the daily volume abstracted from the bore in the Kaupokonui Catchment. Data are summarised in Table 3.

Table 3 Summary of groundwater volumes abstracted during 2012-2013

Month	Number of days abstraction undertaken	Average daily volumes abstracted (m^3) *	Maximum daily volume abstracted (m^3)
July 2012	0	0	0
August 2012	18	3	30
September 2012	30	7	47
October 2012	30	2	11
November 2012	21	54	183
December 2012	19	64	186
January 2013	10	74	415
February 2013	6	23	136
March 2013	21	72	126
April 2013	11	1	2
May 2013	29	2	8
June 2013	15	1	1

*: = on days bore utilised

In 2012-2013, most bore usage occurred over several periods of 2 or 3 days between November and March, with two longer periods of 8 and 16 days in early December and early March, respectively. Bore abstraction reduced markedly from mid-March 2013 onwards, following modifications made to the York Chiller. Maximum daily abstraction was 415 m^3 on 23 January 2013, or 59% of the limit of 700 m^3/day.

No problems associated with the abstraction of water from the groundwater bore were experienced during the monitoring period. The abstraction information supplied by Fonterra was in accordance with the Resource Management Regulations, 2010.

2.1.1.3 Irrigation records

In relation to Fonterra's spray irrigation of wastewater onto land (i.e. the exercise of consents **0922** and **0923)** Fonterra supplied the Taranaki Regional Council with monitoring data relating to the daily volume of effluent produced, and the volume of wastes spray irrigated. This information is summarised in Table 4.

Table 4 Wastes irrigation records supplied by Fonterra, 2012-2013

Month	Northern Farm				Southern Farms			
	Days irrigated	Average daily volume irrigated (m^3/day)	Maximum daily volume irrigation (m^3/day)	Number of times 2-day irrigation >2600m^3	Days irrigated	Average daily volume irrigated (m^3/day)	Maximum daily volume irrigated (m^3/day)	Number of times 2-day irrigation >3750m^3
July 2012	11	43	163	0	20	80	204	0
August 2012	7	212	312	0	31	528	1373	0
September 2012	30	476	693	0	30	1424	1701	0
October 2012	31	529	751	0	31	1506	1770	0
November 2012	30	624	982	0	30	1645	2017	0
December 2012	31	518	951	0	31	1530	2046	0
January 2013	31	443	940	0	31	1334	1847	0
February 2013	28	474	894	0	28	1177	1546	0
March 2013	31	509	898	0	31	1241	1525	0
April 2013	30	327	656	0	30	991	1234	0
May 2013	30	338	569	0	31	951	1245	0
June 2013	22	255	412	0	30	612	1055	0

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

Fonterra continued to irrigate a large volume of wastewater during the 2012-2013 monitoring period. Consents **0922** and **0923** permit a maximum volume of 2,600 cubic metres (Northern farm) and 3,750 cubic metres (Southern farms) to be spray irrigated onto land per two consecutive days. Irrigation occurred almost daily during both monitoring years. A total volume of 530,225 m^3 was irrigated, with a distribution between farms of 26%, 15% and 60% for Farm 1, Farm 2 and Farm 3, respectively. This was a decrease of 0.6% from the volume of 533,276 m^3 irrigated in 2011-2012, with similar distribution between farms.

The record shows that the volume limits on both consents were complied with throughout the 2012-2013 monitoring period.

2.1.1.4 Receiving water and coolant temperatures

Fonterra maintained continuous records of Kaupokonui River water temperatures (upstream of the spray coolant discharge zone and at the downstream end of the designated mixing zone), and spray coolant water temperature. These records have been examined by the Council and a summary of performance and compliance in 2012-2013 is presented in Table 5. 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 river 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. Calibration was generally performed at weekly to fortnightly intervals by Company personnel, and checks were made by Council staff during monthly receiving water sampling surveys.

Table 5 Summary of Fonterra continuous water temperature records (℃) from two monitoring probes in the Kaupokonui River, July 2012 to June 2013.

Month	No. of Days on Record	% Time* River Increase			Downstream River temperature		Comments
		>2˚C	>2.5˚C	>3˚C	Max Increase (˚C)	Max in excess of 25˚C	
July 2012	19	0.0	0.0	0.0	0.7	0	Temperature sensors nulled for 6.2 hours
August 2012	31	0.9	0.0	0.0	2.6	0	Temperature sensors nulled for 25 minutes
September 2012	30	0.3	0.0	0.0	2.7	0	Temperature sensors not nulled
October 20102	31	0.0	0.0	0.0	1.7	0	Temperature sensors nulled for 6.2 hours
November 2012	30	1.4	0.0	0.0	2.4	0	Temperature sensors nulled for 10 hours
December 2012	31	2.3	0.0	0.0	2.9	0	Temperature sensors nulled for 26 hours
January 2013	31	4.9	0.2	0.0	3.1	0	Temperature sensors nulled for 8.5 hours
February 2013	28	5.6	0.3	0.0	3.1	0	Temperature sensors nulled for 16 hours
March 2013	31	9.3	1.1	0.04	3.3	0	Temperature sensors nulled for 9.3 hours
April 2013	28	0.8	0.0	0.0	2.5	0	Temperature sensors nulled for 40 hours
May 2013	30	0.0	0.0	0.0	2.0	0	Temperature sensors nulled for 20 hours
June 2013	28	0.0	0.0	0.0	1.7	0	Temperature sensors nulled for 16 hours
Mean 2012-2013		2.1	0.1	0.003	3.3	0	

Note:* = % of actual record

The temperature data shown in Table 5 are derived from the statistical PLC record. There were occasions when temperature differences reached or exceeded 2˚C, during periods of low flow in Kaupokonui River.

Condition 4(b) of consent **0919** requires that the discharge does not result in an increase of more than 3˚C at any time. This limit was exceeded for short periods, by 0.1 °C on a total of three occasions in January, February and March 2013 for about 10-12 seconds each, and by 0.3°C on 22 March 2013 for 17 minutes. Refer to section 2.3.

Part of the reason for the breaches of river temperature increase limit was a fault in the PLC system for regulating operation of the cooling tower. The system computer programme was upgraded, and trialled successfully in May 2013.

For the 2012-2013 monitoring period as a whole, exceedances of the 2°C limit occurred less than 10% of the time (i.e. satisfying special condition 4(a) of consent 0919). The temperature differential exceeded 2°C for about 5% of the time in January and February, and for 9% of the time in March 2013 during a period of exceptionally low flow in Kaupokonui River.

Fonterra 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).

Special condition 5 of consent **0919** requires that the discharge shall not raise the river temperature above 25˚C at the periphery of the mixing zone. This was not found to have been exceeded.

2.1.1.5 Wastewater composition

Fonterra commenced monthly monitoring of wastewater composition in May 2007. This was done at the request of the Regional Council in order to improve calculations of loadings on irrigation areas and to characterise variation in effluent quality. Fonterra increased the frequency to weekly in July 2008. Grab samples are taken at the filter on the line from the plant wastewater tank and sent to an outside laboratory (Industrial Chemistry Services Ltd) for analysis of pH, organic strength, major mineral components, and nutrients, including nitrogen species. The results for the 43 samples taken between 28 August 2012 and 21 June 2013 are summarised in Table 6.

Table 6 Results of wastewater monitoring by Fonterra 2012-2013

Parameter	Unit	2012-2013		% change	2011-2012	
		Median N = 43	Range		Median N = 34	Range
pH	pH	4.4	4.2 – 5.3	-	4.3	4.0 – 5.4
Chemical oxygen demand	g/m^3	7,273	2,475 – 13,905	-32	10,691	2,044 – 19,996
Lactose	%	0.41	0.00 – 0.77	-24	0.54	0.00 – 1.21
Nitrate	g/m^3	41	11 - 86	-13	47	1 – 93
Nitrite	g/m^3	3.1	0.6 - 11	-22	4.0	0.0 – 20
Total Kjeldahl Nitrogen (TKN)	g/m^3	40	12 - 73	-27	55	0 – 207
Total Nitrogen	g/m^3	90	52 - 148	-4	94	53 - 259
Total Phosphorus	g/m^3	121	18 - 267	-12	138	14 - 275
Sodium	g/m^3	98	37 - 142	-20	122	51 – 280
Potassium	g/m^3	150	45 - 300	-40	250	45 – 1,020
Calcium	g/m^3	209	100 - 519	-12	238	104 – 598
Magnesium	g/m^3	21	1 - 191	<-1	22	2 – 69
Sodium adsorption ratio		2.3	0.8 – 3.6	-21	2.9	1.6 – 6.5

The lactose plant wastewater typically has high organic strength and is relatively acidic. A comparison can be made between results for the 2011-2012 and 2012-2013 monitoring years on the basis of median values, as described in Table 6.

There was reduction in median concentration for all parameters monitored, notably COD (32%), lactose (24%), sodium (20%) and potassium (40%). For nitrogen, a discrepancy in the 2011-2012 data between individual nitrogen species and total

nitrogen values, (in theory, nitrate-N + nitrite-N + TKN = total nitrogen), makes comparison between years difficult. A reduction in total nitrogen concentration of about 15-20% seems likely.

Fonterra has ascribed the reduction in wastewater strength to a strong focus on loss minimisation at the Kapuni site during the 2012-2013 season.

With respect to mass discharge rate of wastewater components, wastewater volume in 2012-2013 was similar to that produced in 2011-2012. Therefore, the mass discharge rate of the wastewater components reduced by the same proportion as their respective concentrations.

Within the production season, measured wastewater strength was significantly higher from early September to late January, in terms of COD, total nitrogen, and minerals except calcium and magnesium. This coincided with peak production periods.

2.1.2 Council monitoring

2.1.2.1 General inspections of factory premises

Twelve scheduled inspections of the premises, treatment system and Kaupokonui River were performed during both the 2012-2013 monitoring 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 made liaison with the Council officer and provided an update on Fonterra'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.

2.1.2.1.2 Intake from the Kaupokonui River

The monthly inspections showed that both Fonterra's weir and intake system worked well during the period under review.

The fish pass installed by Fonterra under the guidance of the Taranaki Regional Council in March 2004, contained an adequate level of water during all inspections, though some damage to the side of the lower section of the pass was discovered during the bio-monitoring survey of 3 November 2010. Work to stabilise the side of the upper and middle sections of the pass was carried out in May 2013. (The remaining work to be done, on the side of the lower section, was completed during the next summer low flow period).

The river sampling site upstream of the intake at the railway bridge (KPK000660), that is situated to differentiate any effects of wastewater disposal at Farm 1 from those of cooling water discharges to the river, was moved downstream about 50 metres to beside the intake structure in September 2011. This was done because a recent flood had affected access, and there is better mixing at the new site with the tributary from Farm 1.

2.1.2.1.3 Spray cooling wastes discharges to the Kaupokonui River

The cooling water discharge system had variable performance during the monitoring year. Fonterra's recording system had some malfunctions, resulting in periods of missing records with regard to river temperatures.

In general, the main cooling tower system worked well. However, a problem with the PLC, in regulating maximum temperature increase and differential in the river, led to the cooling system being operated continuously as a precaution in March and April. A new PLC programme was fully tested successfully in May.

The most common cause of missing (or inaccurate) data in the temperature record was due to one or both instream temperature probes being removed from the river during fresh conditions to prevent damage, or during calibration exercises. During these times a null switch is activated to avoid recording inaccurate data.

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 River

The stormwater outfalls from IGL plant installed upstream of the old rail bridge, and from the detention pond downstream of the cooling water sprayers, did not cause concern during the monitoring period, due to either very low discharge rates or limited contamination of the discharge.

Photo 1 Valve on northern storm drain, 15 November 2012, and Reno mattresses laid out below storm drains to Kaupokonui River, 27 June 2013

The discharge from the stormwater outfall for the northern part of the main plant was significantly below the lower pH range limit on one occasion, This was attributed to aerial deposition of lactose during a long dry period before sampling. A valve was installed on this stormwater outfall during the review period, in case of accidental spillage of chemicals, and Reno mattresses for erosion control were laid below both northern stormwater outlets, as shown in Photo 1.

2.1.2.1.5 Water bore in the Kaupokonui Catchment

Fonterra utilised its groundwater bore until mid-March 2013, when an upgrade of the York Chiller removed the need for additional cooling during periods of warmer temperatures in Kaupokonui River. The monthly monitoring inspections showed that the bore was utilised intermittently from August to March, mostly at a low rate, and that there was complete compliance with the limit on maximum abstraction rate.

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 heats its swimming pool. The school is now closed and no longer has a need for this service. Bore water is also discharged back to the Motumate catchment via a tributary immediately opposite the factory across Manaia Road.

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 Fonterra.

This extension increased the irrigated area during the 2007-2008 dairy season by 49 ha to 169 ha (Figure 1), of which 44 ha is reticulated with in-ground irrigators. The total area farmed is 244 ha.

The majority of inspections noted spraying of wastewater onto paddocks well away from stock. No spray drift across streams was observed. Care is required while irrigating near watercourses particularly during windy conditions. Spraying is not to occur within 20 m of a watercourse (condition 6 of consent **0923**).

No leakage of wastewater/stormwater from the underground transfer and distribution pipelines to surface water was recorded. A set of standard operating procedures is in place for monitoring of the system. Pumping is stopped automatically, and restarts must be made manually, when the pressure set point is exceeded.

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 Fonterra farms, which improved the performance of these areas in their ability to receive and assimilate the irrigated wastewater. Testing undertaken in May 2010 indicated that aeration is no longer required, unless there is visible sign of ponding.

2.1.2.1.8 Riparian planting

The riparian planting on the left bank of the Kaupokonui River adjacent to and downstream of the cooling sprays continues to provide a 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 North Farm cowshed to the lower farm boundary, which were planted during the 1997 and 1998 winter periods, continued to be maintained during the 2012-2013 monitoring period.

Fonterra is currently investing around $20,000 a year in planting and fencing of waterways around the factory and Company farms, and a further $2,000 a year on maintenance of these areas, such as spraying. This includes an annual donation of $3000 to the Taranaki Tree Trust in accordance with condition 10 (b) of consent **0919.** At the end of the review period, at total of $46,035.00 had been donated to the Trust.

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.

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

In a separate project initiated by Fonterra 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 will 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 Kapuni Farm 1 run-off. All plantings were maintained in 2012-2103, and replanting was undertaken where a new crossing was installed over Waiokura Stream between Farm 2 and Farm 3 in June 2013.

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**) and the combined stormwater/cooling water pipe discharge (permit **0924**) involved the collection by the consent holder of one representative 24-hour composite sample of each waste, to be analysed by the Council. The results of these analyses for 2012-2013 are presented in Table 7.

Table 7 Results of the analysis of stormwater/cooling water and spray cooling water discharge, 2012-2013

Waste	Spray cooling water					'Stormwater/cooling water'						
Site code	STW 002017					STW 002018						
Date	BOD_5		Condy @ 20°C	Turbidity	pH	BOD_5		Condy @ 20°C	Turbid-ity	Susp-ended solids	pH	O&G
	Total	Filtered				Total	Filtered					
	g/m³	g/m³	mS/m	NTU		g/m³	g/m³	mS/m	NTU	g/m³	pH	g/m³
22-Aug-12	0.6	0.9	8.7	1.2	-			10.3	3.5		7.5	
27-Sep-12	7.0	6.6	10.3	2.5	-	2.7	2.2	10.4	4.6	7	7.4	0.5
18-Oct-12	10	8.4	8.6	2.6	-	6.3	5.9	8.4	1.7	3	7.3	<0.5
15-Nov.12	11	8.1	9.9	3.8	7.3	23	22	10.1	3.2	<2	7.3	<0.5
13-Dec-12	37	25	9.5	2.3	-	9.4	7.9	11.9	4.4	6	7.6	0.6
17-Jan-13	35	32	9.8	1.8	7.3	8.1	7.3	8.9	2.5	3	7.3	<0.5
21-Feb-13	46	>25	9.8	4.6	7.5	8.0	6.6	9.2	1.6	2	7.6	0.7
21-Mar-13	29	15	7.6	2.0	7.4	3.2	2.7	7.7	2.1	4	7.7	<0.5
18-Apr-13	40	32	5.3	17	7.1	6.0	5.0	5.4	6.4	10	7.2	<0.5
16-May-13	16	13	8.8	1.7	7.2	4.0	3.5	8.2	1.6	2	7.5	<0.5
Range	0.6 - 46	0.9 - 32	5.3 – 10.3	1.2 - 17	7.1 – 7.5	2.7 – 23	2.2 – 22	5.4 - 11.9	1.6 – 6.4	<2 - 10	7.2 - 7.7	<0.5 – 0.7
Median	22	14	9.1	2.4	7.3	6.3	5.9	9.0	2.8	3	7.4	<0.5

Composite samples of the spray cooling water discharge were either not collected or of insufficient volume on two out of ten monitoring occasions in 2012-2013, because the samplers had either not been set up properly or failed, in which cases a grab sample was taken.

Both discharges have been sampled (mainly as 24-hour composites) and analysed by the Regional Council during previous monitoring periods. A summary of these results is presented in Table 8.

Table 8 Summary of cooling water discharge quality from Taranaki Regional Council surveys during the period March 1992 to June 2012

Waste	Spray cooling water				'Stormwater/cooling' water		
Parameter	**Unit**	**No. of samples**	**Range**	**Median**	**No. of samples**	**Range**	**Median**
Conductivity at 20°C	mS/m	162	3.1 – 46.8	9.8	181	5.7 - 132	10.8
Turbidity	NTU	159	0.4 - 450	1.2	175	0.3- 110	1.6
BOD_5	g/m^3	162	0.4 - 460	2.0	177	<0.5 - 1100	2.2
BOD_5 (filtered)	g/m^3	147	0.4 - 91	1.0	159	<0.5 - 1100	1.2
pH	pH	48	5.8 – 8.2	7.4	85	4.6 – 8.0	7.2
Oil and grease	g/m	2	<0.5	<0.5	53	<0.5 – 2.3	<0.5

In comparison to previous data, all parameter values were within previous ranges.

There was an apparent increase in cooling water BOD in 2012-2013 for the second, consecutive year, the median value increasing to 22 from 7.4 g/m^3 in 2011-2012, and from 2.7 g/m^3 in 2010-2011.

For the stormwater/cooling water discharge, the measured BOD_5 values in 2012-2013were relatively high for the second consecutive year, the median value of 6.3 g/m^3 being similar that of 5.7 g/m^3 in 2011-2102, which had increased from 2.4 g/m^3 in 2010-11.

Normally, contaminated 'stormwater/cooling water' is dealt with by diversion to the effluent irrigation system (by means of Fonterra's internal conductivity/turbidity-based alarm system) or by the location and elimination of a major contamination source.

In comparison with historical data (Table 8), the 'stormwater/cooling water' discharge results were within ranges previously recorded.

2.1.3.1.2 Stormwater quality

Discharges from stormwater pipe outlets to the river were sampled at four locations: from the northern (STW001062) and southern (STW002018) areas of the lactose plant, the IGL plant (STW001109), and the stormwater pond (STW002078), as described in Figure 3. The discharge from the southern area of the lactose plant is combined with cooling water and has been addressed in the section above.

Discharges were found to be occurring on most inspections, however some of these were very small volumes.

2.1.3.1.2.1 Northern outfall

A grab sample was collected from the discharge (STW001062, see Figure 3) on eight occasions in 2012-2013 and analysed by the Council's laboratory. These results are presented in Table 9 below. Rain was falling or had recently occurred on three occasions. There was typically a small discharge.

Table 9 Results of the analysis of grab samples ot the stormwater from the northern factory extensions outfall discharge during the 2012-2013 monitoring period

Date	Flow rate (estimated)	BOD_5	Conductivity at 20˚C	Turbidity	O&G	pH	Suspended solids
	L/s	g/m^3	mS/m	NTU	g/m^3		g/m^3
27-Sep-12	0.1	6.6	18.1	8.8	<0.5	6.8	9
18-Oct-12*	0.2	3.6	9.6	3.5	<0.5	6.8	3
13-Dec-12	<0.1	0.6	10.8	1.2	<0.5	7.7	3
17-Jan-12*	0.2	4.3	4.3	6.6	<0.5	6.8	7
21-Feb-12	<0.1	>85	11.1	3.4	<0.5	7.3	9
21-Mar-12	0.1	12	10.6	1.4	<0/5	7.2	3
18-Apr-12*	<0.1	**1400**	17.8	3.8	<0.5	**4.4**	9
16-May-12	<0.1	83	16.8	3.2	2.2	6.7	6
Consent limit					**15**	**6.0 – 8.5**	**100**
1995-2012 No of samples Range Median		 72 <0.5 – 1000 6.0	 74 0.6 – 38.4 10.2	 468 0.20 – 29 2	 36 <0.5 - 1.3 <0.5	 63 3.8 – 8.7 7.1	 45 <2 – 32 3

BOD_5 was higher on the last four monitoring occasions indicating more organic contamination. This may have been a result of lactose powder deposition within the stormwater catchment, particularly on 18 April 2012, when the sample was taken at the end of a long dry spell. A slight organic odour was noticed on several occasions.

pH level was below the consent limit of 6.0 on one occasion, as discussed in the Register of Incidents section 2.3 below.

The limits on oil and grease and suspended solids prescribed by conditions on consent **4604-2** were complied with.

2.1.3.1.2.2 IGL plant outfall

The IGL plant stormwater outfall (STW001109, Figure 3) was discharging during one inspection in both 2012-2013 . The results of the grab sample collected are presented in Table 10 below.

Table 10 Results of the analysis of grab sample of the stormwater from the IGL outfall discharge during the 2012-2013 monitoring period

Date	Flow rate (estimated)	BOD_5	Conductivity at 20°C	Turbidity	O&G	pH	Suspended solids
	L/s	g/m³	mS/m	NTU	g/m³		g/m³
17-Jan-13	0.1	6.0	4.9	1.8	<0.5	6.8	<2
Consent limit		-	-	-	**15**	**6.5 – 8.5**	**100**
2005-2010 No of samples Range Median		17 <0.5 – 30 4.4	18 0.9 – 22.6 7.4	18 1.1 – 21 6.6	10 <0.5 – 0.8 <0.5	18 6.5 – 8.0 7.1	16 <2 – 62 6

A slight organic odour was noted. There was no sign of undesirable biological growths in the receiving waters below the discharge point. Limits prescribed by conditions of consent **6423-1** were complied with.

2.1.3.1.2.3 Stormwater pond outfall

Samples were also collected from the outlet of the stormwater pond (STW002078, Figure 3) on 2 occasions in 2012-2013. The results of the grab samples collected are presented in Table 11. There had been recent rain on both sampling occasions. The stormpond outlet valve was closed on the first occasion, suggesting groundwater seepage. The valve was slightly open (less than half a turn) on the second occasion, and a slight organic odour and some turbidity was observed.

Table 11 Results of the analysis of grab samples of the stormwater pond during the 2012-2013 monitoring period

Date	Flow rate (estimated)	BOD_5	Conductivity at 20°C	Turbidity	Hydro-carbons	pH	Suspended solids
	L/s	g/m³	mS/m	NTU	g/m³		g/m³
22-Aug-12	0.1	1.5	41.8	0.8	<0.5	7.4	3
17-Jan-13	0.1	19	19.9	27	<0.5	6.9	35
Consent limit		-	-	-	**15**	**6.5 – 8.5**	**100**
2008-2010 No of samples Range Median		9 <0.5 – 28 1.3	10 4.6 – 43.8 39.7	10 0.3 – 31 1.3	6 <0.5 <0.5	9 6.6 – 7.6 7.1	7 <2-24 2

Conductivity values at this site have been found to vary widely, 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 grouted in July 2009, but some infiltration continued). An elevated BOD value was recorded for 17 January 2013, but no effect was found in the river. Limits prescribed by conditions on consent **0924-3** were complied with.

2.1.3.1.3 Receiving water (Kaupokonui River) quality

Sampling of the Kaupokonui River adjacent to Fonterra's factory and Northern Farm wastes irrigation area was performed by the Regional Council on ten of the monthly inspection visits. Three sites were located in the Kaupokonui River (Figure 3 and Table 12) as follows:

Table 12 Location of water quality sampling sites

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

Sampling was performed under varying flow conditions ranging from 0.80 m^3/s to 4.9 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 0.75 m^3/s. A record of flows (hydrograph) over the reporting period is presented in Figure 9. Samples were taken in mid to late morning. The results of this monitoring are contained in Appendix II and summarised in Table 13.

Table 13 Summary of Kaupokonui River water quality data (ranges) from monthly monitoring for the period August 2012 to May 2013 (N=10 samples)

Site		KPK000655		KPK000660		KPK000679	
Parameter	Unit	Range	Median	Range	Median	Range	Median
Temperature	˚C	9.4 – 15.9	11.6	9.2 – 16.5	12.2	9.6 – 18.7	13.9
Conductivity @ 20˚C	mS/m	5.3 – 8.9	8.2	5.4 – 9.8	9.8	5.4 – 9.9	8.7
Turbidity	NTU	0.6 – 6.6	1.0	0.5 – 5.6	1.1	0.54 – 10	1.2
pH	pH	7.5 – 7.8	7.7	7.5 – 7.9	7.7	7.5 – 8.0	7.7
Total BOD_5	g/m^3	<0.5 – 1.2	0.6	<0.5 – 1.1	0.6	<0.5 – 2.0	0.7
Filtered BOD_5	g/m^3	<0.5 – 0.7	<0.5	<0.5 – 0.6	0.5	<0.5 – 1.2	0.5
Ammonia-N	g/m^3 N	0.008 – 0.076	0.018	0.006 – 0.068	0.028	0.006 – 0.075	0.033
Nitrate+Nitrite	g/m^3 N	0.19 – 0.64	0.29	0.24 – 0.72	0.34	0.23 – 0.77	0.33

Past Council sampling results from these sites are presented in summary form in Table 14.

Table 14 Summary of Kaupokonui River water quality data from Taranaki Regional Council surveys during the period August 1994 to June 2012

Site		KPK000655			KPK000660			KPK000679		
Parameter	Unit	No.	Range	Median	No.	Range	Median	No.	Range	Median
Temperature	˚C	166	4.9 – 19.1	12.2	170	5.1 – 19.4	12.5	170	5.2 – 21.7	13.8
Conductivity	mS/m	169	3.3 – 11.1	9.1	171	3.3 – 11.8	9.6	171	3.2 – 11.9	9.8
Turbidity	NTU	168	0.39 – 120	1.0	170	0.4 – 130	0.8	170	0.4 – 160	0.82
pH	pH	166	6.9 – 8.5	7.7	167	7.0 – 8.6	7.7	167	7.0 – 8.5	7.7
Total BOD_5	g/m^3	166	<0.5 – >8.3	0.6	169	<0.5 – 5.0	0.6	149	<0.5 - >8	0.7
Filtered BOD_5	g/m^3	166	<0.5 – 1.8	<0.5	169	<0.5 – 1.7	<0.5	148	<0.5 - >8	<0.5
Ammonia-N	g/m^3 N	168	<0.003 – 0.87	0.022	167	<0.003– 0.147	0.016	148	<0.003 –0.248	0.018
Nitrate+Nitrite	g/m^3 N	38	0.13 – 0.81	0.40	38	0.14 – 1.06	0.46	38	0.13 – 1.01	0.50

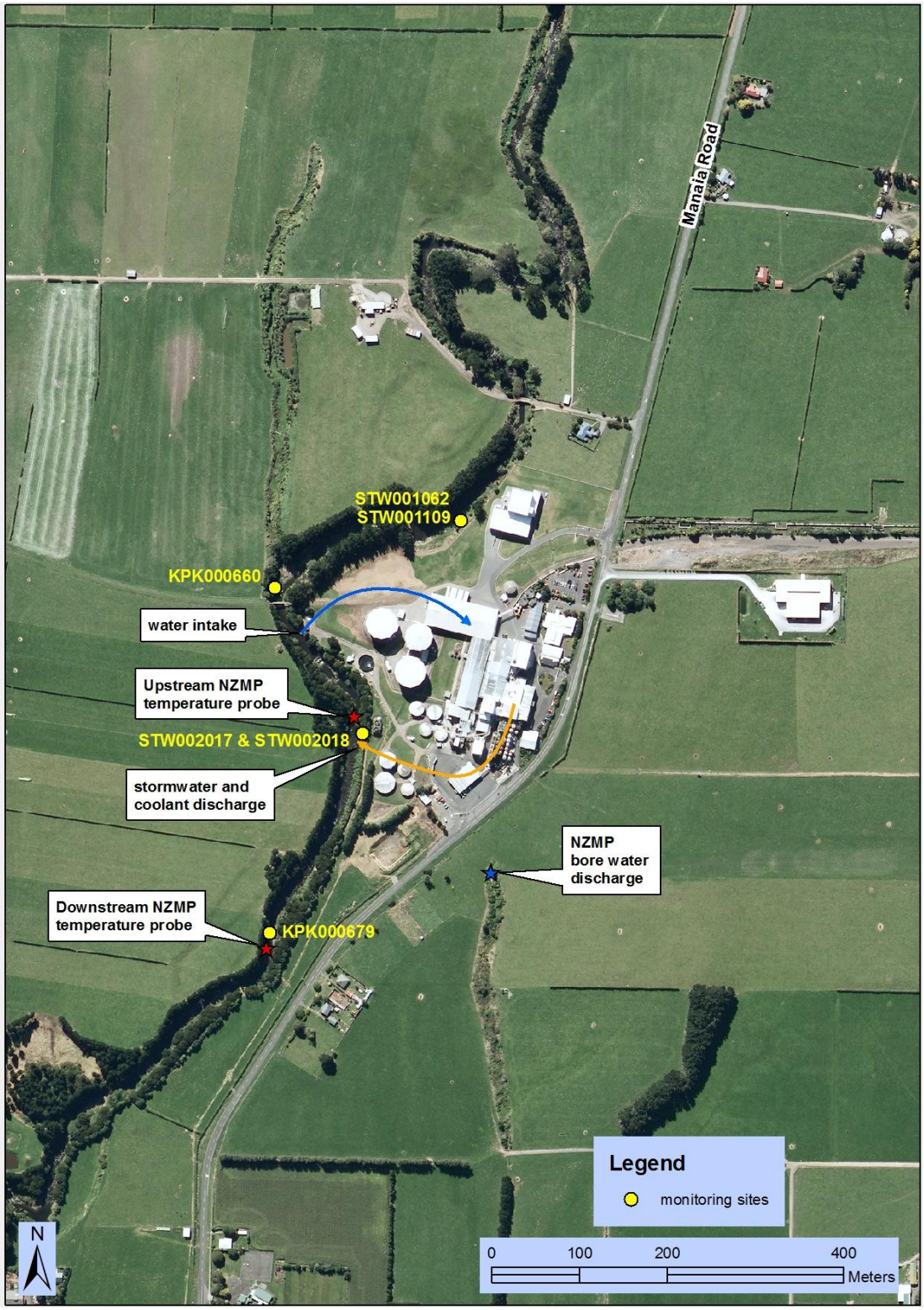

Figure 3 Section of Kaupokonui River for physicochemical monitoring in relation to Fonterra Kapuni's waste discharges to water

The receiving water quality sampling results (Table 13 and Appendix II) indicated that minimal impacts of the two cooling waters' discharges were measured in the Kaupokonui River, at the time of sampling, with no sewage fungus noted over the monitoring period. 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).

No conspicuous changes in clarity, as indicated by turbidity measurements and field comments, were attributed to discharges of cooling or storm water. Natural variation in clarity was observed, in relation to rainfall.

The consent limit on maximum concentration of filtered BOD_5 of 2 g/m^3, in the river at the mixing zone periphery, was complied with on each of the ten monitoring occasions.

The summary of Kaupokonui River water quality data for the upstream (control) site recorded over the 18-year period prior to the 2012-2013 monitoring period (Table 14) and during this period (Table 13), shows that, apart from a single lapse in May 2007, there has been very good water quality for the parameters measured under normal flow conditions.

2.1.3.1.4 Groundwater quality

Sampling of shallow groundwater bores was undertaken approximately two-monthly 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 in seasonal variation in groundwater quality, and was reduced to two-monthly in 2009-2010. Ten bores were sampled on the three wastewater spray irrigation farm properties, as described in Table 15 and depicted in Figure 4. One bore ('control') on each property is sited upslope of the irrigation area and another one to three bores ('impact') within or down-slope of the irrigation area.

These bores were located as follows:

Table 15 Groundwater monitoring sites

Property	Bore	Designation	Site code	Depth m	Map reference, NZTM	
					Easting	Northing
'Northern' (No 1) Farm	North	Control	GND0636	6.5	1697543	2630420
	South	Impact	GND0637	6.5	1697238	5629857
'Southern' (No 2) Farm	North	Control (new)	GND2049	5.6	1698575	2628905
	West	Impact	GND0638	5.9	1698332	2628562
	South-west	Impact (new)	GND2050	7.0	1698397	5627747
No 3 Farm	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 the Southern and No. 2 farms was performed in April 1998 (see TRC 98-73), in consultation with the consent holder and following investigations into groundwater contours and flow directions at each of these farms' monitoring sites.

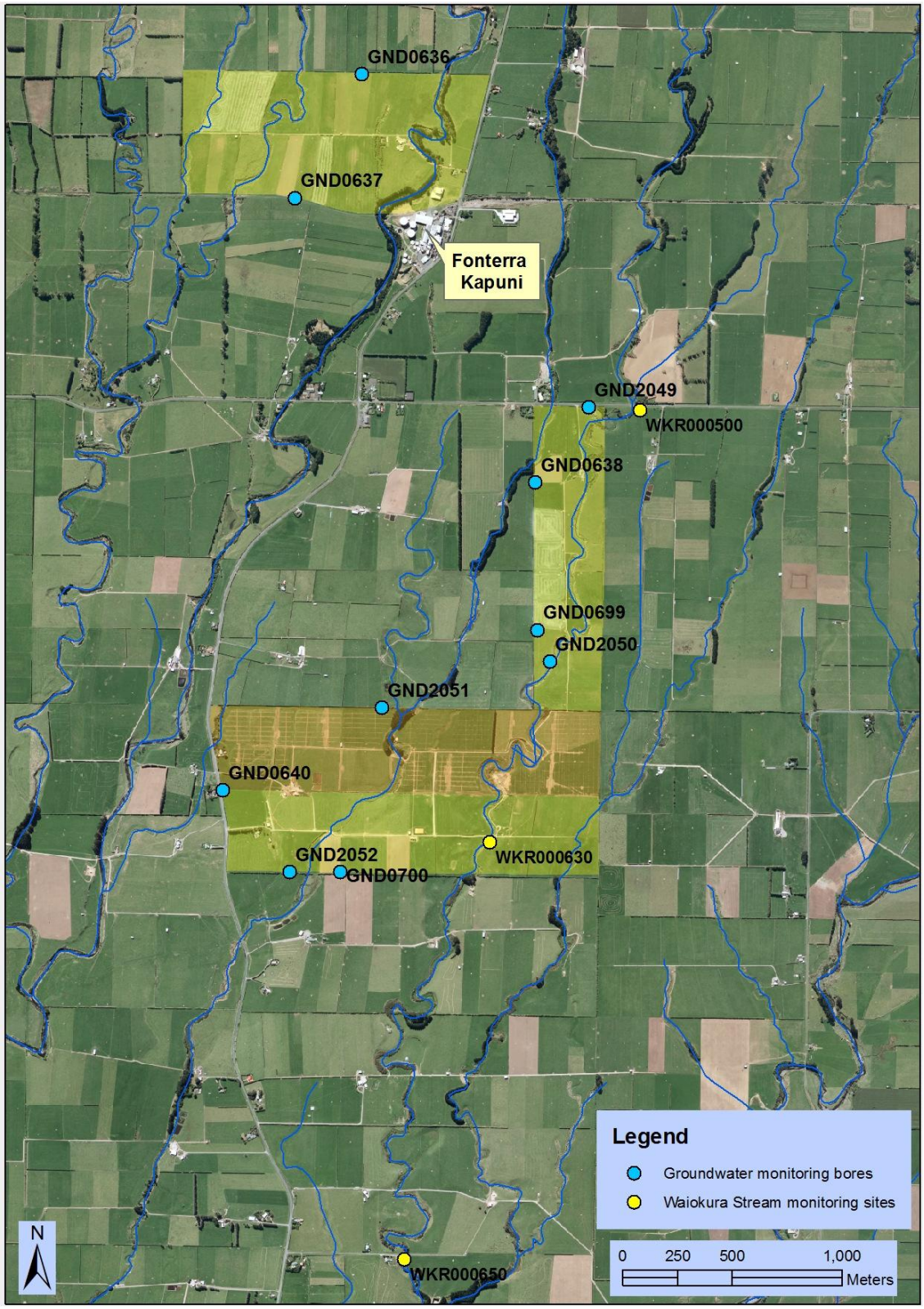

Figure 4 Groundwater monitoring bores and Waiokura Stream sampling site locations on the three Company farms

A summary of groundwater quality data previously collected by the Regional Council from these farm bores is presented in Table 16 for comparison with data collected during the recent monitoring period.

Table 16 Summary of previous Council groundwater quality sampling performed during the period October 1991 to June 2012

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)
Northern	Control GND0636	59	1.55-4.83 (2.85)	100	6.2-7.1 (6.5)	99	26.4 -57.7 (30.0)	69	12.0-56 (25)	100	5.9-24 (8.4)	57	<5-27 (<5)
	Impact GND0637	58	2.77-5.69 (4.12)	96	6.1-7.8 (6.5)	94	34.8-82.4 (58.6)	66	40-179 (81)	95	1.5-33 (11.4)	53	<5-42 (5)
Southern (No 2)	Control (New) GND2049	30	1.73-3.70 (2.52)	31	6.2-7.2 (6.4)	31	21.2-48.3 (38.8)	14	26-36 (31)	31	2.4-19 (15.3)	14	<5-7 (<5)
	Impact ('central') GND0638	58	1.08-3.55 (2.62)	93	4.7-6.9 (6.5)	92	54.4-149 (75.5)	63	67-136 (93)	92	<0.01-49 (10.0)	57	<5-1600 (10)
	Impact ('original') GND0639	28	1.99-4.12 (2.86)	50	6.5-7.5 (6.9)	50	45.5-82.6 (64.6)	37	88-157 (120)	50	3.8-29 (11.2)	32	<5-57 (12)
	Impact ('new') GND2050	31	1.65-3.20 (2.59)	31	6.5-6.9 (6.8)	31	13.7-71.1 (58.9)	14	49-102 (87)	31	0.03-13.0 (6.8)	14	<5-20 (<5)
No 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 (31)	51	<0.01-3.4 (0.13)	42	4-30 (6)
	Control new GND2051	31	1.98-4.30 (3.04)	31	6.4-7.2 (6.5)	31	25.4-46.4 (35.9)	14	27-37 (30)	31	0.03-19.4 (8.1)	14	<5-31 (<5)
	Impact GND0641	29	1.01–2.94 (1.58)	48	6.3-6.8 (6.5)	49	25.2-63.6 (55.6)	33	30-57 (42)	49	0.87-15.6 (10.6)	30	<5-34 (8)
	Impact ('original') GND0700	55	0.40-4.60 (2.21)	67	5.6-7.2 (6.7)	67	30.3-154 (63.3)	41	39-188 (80)	68	0.02-47 (8.6)	41	<5-33 (6)
	Impact ('new') GND2052	31	1.30-4.38 (2.51)	31	6.4-7.3 (6.6)	31	18.9-42.6 (31.0)	14	34-55 (41)	31	0.02-12.9 (2.3)	14	<5-10 (<5)

* COD = filtered prior to 2006

The groundwater quality monitored at each farm is discussed below. Wastewater irrigation occurred on each farm throughout the monitoring period (see Section 2.1.1.3).

2.1.3.1.4.1 'Northern' Farm groundwater

The results of groundwater monitoring on this farm during the 2010-2012 period are summarised in Table 17. The full set of results is given in Appendix IV.

Table 17 Results of groundwater quality sampling on 'Northern' Farm, 2012-2013

Parameter	Unit	Control (GND0636)			Impact (GND 0637)		
		N	Range	Median	N	Range	Median
Water level	m	6	2.26 – 3.89	3.44	6	3.52 – 6.15	4.46
Temperature	°C	6	12.9 – 13.9	13.6	6	13.7 – 14.8	14.2
Conductivity, 20°C	mS/m	6	28.0 – 30.7	29.8	6	37.5 – 69.4	51.8
pH	pH	6	6.4 – 6.7	6.4	6	6.4 – 6.6	6.5
Nitrate+nitrite	g/m³N	6	3.7– 7.5	6.8	6	5.1 – 17.8	9.0
Ammonia	g/m³N	3	<0.003 – 0.011	0.009	3	<0.003 – 0.031	0.013
Sodium	g/m³	3	21 – 26	25	3	43 – 74	71
Chloride	g/m³	3	35 – 37	35	3	45 – 56	46
COD	g/m³	3	<5	<5	3	6 - 11	7

The water quality of the control bore GND0636 groundwater continued to be relatively stable in terms of nitrate. The median nitrate-N concentration of 6.8 g/m³ was lower than the historical median of 8.4 g/m³.

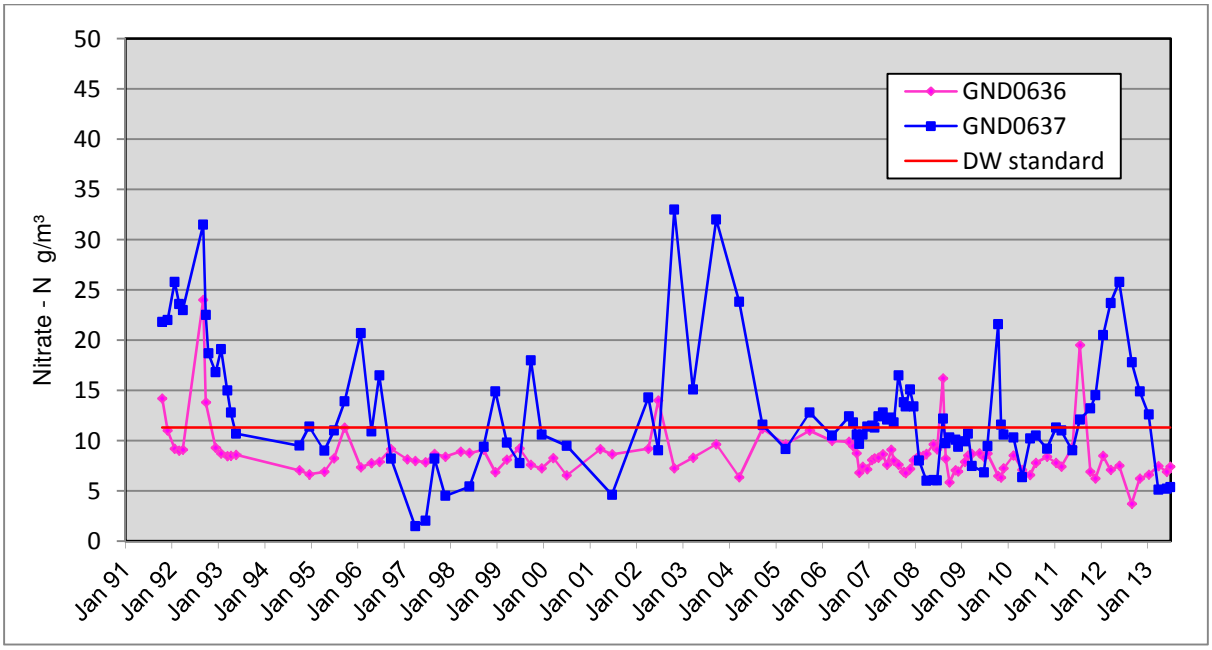

Figure 5 Trends in groundwater Nitrate-N concentration at Farm 1

Water quality at the impact bore GND0637 showed a marked elevation in sodium (and chloride) and conductivity levels when compared with the control bore, consistent with the effect of leaching of wastewater from spray irrigation disposal to shallow groundwater. Conductivity values decreased to relatively low levels, following an increase during summer and autumn 2011-2012. Sodium concentration appears to be reducing, overall (refer to Table 16). COD at the impact bore increased during 2012-2013, to within previous recorded values.

Figure 5 compares trends in groundwater nitrate-N levels at the impact bore with the control bore, 640 m up-gradient. The increase in nitrate-N concentration that occurred at the impact bore over 2011-2012, from about 11 to 26 g/m^3, reduced in 2012-2013 to about 5 g/m^3. The low nitrate values coincided with very low groundwater levels in autumn 2013.

2.1.3.1.4.2 'Southern' Farm groundwater

The results of groundwater monitoring on this farm during the 2012-2013 period are summarised in Table 18. The full set of results is given in Appendix IV.

Table 18 Results of groundwater quality sampling on 'Southern' ('No 2') farm, 2012-2013

Parameter	Unit	Control (GND2049)			Impact (GND 0638)			Impact (GND 2050)		
		N	Range	Median	N	Range	Median	N	Range	Median
Water level	m	6	2.24 – 3.80	2.98	6	2.18 – 3.96	2.98	6	2.30 – 3.12	2.80
Temperature	°C	6	13.2 – 14.1	14.0	6	14.1 – 15.2	14.8	6	13.5 – 14.5	14.3
Conductivity, 20°C	mS/m	6	34.4 – 36.6	35.3	6	62.2 – 71.5	66.7	6	49.8 – 69.0	53.8
pH	pH	6	6.4 – 6.5	6.4	6	6.5 – 6.6	6.6	6	6.6 – 7.0	6.8
Nitrate+nitrite	g/m^{3}N	6	11.8 – 13.4	12.3	6	6.2 – 9.9	8.1	6	0.02 – 12.0	5.2
Ammonia	g/m^{3}N	3	<0.003 – 0.059	0.005	3	<0.003	<0.003	3	0.024 – 0.43	0.42
Sodium	g/m^3	3	29 – 31	30	3	68 – 72	67	3	54 – 91	55
Chloride	g/m^3	3	40 – 43.	43	3	48 – 58	55.8	3	50 – 63	50
COD	g/m^3	3	<5	<5	3	<5 - 39	8	3	<5 - 21	7

A new control bore for Farm 2, GND2049, was drilled in March 2008, on the northern boundary beside Skeet Road. (Refer to Figure 4). This replaced the original 'control' bore, GND0638, which is situated on the western boundary with about 350m of irrigated paddocks up-gradient, and was affected by ponding of effluent in Spring 2006. For this reason, wastewater is now irrigated only in summer in the paddock (number 5) 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 6 compares trends in groundwater nitrate-N levels at the new impact bore, the previous two impact bores, GND0639 and GND0699, and the original control bore, GND0638, with the new control bore GND2049.

The control bore, GND2049, showed the (likely) influence of farming activity up-gradient across Skeet Road, the nitrate-N concentration ranging from 11.8 to 13.4 g/m^3 during the monitoring period, with a median value of 12.3 g/m^3. Conductivity, pH, sodium and chloride levels were within the normal range that is found in adjacent dairy farming areas. COD and ammonia were low, indicating little leaching of organics.

At the bore inside the irrigation area, GND0638, nitrate-N concentration continued to reduce throughout the review period, to about 10 g/m^3, from the peak (49 g/m^3) recorded during 2008-2009.

Conductivity, sodium and chloride values were elevated, as might be expected underneath such a wastewater irrigation area, though COD and ammonia levels were low.

At the new impact bore beside the Waiokura Stream, GND2050, nitrate-N concentration appears to fluctuate with groundwater level, being in the range 5 to 14 g/m³ when water level is high during winter and spring, and falling to <1 g/m³ in summer and autumn when the level is low. Nitrate –N did not fall in summer and autumn 2011-2012, when groundwater level remained relatively high throughout. Mineral levels were significantly higher than at the control bore.

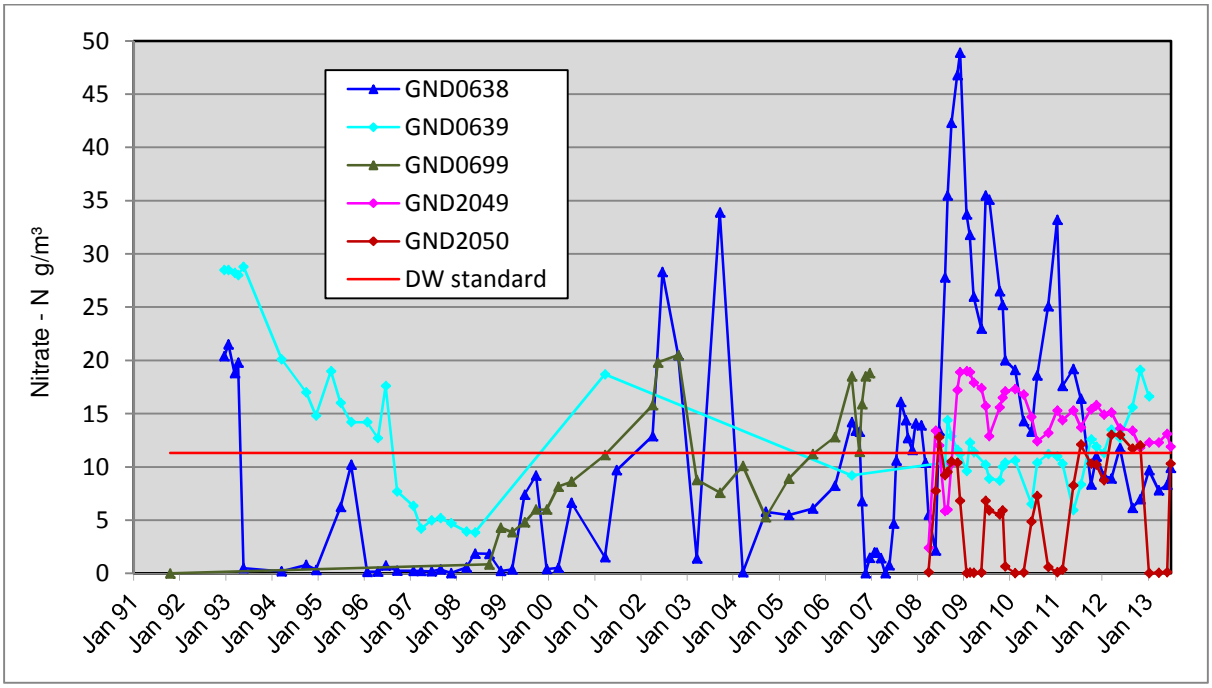

Figure 6 Trends in groundwater Nitrate-N concentration at Farm 2

2.1.3.1.4.3 'No 3' Farm groundwater

The results of groundwater monitoring on this farm during the 2012-2013 period are summarised in Table 19. The full set of results is given in Appendix IV.

Table 19 Results of groundwater quality sampling on 'No 3' Farm, 2012-2013

Parameter	Unit	Control (GND2051)			Impact (GND0641)			Impact (GND 2052)			Impact (GND 0700)		
		N	Range	Median	N	Range	Median	N	Range	Median	N	Range	Median
Water level	m	6	2.66 – 4.66	3.90	5	1.17 – 2.94	1.49	6	1.89 – 3.33	2.88	6	1.55 – 3.16	2.56
Temperature	˚C	6	13.29– 14.3	14.2	4	13.6 – 15.7	14.0	6	13.7 – 14.7	14.2	6	13.6 – 14.5	14.3
Conductivity, 20˚C	mS/m	6	29.6 – 31.2	31.2	4	58.2 – 62.8	59.7	6	29.2 – 41.4	32.6	6	36.3 – 67.3	54.3
pH	pH	6	6.4 – 6.6	6.5	4	6.5 – 6.6	6.6	6	6.5 – 6.8	6.6	6	6.6 – 6.8	6.8
Nitrate+nitrite	g/m³N	6	5.2 – 7.2	5.9	4	8.2 – 15.2	12.4	6	<0.01 – 5.7	2.4	6	0.23 – 12.0	6.0
Ammonia	g/m³N	3	<0.003 – 0.011	<0.003	2	<0.003 – 0.006	0.004	3	0.047 – 0.44	0.21	3	<0.003 – 0.044	0.003
Sodium	g/m³	3	24 – 30	24	2	49 – 50	49	3	35 – 45	42	3	52 – 92	61
Chloride	g/m³	3	35 – 50	36	2	71 – 77	74	3	46 – 52	47	3	60 – 91	71
COD	g/m³	3	<5	<5	2	5 - 10	8	3	<5 - 29	<5	3	5 - 13	6

A new 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.

A new impact monitoring bore was also drilled, 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 monitoring bore, GND0641, situated between the main access track and Motumate Stream, which had at times been dry, was reinstated in the programme.

The impact of wastewater irrigation upon the two older impact bores (GND0641 and GND0700, Table 19) was reflected in elevated sodium, chloride, and conductivity levels, the respective values being higher at GND0700, which has a greater length of irrigated area up-gradient.

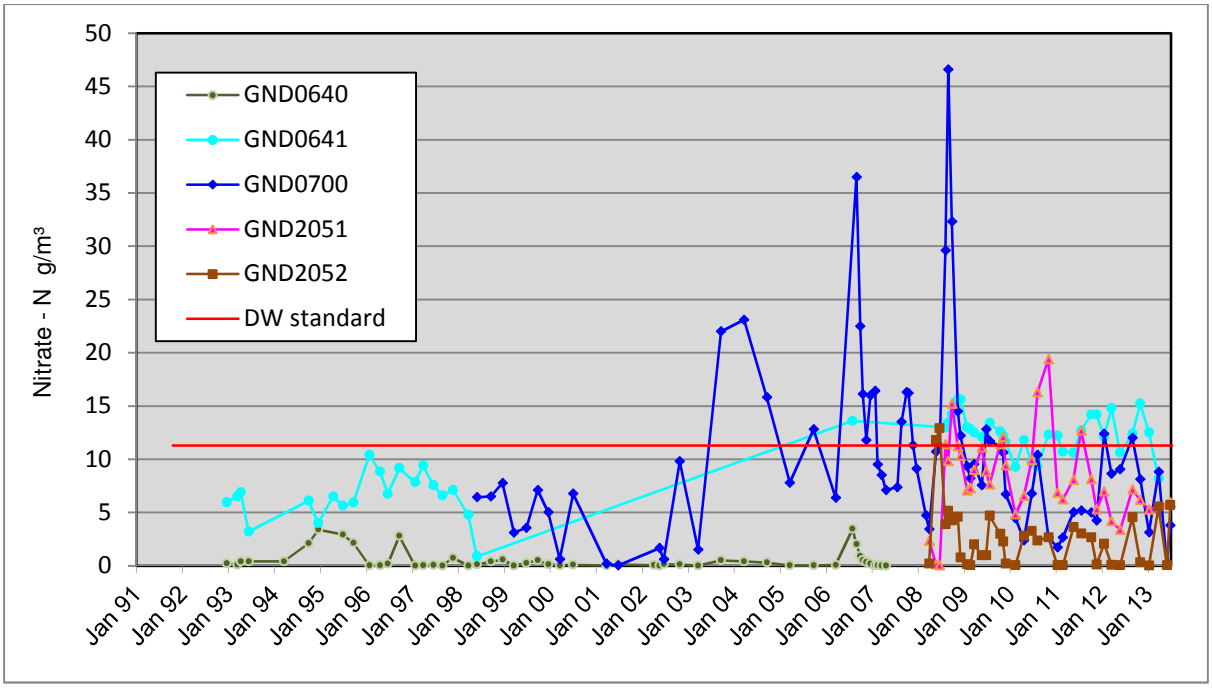

Figure 7 Trends in groundwater Nitrate-N concentration at Farm 3

Figure 7 compares trends in groundwater nitrate-N levels at the two current impact bores, GND2052 and GND0700, and the reinstated impact bore, GND0641, with the old and new control bores, GND0640 and GND2051. Both of the older impact bores yielded relatively low levels of nitrate-N, with median values of 12.4 and 6.0 g/m³ for GND0641 and GND0700, respectively, indicating good management of nitrogen application. In comparison, the control bore GND2051 had a median nitrate-N value of 5.9 g/m³, and the new impact bore GND2052 a median nitrate-N value of 2.4 g/m³.

2.1.3.1.4.4 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 only 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 previous monitoring periods. There are no 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 20.

Table 20 Summary of groundwater nitrate concentrations at monitoring bores, 2012-2013

Property	Bore location	Designation	Nitrate & Nitrite-N, g/m^3		No. samples	Site code
			Median	Range		
'Northern' (No 1) Farm	North South	Control Impact	6.8 9.0	3.7 – 7.5 5.1 – 17.8	6 6	GND0636 GND0637
'Southern' (No 2) Farm	North West South-west	Control (new) Impact Impact (new)	**12.3** 8.1 5.2	11.8 – 13.4 6.2 – 9.3 0.02 – 12.0	6 6 6	GND2049 GND0638 GND2050
'No 3' Farm	North Central South-west South-east	Control (new) Impact Impact (new) Impact	5.9 **12.4** 2.4 6.0	5.2 – 7.2 8.2 – 15.2 <0.01 – 5.7 0.23 – 12.0	6 4 6 6	GND2051 GND0641 GND2052 GND0700
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, Fonterra 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** 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 has been 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%.

In 2012-2013, based on the data provided by Fonterra, a total metered volume of 530,225 m^3 of effluent was generated, which had a (time-based) average total nitrogen concentration of 92 g/m^3 (43 samples, range 52 - 148 g/m^3), giving a total nitrogen mass of 48,783 kg. When applied to 164 ha, at an average depth of 323 mm, this amounted to an overall annual nitrogen application rate of 297 kg/ha. The calculated annual nitrogen application rates for Farm 1 (51 ha), Farm 2 (26 ha) and Farm 3 (87 ha) are 244, 274 and 335 kg/ha, respectively.

Four new 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. Overall, it appears that nitrate levels under the irrigation areas have decreased and are stabilising in response to the increase in irrigated area. This is most notable at bore GND0700, at the downslope boundary of Farm 3, where annual median nitrate-N level decreased in 2009-2010 from 12.5 to 6.0 g/m^3 in 2012-2013. The results for the two new control bores, at the upslope boundaries of Farm 2 and Farm 3 indicate a significant influence on groundwater nitrate-N levels by activities on adjacent farms.

2.1.3.2 Waiokura Stream surface water quality

In combination with groundwater monitoring, some spatial synoptic surface water monitoring was conducted at 3 sites on the Waiokura Stream adjacent to and downstream of Fonterra's farms (Figure 4, Table 21). This was carried out two-monthly at the following sites in conjunction with the groundwater sampling.

Table 21 Water quality monitoring sites in the Waiokura Stream

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
1	Waiokura Stream at Skeet Road	1698807	5628892	WKR000500
2	Waiokura Stream 1.5 l, u/s of Hicks Road (No. 3 Farm)	1698126	5626926	WKR000630
3	Waiokura Stream at Hicks Road	1697735	5625026	WKR000650

These sites were chosen to monitor any possible effects on surface water from the spray irrigation of wastes on Fonterra's Southern Farms. The results of analytical work performed by the Council's laboratory in the 2012-2013 monitoring period are presented in Table 22, and a summary of the monitoring previously performed is presented in Table 23.

Table 22 Results of Waiokura Stream quality sampling for the 2012-2013

Site		Site 1(WKR000500)			Site 2 (WKR000630)			Site 3 (WKR000650)		
Parameter	Unit	N	Range	Median	N	Range	Median	N	Range	Median
Temperature	C	9	8.6 – 16.0	10.6	10	8.4 – 16.7	11.3	10	8.1 – 17.5	11.8
Conductivity	mS/m	8	20.3 – 22.2	22.2	10	21.2 – 22.8	21.2	10	20.9 – 24.2	22.9
Nitrate + nitrite	g/m³	9	1.4 – 3.2	2.8	10	1.4 – 3.4	3.2	10	1.3 – 3.4	3.0
Sodium	g/m³	9	18.8 – 20.8	21.0	10	19.6 – 23.5	21.2	10	19.3 – 25.4	22.6

Table 23 Summary of Waiokura Stream water quality data from Taranaki Regional Council Surveys during the period March 2001 to June 2012

Site		Site 1(WKR000500)			Site 2 (WKR000630)			Site 3 (WKR000650)		
Parameter	**Unit**	**N**	**Range**	**Median**	**N**	**Range**	**Median**	**N**	**Range**	**Median**
Temperature	°C	69	7.1 – 18.0	12.3	69	8.5 – 20.2	12.7	67	8.2 – 19.6	12.7
Conductivity	mS/m	68	16.6 – 30.4	21.3	68	17.0 – 25.3	22.4	66	15.0 – 27.4	23.1
Nitrate + nitrite	g/m³	55	1.3 – 4.0	2.7	54	1.0 – 4.0	2.9	55	1.0 – 4.2	2.8
Sodium	g/m³	66	14.8 – 24.1	19.6	66	9.7 – 24.6	21.6	64	13.9 – 26.5	22.4

The results for the 2012-2013 monitoring period indicate a slight increase in sodium in the samples downstream of the control site (site 1) on all survey occasions (Table 22), but not significant enough to be considered an environmental effect. Nitrate concentration showed a large seasonal fluctuation, varying from about 3.4 gN/m³ in September to 1.3 g/m³ in April. The ranges of all parameters were similar to those recorded in previous monitoring periods (Table 23). Continued monitoring over future periods will provide further assessment of any possible environmental effects to surface water from the spray irrigation of wastewater on the Southern Farms.

2.1.3.3 Fish passage temperature compliance in mixing zone

The Taranaki Regional Council installed and maintained two water temperature data loggers in the Kaupokonui River during the 1994-1995 monitoring period. These loggers were sited toward the left and right banks of the river 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** and 9 of consent **0924** 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 River.

The presence of a significant water temperature differential across the river 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 river 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 river. The across-river 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, river 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 river, after continuous monitoring (at 15-minute intervals with very occasional disruption) since August 1993. The record is depicted in Figure 8. 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 Fonterra, transverse monitoring was no longer considered necessary, as disruption to fish passage was not expected to occur because significant

periods of cooler water conditions had ben demonstrated towards the right bank of the river and there was gradual mixing of the cooling water discharges with the receiving water.

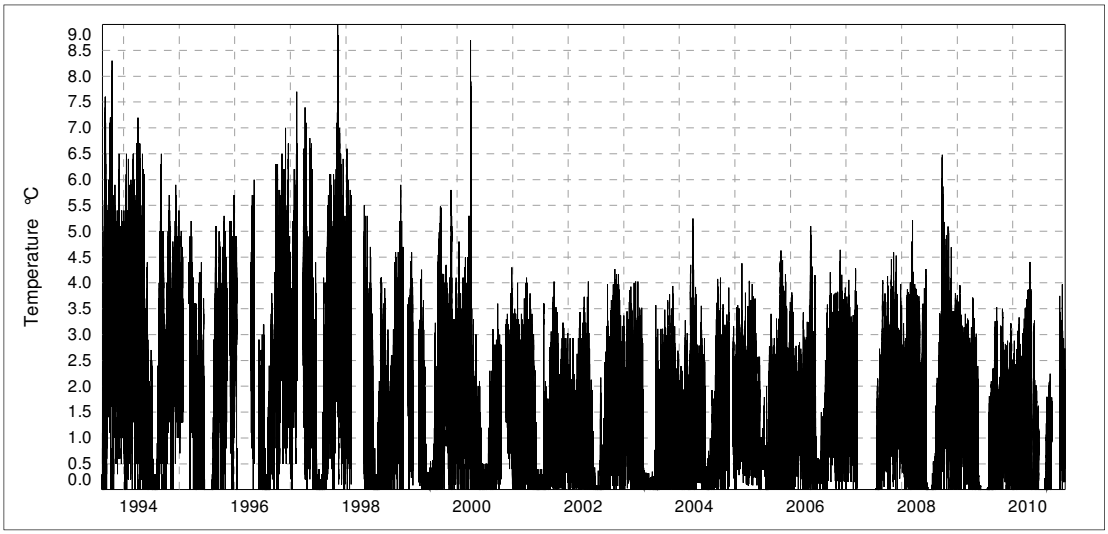

Figure 8 Kaupokonui River water temperature differential (LB-RB) records at the periphery of the Fonterra Kapuni spray cooling water discharge zone, 1993-2010

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 is due to be carried out in 2013-2014).

Kaupokonui River flow records for the monitoring period for the Glenn Road recording station are presented in Figure 9.

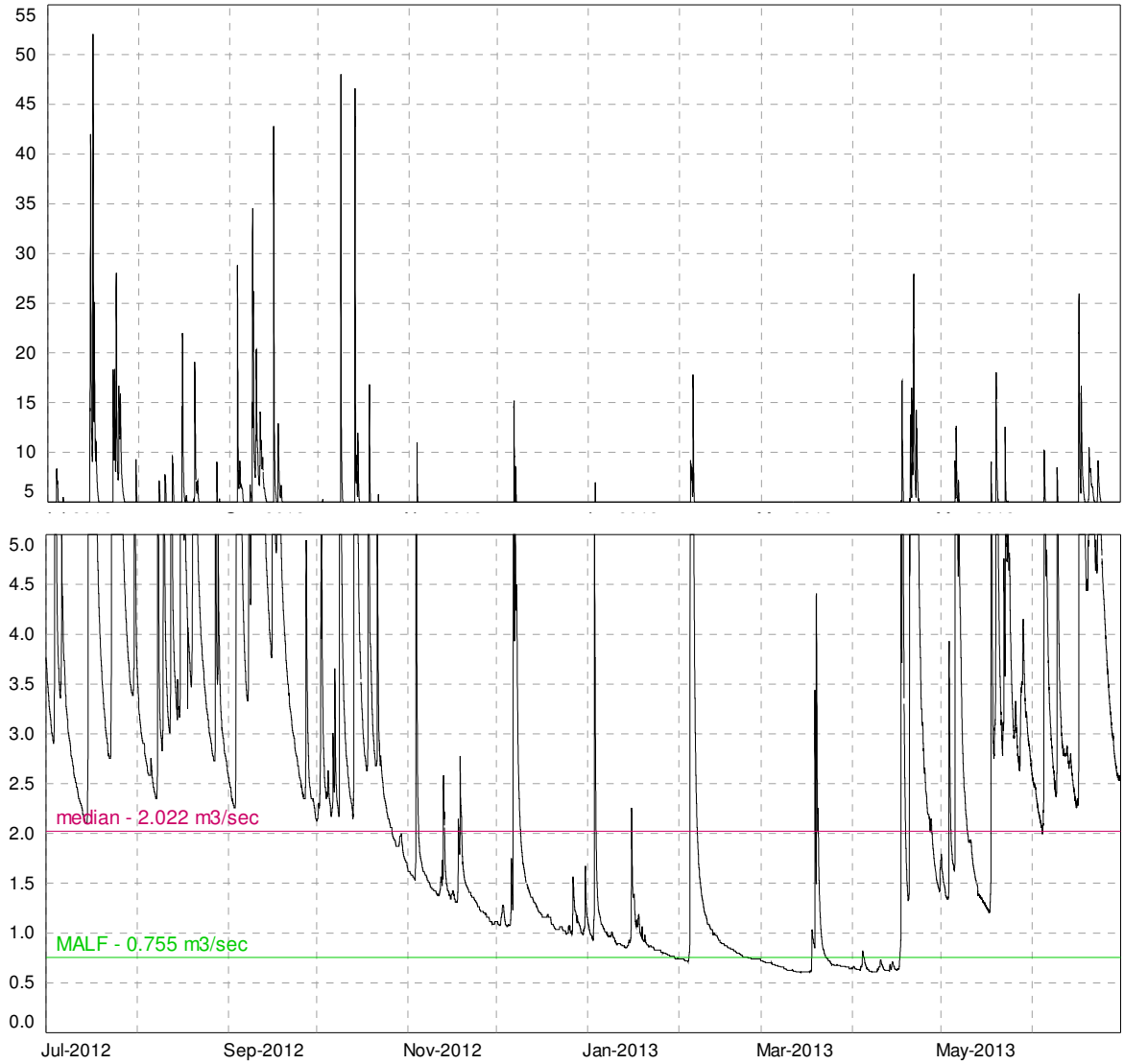

Figure 9 Kaupokonui River at Glenn Road flow record (m³/s) for period 1 July 2012 to 30 June 2013

2.1.3.4 Lower river water temperatures

Two additional water temperature data loggers were installed in the lower reaches of the Kaupokonui River for the duration of the 2012-2013 period to provide ambient river temperature data over the 14 km reach downstream of the factory to the coast. These loggers were sited in the river 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 river mouth. The loggers were installed in July 1999, with the agreement of the Company, in response to concerns expressed by submitters to consents **0919** and **0924** to discharge cooling water from the lactose plant.

Water temperature records for these two sites are illustrated in Figure 10 and Figure 11.

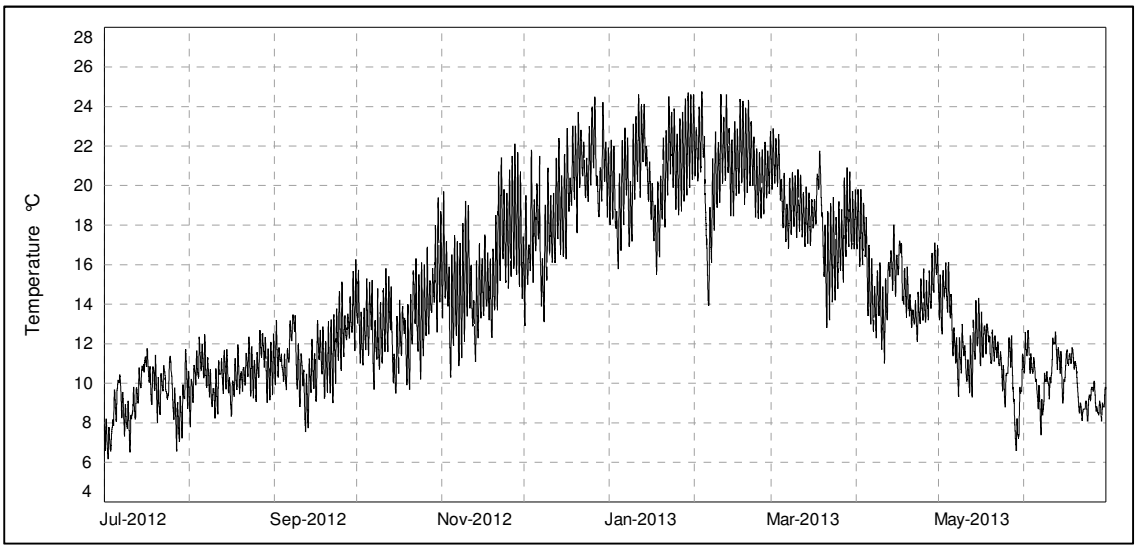

Figure 10 Water temperature (°C) records for the Kaupokonui River at Glenn Rd during the period 1 July 2012 to 30 June 2013

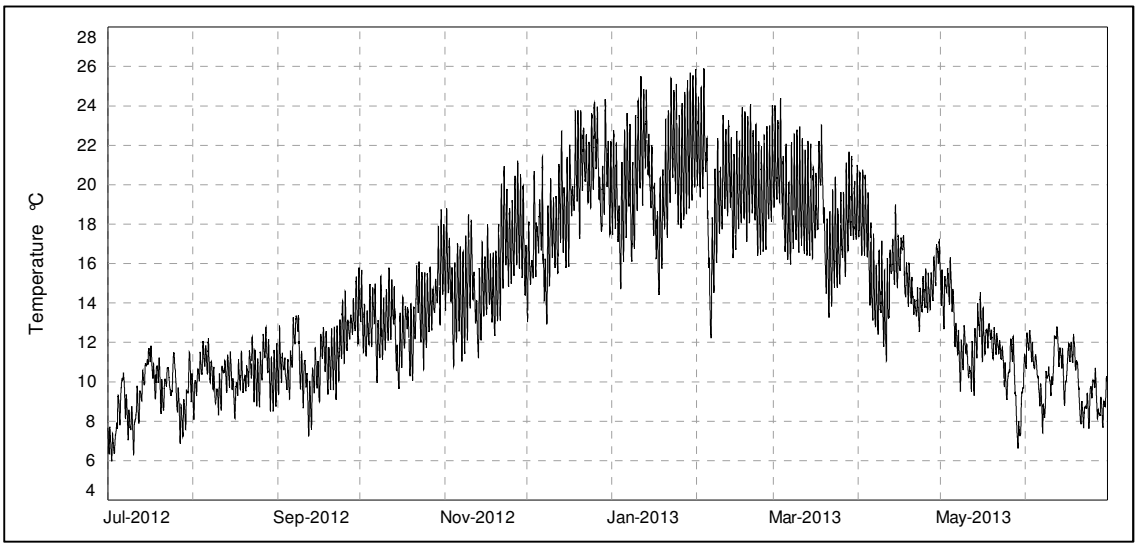

Figure 11 Water temperature records for the Kaupokonui River at Beach during the period 1 July 2012 to 30 June 2013

A monthly summary of these data is included in Table 24.

Table 24 Monthly Kaupokonui River water temperature data for two sites from July 2012 to June 2013

Site	Upper Glenn Road			Near Coast		
	Min	Max	Mean	Min	Max	Mean
July 2012	6.2	11.8	9.2	6.0	11.8	9.2
August 2012	7.8	12.7	10.5	8.1	12.8	10.4
September 2012	7.6	16.2	11.6	7.2	15.8	11.4
October 2012	9.5	19.4	13.2	9.6	18.8	13.3
November 2012	10.3	22.1	15.7	10.8	21.2	15.5
December 2012	12.9	24.5	19.3	12.9	24.3	19.0
January 2013	15.5	24.7	20.6	14.4	25.9	20.4
February 2013	13.9	24.8	20.9	12/2	25.9	19.8
March 2013	12.8	22.9	18.5	-	-	-
April 2013	11.0	19.8	15.0	11.0	20.7	15.4
May 2013	6.6	16.1	11.6	6.6	16.3	11.8
June 2013	7.4	12.7	10.1	7.4	12.8	10.1

In 2012-2013, river temperatures reached an instantaneous maximum of 25.9˚C on 3 February 2013 at 1545 NZST at the site near the coast. An analysis of the river water temperature data for each site indicated that 20˚C (above which temperature trout start to become stressed) was exceeded for approximately 17% and 14% of the year at Glenn Road and near the mouth, respectively, while the median water temperatures were 13.8˚C at Glenn Road and 13.9˚C near the mouth.

2.1.3.5 Evaluation of fish passage

An assessment of the effectiveness of the fishpass on the Kaupokonui River weir at the Fonterra plant (consent **0302**) was performed by Council staff using night spotting techniques at six sites in the Kaupokonui River late in the 1998-1999 monitoring period. These results were reported in the 1998-1999 Annual Report by Taranaki Regional Council (TRC 1999) which contained a recommendation for further fish investigations in the Kaupokonui River upstream of the Fonterra weir. The purpose of the proposed investigations was to determine the upstream extent of red-finned bully migration within the river. 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 River 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 Taranaki Regional Council recorded torrentfish in the lower section of the Kaupokonui River. Torrentfish migrate up and down waterways several times throughout the year and have been recorded in Taranaki streams up to an altitude of 440 metres. However, they are poor climbers and are not currently able to negotiate the hydrological control weir in the Kaupokonui River at Glenn Road, at an altitude of 50 metres. 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 Fonterra site, at an altitude of 160 metres.

In September 2000 Fish and Game Taranaki wrote to the Taranaki Regional Council recommending that a 'constructed stream' type fish pass be built over the Fonterra 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. Taranaki Regional Council concurred with this proposal.

In December 2000 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 Fonterra 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. Taranaki Regional 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 November2010, 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 scheduled for (and was carried out in) summer 2013-2014. An electric fishing survey, to assess the effectiveness of the pass will be carried out after the repairs are completed.

Photo 3 Construction of the new fish pass, March 2004, and repaired upper section, May 2013

2.1.3.6 Biomonitoring

The Council's standard 'kick-sampling' technique was used to collect streambed macroinvertebrates from five sites in the Kaupokonui River in October 2012 and February 2013. Two sites in the Waiokura Stream were sampled in February 2013. Samples were sorted and identified to provide the number of taxa (richness), MCI and $SQMCI_s$ scores for each site. The reports are included as Appendix III. The report summaries are provided below.

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.

4 October 2012

In the Kaupokonui River, taxa richnesses were similar to median richnesses, while MCI scores indicated very healthy communities at all sites. The MCI scores at all five sites were significantly higher than their median scores, with four sites recording new maxima. All sites showed improvement from those recorded by the February 2012 survey, which is a fairly typical trend for a spring survey. The survey continued to show that the Kaupokonui River generally has good quality macroinvertebrate communities throughout the reach surveyed. The standout site during the current survey was site 4 just upstream of the railway bridge, which recorded the highest MCI score of the current survey (128), thirty-seven units higher than its respective long term median. This MCI score was also higher than any other score recorded at any of the sites to date.

It can be concluded that the factory's cooling water discharges did not result in a significant adverse effect on the macroinvertebrate communities, which shows continued recovery from that recorded in the 2010 spring survey. That survey recorded the presence of sewage fungus and *Chironomus* blood worms, both indicative of enrichment, at sites 5 and 6, at least 800 metres downstream of the site. Neither was recorded in the following three surveys, or in the current survey, indicating that the discharge that caused the previous result has either ceased, or improved in quality. In addition, there was no deterioration in the macroinvertebrate community between sites upstream and downstream of spray irrigation of wastes onto land (but upstream of the cooling water discharge) from the Fonterra Kapuni factory in the current survey.

MCI values continued to indicate in general that macroinvertebrate communities were in good condition, being above median MCI scores from surveys conducted since 1998 for all sites. Similarities in community composition, including the characteristic taxa, were generally consistent for all sites, although there was some subtle variation at site 7. Although there was deterioration in MCI score recorded between sites 6 and 7 (in the lower reaches), it was not a statistically significant result, and it is also a result commonly recorded in this stream, usually due to natural deterioration in communities in a downstream direction, typical of Taranaki

ringplain rivers and streams. However, in the current survey, this deterioration was more related to the good result recorded at site 6, as site 7 still recorded an improved result relative to historical data. The conclusion that there was a lack of deterioration at site 7 is supported by the lack of deterioration in the $SQMCI_S$ score through this reach, an atypical result.
The trend of improvement in communities noted in recent years adjacent to the factory was generally continued in this survey, following a break in the trend in February 2008 survey, which also recorded the additional presence of 'undesirable heterotrophic growths' on the riverbed. The spring 2010 survey also recorded such growths at two sites, although only subtle impacts were recorded in the macroinvertebrate communities. No such growth was recorded in the current survey.

15 February 2013
In the Kaupokonui River, taxa richnesses were similar to median richnesses, while MCI scores indicated healthy communities at all sites. The MCI scores at all five sites were similar to or higher than their median scores. All sites showed some reduction in community health from those recorded by the October 2012 survey, which is a fairly typical trend for a summer survey. The survey continued to show that the Kaupokonui River generally has good quality macroinvertebrate communities throughout the reach surveyed. The standout site during the current survey was site 4 just upstream of the railway bridge, which recorded the highest MCI score of the current survey (115), twenty-three units higher than its respective long term median.

It can be concluded that the factory's cooling water discharges did not result in a significant adverse effect on the macroinvertebrate communities, which shows continued recovery from that recorded in the 2010 spring survey. That survey recorded the presence of sewage fungus and *Chironomus* blood worms, both indicative of enrichment, at sites 5 and 6, at least 800 metres downstream of the site. Neither was recorded in the following four surveys, or in the current survey, indicating that the discharge that caused the previous result has either ceased, or improved in quality. In addition, there was no deterioration in the macroinvertebrate community between sites upstream and downstream of spray irrigation of wastes onto land (but upstream of the cooling water discharge) from the Fonterra Kapuni factory in the current survey.

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The trend of improvement in communities noted in recent years adjacent to the factory was generally continued in this survey, following a break in the trend in

February 2008 survey, which also recorded the additional presence of 'undesirable heterotrophic growths' on the riverbed. The spring 2010 survey also recorded such growths at two sites, although only subtle impacts were recorded in the macroinvertebrate communities. No such growth was recorded in the current survey.

The Waiokura Stream communities indicated that conditions during this survey were similar to or better than during the relatively limited number of previous surveys at these two sites to date. The MCI value recorded at the downstream site was less than that recorded upstream (but not significantly so), and both values were similar to or above their respective medians. There were only subtle changes in macroinvertebrate community compositions between the sites despite some differences in habitat, principally the increase in macrophytes downstream. These community differences were insignificant and not indicative of recent impacts of wastewater irrigation within the Waiokura Stream catchment.

2.2 Air

2.2.1 Inspections

Officers of the Taranaki Regional Council carried out inspections in relation to air emissions, of the Fonterra Kapuni plant, during the 2012-2013 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.

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. On-site odours were noted during inspections, particularly in the vicinity of the effluent tank, and occasional slight odours were noted at the southern plant entrance under northerly wind conditions.

The plant appeared to be well managed and well maintained, with a high standard of housekeeping observed at the time of each inspection. Any on-site spills were responded to and cleaned up promptly.

2.2.2 Emission monitoring

A wet scrubber system was commissioned at Fonterra in October 1998. The wet scrubber system links the exhaust streams from the pre-drier stack and the refined fluid bed drier. Table 25 is included for comparison of results prior to the installation of the wet scrubber system.

Table 25 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 wet scrubber stack for particulates was conducted on 9 January 2013 by CPL consultants, using USEPA Method 17 over a 64 minute period. Average production rate was 5 tonne/hour. These results are presented in Table 26 below, along with previous CPL and Council results since 1998.

Table 26 Summary of isokinetic stack analysis for 1998-2013

Date	Emission (mg/m^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/h
11 January 2012	67	Mass emission rate 3.0 kg/h
9 January 2013	27	Mass emission rate 1.3 kg/h

Key * mg/m^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. Fonterra 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 milligrams per cubic metre 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 milligrams per cubic metre of gas, adjusted to 0˚C, 1 atmosphere pressure and calculated as dry gas.

The result obtained in January 2013 was below that allowed in the consent.

2.2.3 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 1.6m. The buckets have a solution in them to ensure that any dust that settles out of the air is not re-suspended by wind.

Gauges are placed around the site and within the surrounding community. The gauges were left in place for between two weeks and a month.

Guideline values used by the Taranaki Regional Council for dust deposition are $4g/m^2/30$ days or $0.13g/ m^2/day$ deposited matter. Consideration is given to the

location of the industry and the sensitivity of the surrounding community, when assessing results against these values.

Material from the gauges was analysed both for solid particulates and for various chemicals associated with pollution.

The location and description of the sample sites are shown in Table 27 and Figure 12 below.

Table 27 Description of the Fonterra 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

The Taranaki Regional Council guideline value for total particulate deposited to cause nuisance is 130 milligrams per square metre per day, but the Council does not have a specific guideline value for lactose powder deposited. The lactose deposition survey determines deposition due to total deposition, not lactose powder only. Therefore using 130 milligrams per square metre per day is conservative.

Prior to the commissioning of the wet scrubber in October 1998, deposition rates of up to 1300 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).

Table 28 Deposition gauge results from 1997-2013 monitoring periods

Period	Number of days	TDP 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
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

Period	Number of days	TDP mg/m²/day				
		AIR002301	AIR002302	AIR002303	AIR002304	AIR002305
29 Sep to 17 Oct 2011	18	40	110	340	40	70
28 Jan to 15 Feb 2013	18	30	64	30	33	30

The deposition rates obtained during the period under review were lower than in most recent monitoring periods (Table 28). South and southwesterly winds predominated during the monitoring period. There was no visible evidence of lactose powder deposition.

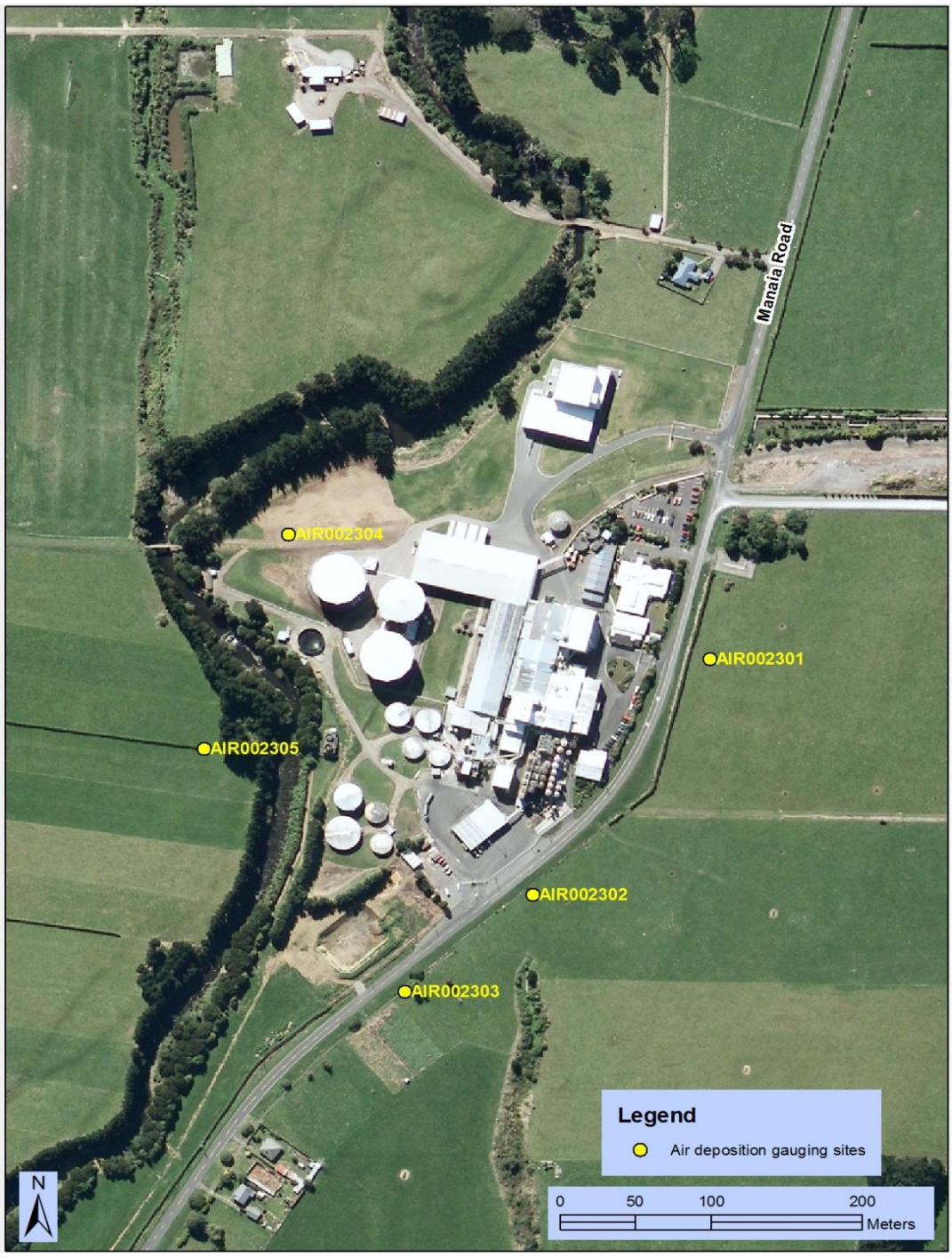

Figure 12 Location of air deposition gauging sites

2.3 Investigations, interventions and incidents

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

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

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

In the 2012-2013 period, it was necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with Fonterra's conditions in resource consents or provisions in Regional Plans in relation to the Company's activities at its Kapuni site two occasions, both in 2013.

Kaupokonui River temperature, January to March 2013 (Incident 23347)
On 31 January 2013, Fonterra notified the Council of a breach of the limit on maximum temperature increase allowed in Kaupokonui River below the cooling water discharge from the lactose plant (consents **0919-3** and **0924-3**, special conditions 4(b)). The limit of 3.0°C had been exceeded by 0.1°C for 12 seconds. Similar breaches of less than 10 seconds duration were recorded for 3 February and 10 March, and on 22 March a breach of 0.3°C for 17 minutes was recorded. River flows were low. The maximum temperature limit of 25°C was not exceeded. After investigation, remedial action was taken by reprogramming the PLC which controls the operation of the water cooling tower and thus temperature increase and maximum temperature in the river. As the breaches of consents were minor in degree and duration, no further action was taken by Council.

Kaupokonui River, 18 April 2013 (Incident 23569)
On the morning of 18 April 2013, a breach of the pH range limit for a discharge from the northern storm drain at the lactose plant was discovered during the monthly Council inspection and sampling. A pH of 4.4 was measured, below the lower limit of 6.0 on consent 4604-2. The small flow of stormwater smelled of lactose and was found to have a high total BOD of 1,400 mg/L, possibly from lactose particulate deposition during a long dry period before the sampling. There was no effect on the pH or BOD of the receiving water, the Kaupokonui River, which was receding after a small fresh. In a written report, Fonterra stated that immediate investigation had found no leaks or spills to the drain. Retesting of the stormwater discharge that afternoon gave a pH of 5-6, and further testing, during the next routine monthly Council inspection returned a normal pH value of 6.7. As no adverse effect was found to occur, no further action was taken.

3. Discussion

3.1 Discussion of plant performance

Generally the on-site management and operation of the Fonterra Kapuni site was undertaken in a satisfactory manner. Continual liaison between Fonterra staff and the Council has contributed to this performance.

Contingency planning is in place in the form of the Environmental Management System manual (this included the Spray Irrigation Plan). The plan is updated annually, with the most recent edition received in April 2013.

Data were collected by Fonterra and forwarded to the Council regarding the abstraction of water from the Kaupokonui River, rate of abstraction from the bore, temperature of the Kaupokonui River above and below the discharge of cooling wastes, and volume and composition of effluent sprayed to pasture on the three farms.

Two unauthorised incidents were recorded, one about minor temperature limit breaches in Kaupokonui River, and one involving a breach of pH limit in stormwater.

Recorded annual abstraction volume from Kaupokonui River increased in 2012-2013, by a factor of about 26% over 2011-2012. The strength of wastewater irrigated onto land, in terms of organics, mineral and nitrogen loadings, reduced by about 20-40%, while volume remained constant. This was ascribed by Fonterra to a strong focus on loss minimisation at the Kapuni site in the 2012-2013 season. As the volume abstracted increased while the volume discharged to land changed little, it is assumed that the volume returned to Kaupokonui River as cooling water increased correspondingly.

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 at a cost of $2.4 million, and construction of a stormwater detention system at a cost of $0.5 million.

The 41% extension of irrigation area, from 120 to 169 ha, with no increase in effluent volume has significantly reduced loadings 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 new stormwater system to contain and control stormwater from the southern catchment of the factory site has provided additional security for the area where road tankers operate and process materials are stored.

The fish pass at the weir on Kaupokonui River was repaired.

3.2 Environmental effects of exercise of consents

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

The discharge of cooling water did not have a visible effect on receiving waters during the monitoring period, and there was compliance with discharge permit conditions, with minor exceptions on the temperature increase allowed. Biological monitoring of the Kaupokonui River during Spring 2012 and Summer 2013 did not show any significant adverse effect of the cooling and storm water discharges to the river on streambed communities.

Temperature data supplied by Fonterra showed that, with minor exceptions, the ambient temperature of the receiving water was not increased by more than the amounts prescribed on consents **0921** and **0924**, that is by less than 2˚C for 90% of the time with an upper limit of 3˚C. The maximum temperature of 25˚C was not exceeded. Riparian planting was maintained on the factory site and a donation was received by the Taranaki Tree Trust as per consent conditions.

Irrigation onto the three dairy farms was, in general, well managed. A 20-metre buffer was maintained to the bank of water courses. Effects on the groundwater in the vicinity of the farms were varied, but most showed an adverse but reducing impact on both mineral and organic component levels. This has been addressed through extension of the irrigation disposal system and by more intensive wastewater and groundwater monitoring. The monitoring results show a substantial reduction in nitrogen loading on irrigation areas and indicate an improvement in groundwater quality.

No effect on stream communities of Kaupokonui River or Waiokura Stream was noted in relation to land irrigation.

Stormwater pH was below the range prescribed in consent **4604** from the northern outfall on one occasion. However, no change in pH or adverse effect was noted in the Kaupokonui River.

Results from monitoring of the stormwater discharged from the IGL plant showed that the discharge was complying with conditions of consent **6423.**

Levels of suspended solids in the septic tank discharge continued to be higher than consent conditions allowed, however these were not high in regard to a discharge of this nature. Fonterra installed a new filter in the treatment system in July 2007, but subsequent monitoring showed it had little effect on suspended solids level. The Company has been advised that the discharge to land would be a permitted activity under the Regional Freshwater Plan, provided certain conditions are met, such as the disposal area being directly associated with the plant.

Particulate deposition from air emissions were similar to the previous monitoring periods, and all but one site were within the guideline target value set by the Council. Visual inspections found no evidence of depositions, and odour surveys continued to note low level of odour off site, with some odour observed around the effluent tank and in the vicinity of this depending on the direction of the wind.

3.3 Evaluation of performance

A tabular summary of the Company's compliance record for the year under review is set out in Table 29 to Table 47.

Table 29 Summary of performance for Consent 0302-3 take and use water for cooling and general purposes

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 Fonterra	Yes
3. Review of consent conditions	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 30 Summary of performance for Consent 0919-3 discharge cooling water

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Physicochemical and ecological monitoring of wastes	Collection of samples	Yes
2. Effects on receiving water	Site inspections, collection of samples	Yes
3. BOD level	Collection of samples	Yes
4. Limits on temperature increase of receiving water	Council data logger information, temperature information supplied by Fonterra	Short minor breaches, remedied
5. Limit on temperature of receiving water	Council data logger information, temperature information supplied by Fonterra	Yes
6. Monitoring of temperature of receiving water	Temperature information supplied by Fonterra	Yes, with minor loss of record
7. Review of conditions 4 and 5	Conditions not reviewed	N/A
8. No thermal barrier or growths as a result of discharge	Temperature information, site inspections	Yes
9. No anti-corrosion agents, biocides, anti-flocculants or other chemicals added to cooling water	Site inspections, sample collection	Yes
10. Maintenance of riparian zone and annual donation to Taranaki Tree Trust	Site inspections	Yes
11. Review of consent conditions	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**

Table 31 Summary of performance for Consent 0920-3 abstract bore water

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Records of abstractions kept and supplied to Council	Records received	Yes
2. Access to bore provided		Yes
3. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 32 Summary of performance for Consent 0921-3 discharge cooling water

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	Yes
2. Consent holder to monitor daily volume, temperature of discharge	Information supplied by Fonterra	Yes
3. Review of consent conditions	Recommendation attached	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 33 Summary of performance for Consent 0922-3 discharge via spray irrigation into Kaupokonui catchment

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintenance of effluent spray irrigation plan		Yes
2. Consent exercised in accordance with procedures set out in effluent spray irrigation plan	Site and farm inspections	Yes
3. Review of spray irrigation plan	Document received, October 2012	Yes
4. Operation of spray irrigation plan, staff training	Site and farm inspections	Yes
5. No direct discharges of effluent into any watercourse	Farm inspections	Yes
6. No ponding	Farm inspections	Yes
7. 20 metre 'buffer zone' to watercourse	Farm inspections	Yes
8. Records provided to Council of effluent produced, volume irrigated, area and hours pumped	Records received	Yes
9. Review of consent conditions	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 34 Summary of performance for Consent 0923-3 discharge via spray irrigation into the Waiokura and Motumate catchments

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		Yes
3. Consent exercised in accordance with procedures set out in plan	Site and farm inspections	Yes
4. Review of spray irrigation plan	Document received, October 2012	Yes
5. Operation of system in accordance with plan. Staff training	Site and farm inspections	Yes
6. No offensive or objectionable odour	Farm inspections	Yes
7. No spray drift beyond boundaries	Farm inspections	Yes
8. No direct discharge to watercourses	Farm inspections	Yes
9. No ponding	Farm inspections	Yes
10. Spray 'buffer zone' limits	Farm inspections	Yes
11. Remediation in case of contamination of groundwater or roof water supply		N/A
12. Installation and maintenance of monitoring bores	Farm inspections	Yes
13. Records provided to Council of effluent produced, volume irrigated, area and hours pumped	Records received	Yes
14. Change of consent conditions	Not sought	N/A
15. Review of consent conditions	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 35 Summary of performance for Consent 0924-3 discharge of stormwater and cooling water

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	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	Short minor breaches, remedied

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 Fonterra	Yes
6. Consent holder to constantly monitor the temperature of the receiving waters	Consent holder maintains temperature probes in river, data forwarded to Council	Yes
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	Temperature monitoring and 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	Plan approved April 2013	Yes
12. Review of consent conditions	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**

Table 36 Summary of performance for Consent 4032-5 discharge emissions to the air

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
3. Limits of particulate from wet scrubber	Stack testing on 9 Jan 2013 (as in Jan 2012 and 2011)	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	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 37 Summary of performance for Consent 4235-2 discharge of stormwater during factory shutdowns

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	Yes
2. Levels of contaminants not to be exceeded in discharge	No sampling was undertaken during period under review	N/A
3. Contingency plan	Approved April 2013	Yes
4. Factory shut down when no whey is being processed		Yes
5. Review of consent		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 38 Summary of performance for Consent 4604-2 to discharge stormwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Effects which must not arise below the mixing zone	Site inspections, samples, biomonitoring	Yes
2. Levels of oil & grease, pH and suspended solids in discharge	Sample collection	One pH non-compliance
3. Contingency planning	Approved April 2013	Yes
4. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**

Table 39 Summary of performance for Consent 4623-2 to erect, place and maintain spray, stormwater, irrigation and intake structures

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification of maintenance works	Receipt of notification	Yes
2. Construction in accordance with application		N/A
3. Best practicable option to minimise environmental effects		N/A
4. Structures not to restrict fish passage	Site inspections	Yes
5. Works to be undertaken between November and April	Waiver obtained 13 May 2013.	Yes
6. Structure to be removed and area reinstated when no longer required		N/A
7. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 40 Summary of performance for Consent 5368-1 to erect, place and maintain a bridge over Little Dunn's Creek

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification of works	Receipt of notification	N/A
2. Construction in accordance with application	Site inspection	N/A
3. Practicable measures to prevent contamination of watercourse	Site inspection	N/A
4. Removal and reinstatement when no longer required	Site inspection	N/A
5. No discharge of contaminated stormwater	Ste inspection	Yes
6. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 41 Summary of performance for Consent 5629-1 to discharge treated domestic effluent

Condition requirement	Means of monitoring during period under review		Compliance achieved?
1. Treatment system installed in accordance with application	Site inspections		Yes
2. Maintenance of treatment system	Sample collection		See 5 below
3. Disposal field within subject boundary			N/A
4. Consent holder to establish sampling point	Sampling point established		Yes
5. Average suspended solids of 12 month period not exceed 33 g/m^3	Sample collection	No. Suspended solids above this level. Company advised to apply for change of consent	
6. Review of consent conditions			N/A
Overall assessment of consent compliance and environmental performance in respect of this consent			**Improvement required**

Table 42 Summary of performance for Consent 6422-1 stormwater outlet structure

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to maintenance	No maintenance undertaken	N/A
2. Exercise fo consent in accordance with application	Site inspections	Yes
3. Best practicable option to minimise environmental effects		N/A
4. Disturbance to be minimised		N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
5. Structure to be removed and area reinstated if no longer required		N/A
6. Lapse of consent		N/A
7. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 43 Summary of performance for Consent 6423-1 to discharge stormwater from IGL plant

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Contingency planning	Approved April 2013	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 levels of pH, suspended solids and hydrocarbons in the discharge	Sample collection	Yes
5. Effects which must not arise below the mixing zone	Site inspections, stream sample collection, biomonitoring	Yes
6. Lapse of consent		N/A
7. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 44 Summary of performance for Consent 6885-1 erect and maintain an outlet structure

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option		N/A
2. Exercise of consent in accordance with application		N/A
3. Notification prior to installation		N/A
4. Minimise disturbance of river bed		N/A
5. Reinstatement when structure no longer needed		N/A
6. Lapse of consent		N/A
7. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 45 Summary of performance of Consent 6948-1 structure for pipeline over Motumate and Waiokura Streams

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		N/A
3. Notification prior to installation		N/A
4. Best practicable option to minimise contaminant		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	Not scheduled during period under review	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 46 Summary of performance of Consent 7276-1 install a bore

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Compliance with NZ Environmental Standard for drilling soil and rock	Consent not exercised	N/A
2. Prevention of interconnection between aquifers		N/A
3. Protection of headworks		N/A
4. Testing of bore water quality as to suitability for intended purpose		N/A
5. Proper disposal of bore drilling and construction wastes		N/A
6. Sealing of bore annulus		N/A
7. Capping to prevent contamination		N/A
8. Installation of concrete pad to secure top of bore		N/A
9. Labelling of bore		N/A
10. Provision of bore log		N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
11. Lapse of consent if not exercised in 5 years		N/A
12. Review of consent conditions		N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A**

Table 47 Summary of performance for Consent 9546-1 Place culvert in Waiokura Stream

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to commencement of works	Liaison with Council. Work undertaken June 2013	Yes
2. Culverts dimensions defined	Inspection by Council	Yes
3. Maximum depth of fill over culverts	Inspection by Council	Yes
4. Shaping of stream banks	Inspection by Council	Yes
5. Placement of rock rip-rap on upstream and downstream batters	Inspection by Council	Yes
6. Gradient of rock rip-rap in condition 5	Inspection by Council	Yes
7. Thickness of rock rip-rap on fill batters	Inspection by Council	Yes
8. Gradient of rock rip-rap in condition 7	Inspection by Council	Yes
9. Separation of concrete work from stream	Inspection by Council	Yes
10. Minimum period for curing of concrete in channel	Inspection by Council	Yes
11. No instream works between 1 June and 31 October	Inspection by Council.	Yes
12. Streambed disturbance minimised and reinstated	Inspection by Council	Yes
13. Fish passage not to be restricted	Inspection by Council	Yes
14. Pipes invert depth set	Inspection by Council	Yes
15. Gradient of culvert pipes not to exceed that of natural stream bed	Inspection by Council	Yes
16. Minimisation and mitigation of sediment discharged to stream	Inspection by Council	Yes
17. Earthworks stabilisation to be as soon as practicable	Inspection by Council	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
18. Prevention of blockage and erosion responsibility of consent holder	Inspection by Council	Yes
19. Procedure on discovery of archaeological remains	Liaison with Council	N/A
20. Removal of structure when no longer required	Inspection by Council	N/A
21. Lapse of consent if not exercised		N/A
22. Optional review provision for environmental effects	Next review date available 1 June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

Overall, during the year, the Company demonstrated a good level of environmental performance and compliance with the resource consents as defined in section 1.1.4. There were two unauthorised incidents during the period under review, neither of which caused significant adverse environmental effect.

3.4 Recommendations from the 2011-2012 Annual Report

In the 2011-2012 Annual Report, it was recommended:

1. THAT monitoring of air emissions from the Fonterra Kapuni site in the 2012-2013 year continue at the same level as in 2010-2011 and 2011-2012.

2. THAT monitoring of discharges from the Fonterra Kapuni site in the 2012-2013 year continue to be exercised as in 2010-2011 and 2011-2012, with the addition of an appropriate triennial fish survey to assess the performance of the abstraction weir fish pass and effect of cooling water discharges on fish passage.

These recommendations were followed in 2011-2012 where relevant. This first triennial fish survey was delayed until 2013-2014, until after the fish pass at the Kaupokonui weir had been repaired.

3.5 Alterations to monitoring programmes for 2013-2014

In designing and implementing the monitoring programmes for air and water discharges in the region, the Taranaki Regional Council has taken into account the extent of information made available by previous authorities, its relevance under the Resource Management Act, the obligations of the Act in terms of monitoring emissions and discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere and discharging to the environment.

In the case of Fonterra Kapuni, the programme for 2013-2014 was the same as that for 2012-2013, with the addition of a triennial fish survey to assess the performance of the abstraction weir fish pass to assess the performance of the abstraction weir fish pass and effect of cooling water discharges on fish passage. It is now proposed that for 2013-2014, the programme remain the same as that for 2012-2013.

3.6 Exercise of optional review of consent

Six of the seventeen consents associated with the lactose plant at Kapuni provide for an optional review in June 2014.

Resource consents **0302-3** (abstraction from surface water), **0919-3** (discharge cooling water), **0922-3** and **0923-3** (discharge to land), **0924-3** (discharge storm/cooling water) and **4032-5** (discharge to air) each provide for an optional review of consent in June 2014.

Condition 3 on consent **0302-3**, condition 11 on consent **0919-3**, condition 9 on consent **0922-3**, condition 15 on consent **0923-3**, condition 12 on consent **0924-3**, and condition 9 on consent **4032-5** allow the council to review the consents, for the purpose of ensuring that the respective conditions are adequate to deal with any adverse effect of the respective activities on the environment.

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

A recommendation to this effect is presented in Section 4 of this report.

4. Recommendations

1. THAT monitoring of air emissions from the Fonterra Kapuni site in the 2012-2013 year continue at the same level as in 2010-2011 and 2011-2012.

2. THAT monitoring of discharges from the Fonterra Kapuni site in the 2012-2013 year continue to be exercised as in 2010-2011 and 2011-2012, with the addition of an appropriate triennial fish survey to assess the performance of the abstraction weir fish pass and effect of cooling water discharges on fish passage.

3. THAT the option for a review of resource consent **0302-3** (abstraction from surface water) in June 2014, as set out in condition 3 on consent **0302-3** not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

4. THAT the option for a review of resource consent **0919-3** (discharge cooling water) in June 2014, as set out in condition 11 on consent **0919-3** not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

5. THAT the option for a review of resource consent **0922-3** (discharge north farm) in June 2014, as set out in condition 9 on consent **0922-3** not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

6. THAT the option for a review of resource consent **0923-3** (discharge south farms) in June 2014, as set out in condition 15 on consent **0923-3** not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

7. THAT the option for a review of resource consent **0924-3** (discharge storm/cooling water) in June 2014, as set out in condition 12 on consent **0924-3** not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

8. THAT the option for a review of resource consent **4032-5** (discharge to air) in June 2014, as set out in condition 3 on consent **4032-5** not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

Glossary of common terms and abbreviations

The following abbreviations and terms are 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
COD	chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20˚C and expressed in mS/m
fresh	elevated flow in a stream, such as after heavy rainfall
g/m^3	grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
incident	an event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred
intervention	action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring
investigation	action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident
l/s	litres per second
MCI	macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats
mS/m	millisiemens per metre
mixing zone	the zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point
NH_4	ammonium, normally expressed in terms of the mass of nitrogen(N)
NH_3	unionised ammonia, normally expressed in terms of the mass of nitrogen (N)
NO_3	nitrate, normally expressed in terms of the mass of nitrogen (N)
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
O&G	oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons)
pH	a numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5

physicochemical	measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of 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 subsequent amendments
SS	suspended solids
Temp	temperature, measured in ˚C (degrees Celsius)
Turb	turbidity, expressed in NTU
UI	Unauthorised Incident
UIR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan

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

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Appendix I

Resource consents held by Fonterra

Consent 0302-3

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted 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 at or about GR: P20:079-914
Expiry Date:	1 June 2019
Review Date(s):	June 2004, June 2009, June 2014
Site Location:	Kaupokonui Stream, Manaia Road, Kapuni Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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

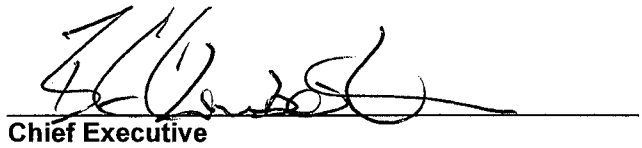
1. That the consent holder shall, in conjunction with the Taranaki Regional Council, undertake such ecological monitoring associated with the abstraction of water from the Kaupokonui Stream as deemed necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 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 4 November 2003

For and on behalf of
Taranaki Regional Council



Chief Executive

Consent 0919-3

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

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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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted 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 at or about GR: P20:078-914
Expiry Date:	1 June 2019
Review Date(s):	June 2004, June 2009, June 2014
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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:

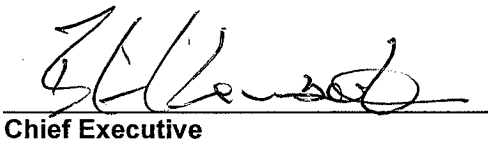
    a) the maintenance of existing riparian planting; and

    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 4 November 2003

For and on behalf of
Taranaki Regional Council



Chief Executive

Consent 0920-3

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

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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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted 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 at or about GR: P20:078-914
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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

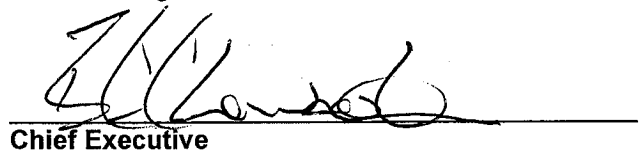
1. That the consent holder shall operate, to the satisfaction of the Chief Executive, Taranaki Regional Council, a measuring device capable of recording groundwater levels and daily and continuous rates of abstraction and shall make records available to the Chief Executive, Taranaki Regional Council.

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 4 November 2003

For and on behalf of
Taranaki Regional Council



Chief Executive

Consent 0921-3

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CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

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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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted 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 at or about GR: P20:080-914 &
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road Kapuni
Legal Description:	Pt Sec 14 Blk XV Kaupokonui SD
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:

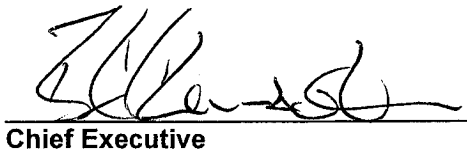
(i) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
(ii) any conspicuous change in the colour or visual clarity;
(iii) any emission of objectionable odour;
(iv) the rendering of freshwater unsuitable for consumption by farm animals, and;
(v) 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 4 November 2003

For and on behalf of
Taranaki Regional Council



Chief Executive

Consent 0922-3

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

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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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Change To Conditions Date:	8 February 2005 [Granted: 9 June 1999]

Conditions of Consent

Consent Granted:	To discharge up to 2,600 cubic metres/two consecutive days of evaporator condensate, washings, processing wastes and stormwater from a lactose manufacturing plant by spray irrigation onto pasture in the Kaupokonui catchment at or about GR: P20:079-919
Expiry Date:	1 June 2019
Review Date(s):	June 2004, June 2009, June 2014
Site Location:	Lactose Farm 1, Manaia Road, Kapuni
Legal Description:	Lot 1 DP 4509 Blk XV Kaupokonui SD
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; and
   k) riparian planting and management.

2. 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.

3. 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.

4. 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.

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

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

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

8. 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.

9. 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 8 February 2005

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 0923-3

TARANAKI REGIONAL COUNCIL
CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Change To Conditions Date:	21 August 2006 [Granted: 9 June 1999]

Conditions of Consent

Consent Granted:	To discharge up to 3,750 cubic metres/two consecutive days of evaporator condensate, washings, processing wastes and stormwater from a lactose manufacturing plant by spray irrigation onto pasture in the Waiokura and Motumate catchments at or about GR: P21:080-894
Expiry Date:	1 June 2019
Review Date(s):	June 2009, June 2014
Site Location:	Lactose Farms 2 & 3 and Gibson, Skeet / Manaia Roads, Kapuni
Legal Description:	Lot 6 DP 2903 Lot 3 DP 3601 Blk XV Kaupokonui SD Lot 2 DP 5897 Lot 2 DP 6039 Blk III Waimate SD Lot 1 DP 6039 Blk III Waimate SD
Catchment:	Waiokura

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

Best practicable option

Condition 1 - additional

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.

Management Plan

Condition 2 [previously condition 1] - changed

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 Kaupokonui Stream [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; and
s) riparian planting and management.

Conditions 3 to 5 [previously conditions 2 to 4] - unchanged

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 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.

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 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.

Odour and spray effects

Condition 6 - additional

6. 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.

Condition 7 - additional

7. 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.

Land effects

Condition 8 [previously condition 5] - unchanged

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

Condition 9 [previously condition 6] - unchanged

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

Condition 10 [previously condition 7] - changed

10. 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.

Mitigation

Condition 11 - additional

11. Should monitoring of the discharge under conditions 12 and 13 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.

Monitoring

Condition 12 - additional

12. 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.

Condition 13 [previously condition 8] - unchanged

13. 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.

Review

Condition 14 - additional

14. 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.

Condition 15 [previously condition 9] - unchanged

15. 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 21 August 2006

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 0924-3

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted 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 at or about GR: P20:078-913
Expiry Date:	1 June 2019
Review Date(s):	June 2004, June 2009, June 2014
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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.

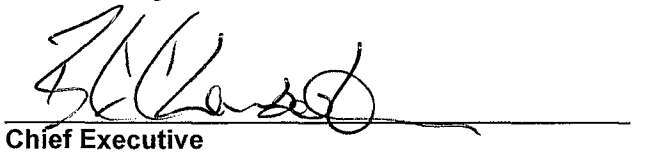
10. That no anti-corrosion agents, biocides, anti-flocculants or other chemicals shall be added to the cooling water without the written permission of the Chief Executive, Taranaki Regional Council.

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 4 November 2003

For and on behalf of
Taranaki Regional Council



Chief Executive

Consent 4032-5

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Change To Conditions Date:	2 June 2004 [Granted: 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 at or about GR: P20:079-916
Expiry Date:	1 June 2019
Review Date(s):	June 2004, June 2009, June 2014
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
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 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.

Signed at Stratford on 2 June 2004

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 4235-2

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted Date:	4 February 1999

Conditions of Consent

Consent Granted:	To discharge up to 240 cubic metres/day of stormwater from the factory site via the existing stormwater system into the Kaupokonui Stream only during factory shutdown periods at or about GR: P20:078-914
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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 mixing zone of 150 metres extending downstream of the periphery of the spray discharge zone, 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 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 g/m^3

3. That the consent holder shall prepare and 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.

4. That the purpose of this consent the factory shall be deemed to be shut down when no whey is being processed.

5. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during 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 4 November 2003

For and on behalf of
Taranaki Regional Council

Chief Executive

Consent 4604-2

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted 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 525mm diameter pipe into the Kaupokonui Stream at or about GR: P20:078-916
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Factory Extension Site, Manaia Road Kapuni
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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 4 November 2003

For and on behalf of
Taranaki Regional Council

Chief Executive

Consent 4623-2

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted Date:	4 February 1999

Conditions of Consent

Consent Granted:	To erect, place, use and maintain various spray, stormwater, irrigation and intake structures in the bed of the Kaupokonui Stream at or about GR: P20:078-914 &
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road Kapuni Kaponga
Legal Description:	Lot 1 DP 6157 Blk XV Kaupokonui SD
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 notify the Taranaki Regional Council at least 48 hours prior to undertaking any maintenance works that would involve disturbance of, or deposition to the river bed or discharges to water.

2. That the structure[s] authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.

3. That the consent holder shall adopt the best practicable option [as defined in the Resource Management Act] to avoid or minimise the discharge of silt or other contaminants into water or onto the river bed and to avoid or minimise the disturbance of the river bed and any adverse effects on water quality.

4. That structures which are the subject of this consent shall not obstruct the passage of eels, mature fish, juveniles and adult trout.

5. That 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 by the written approval of the Chief Executive, Taranaki Regional Council.

6. That 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.

7. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 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 it was not appropriate to deal with at the time.

Transferred at Stratford on 4 November 2003

For and on behalf of
Taranaki Regional Council

Chief Executive

Consent 5368-1

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted Date:	21 July 1998

Conditions of Consent

Consent Granted:	To erect, place, use and maintain a bridge over Little Dunns Creek a tributary of Dunns Creek in the Kaupokonui Catchment for access purposes at or about GR: P20:065-918
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Little Dunns Creek, Manaia Rd Kapuni
Legal Description:	Road Reserve Blk XV Kaupokonui SD
Catchment:	Kaupokonui
Tributary:	Dunns Creek Little Dunns Creek

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 notify the Taranaki Regional Council at least 48 hours prior to commencement, and upon completion of the initial construction, and again prior to, and upon completion of, any subsequent maintenance works which might involve disturbance of the streambed or discharges to the watercourse.

2. That the structure licenced by this consent shall be constructed and maintained in accordance with the documentation submitted in support of application 401.

3. That during the construction, and any subsequent maintenance of the bridge and its approaches, the consent holder shall observe every practicable measure to prevent the discharge or placement of silt and/or organics and/or cement products and/or any other contaminants into the watercourse.

4. That the structure covered by this consent shall be removed and the area reinstated, if and when it is no longer required.

5. That the consent holder shall ensure that there is not discharge of contaminated stormwater to the watercourse from the bridge or its approaches.

6. 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 adequately deal with the environmental effects arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at that time.

Transferred at Stratford on 4 November 2003

For and on behalf of
Taranaki Regional Council

Chief Executive

Consent 5629-1

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Change To Conditions Date:	28 July 2000 [Granted: 23 May 2000]

Conditions of Consent

Consent Granted:	To discharge up to 7.5 cubic metres/day [114 litres/second] of treated domestic effluent from the Lactose New Zealand processing plant into land at or about GR: P20:080-914
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road South, Kapuni
Legal Description:	Lots 1-9 DP 6588 Pt Secs 34 & 54 Lots 1-4 DP 7211 Pt Secs 14816 Blk XV Kaupokonui SD
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. The treatment system shall be installed according to the plans submitted with application 935.

2. The consent holder shall maintain the treatment system to ensure the conditions of this consent are met.

3. The disposal field shall be located within the boundaries of the subject property, and as far as is reasonably practicable the discharge shall be contained within the boundaries of the subject property and not adversely affect groundwater quality.

4. The consent holder shall establish an access point for sampling of the discharge prior to discharge to the disposal field.

5. The average of four samples in any 12 month period shall not exceed 33 gm^{-3} total suspended solids.

6. 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 20011, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this consent, which 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 4 November 2003

For and on behalf of
Taranaki Regional Council

Chief Executive

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted Date:	13 July 2004

Conditions of Consent

Consent Granted:	To erect, place and maintain a stormwater outlet structure in the bed of the Kaupokonui Stream at or about GR: P20:078-915
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road, Kapuni
Legal Description:	Lot 1 DP 4509 Sec 1 SO 11967 Blk XV Kaupokonui SD
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 notify the Chief Executive, Taranaki Regional Council in writing at least 48 hours prior to the commencement and upon completion of the initial installation and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the river bed or discharges to water.

2. The structure authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of application 3197 and shall be maintained to ensure the conditions of this consent are met. In the case of any contradiction between the documentation submitted in support of application 3197 and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.

4. 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.

5. 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.

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.

Signed at Stratford on 13 July 2004

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number on all correspondence

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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted Date:	13 July 2004

Conditions of Consent

Consent Granted:	To discharge stormwater from an inhalation grade lactose plant site into the Kaupokonui Stream at or about GR: P20:078-915
Expiry Date:	1 June 2017
Review Date(s):	June 2005, June 2011
Site Location:	Manaia Road, Kapuni
Legal Description:	Lot 1 DP 4509 Sec 1 SO 11967 Blk XV Kaupokonui SD
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.

Signed at Stratford on 13 July 2004

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 6885-1

TARANAKI REGIONAL COUNCIL
CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

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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 Co-operative Group Limited, Kapuni P O Box 424 HAWERA
Consent Granted Date:	12 May 2006

Conditions of Consent

Consent Granted:	To erect, place and maintain an outlet structure in the Kaupokonui Stream for stormwater discharge purposes at or about GR: P20:077-912
Expiry Date:	1 June 2017
Review Date(s):	June 2011
Site Location:	Manaia Road, Kapuni
Legal Description:	Lot 6 Pt Lot 5 DP 4509 Pt Lot 2 DP 6157 Secs 51 & 55 Blk XV Kaupononui SD
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 adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 4214. In the case of any contradiction between the documentation submitted in support of application 4214 and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the commencement and upon completion of the initial installation and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.

4. 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.

5. 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.

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 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.

Signed at Stratford on 12 May 2006

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 6948-1

TARANAKI REGIONAL COUNCIL
CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

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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 Co-operative Group Limited P O Box 424 HAWERA
Consent Granted 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:	1 June 2023
Review Date(s):	June 2011, 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
Catchment:	Motumate Waiokura

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.

Signed at Stratford on 18 September 2006

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 7276-1

TARANAKI
REGIONAL
COUNCIL

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number on all correspondence

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 Co-operative Group Limited P O Box 424 HAWERA
Consent Granted Date:	11 April 2008

Conditions of Consent

Consent Granted:	To drill and construct an exploratory bore for general factory purposes at or about 2607775E-6191491N
Review Date(s):	June 2011 and every six years thereafter
Site Location:	879 Manaia Road, Kaponga
Legal Description:	Pt Lot 1 DP 6157 Lots 1-9 DP 6588 Lot 1 DP 9769 Blk XV Kaupokonui SD
Catchment:	Kaupokonui

For General, Standard and Special conditions pertaining to this consent please see reverse side of this document
www.trc.govt.nz

Doc# 443420-v1

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 activity shall comply with New Zealand Standard 4411:2001 (Environmental Standard for Drilling of Soil and Rock) and shall comply with mitigating measures for: drilling fluids and additives, casing requirements, grout types and specifications, screens and gravel pack.

2. Only one aquifer or water-permeable zone shall be tapped by a single bore. All aquifers and permeable zones of differing pressure and water quality shall be sealed to prevent the interconnection or movement of groundwater between aquifers and permeable zones.

3. The bore should be positioned so that the headworks are protected from flooding. Temporary caps should be fitted to the bores during the period from completion to pump installation to ensure foreign matter does not enter the bore.

4. After construction, water samples shall be taken from the bore and analysed to determine if the water quality is suitable for the intended purpose. The method used to collect the sample shall be in accordance with the National Protocol for State of the Environment Groundwater Sampling in New Zealand.

5. Upon completion of the bore, the wastes introduced to the bore during drilling and construction shall be properly disposed of.

6. The annulus of the bore shall be sealed with grout to above the screen pack or one metre below ground level, whichever is the lesser, to prevent fluid movement down the sides of the casing into the screened aquifer.

7. The top of the bore shall be covered or capped to prevent contaminants entering the bore and underlying groundwater.

8. A concrete pad of at least 0.5 metres radius and 0.15 metres thickness shall be constructed around the bore head at ground or pump-shed floor level to prevent leakage of groundwater, any movement of the casing, and any material or surface water entering the bore or annulus. The concrete pad shall slope away from the bore.

9. The bore shall be easily identifiable by permanent labels, which may be welded or engraved on the casing, or on the equivalent fixed part of the well construction or associated building. The numbering on the label shall be the bore number assigned by Taranaki Regional Council **(GND2034)**.

10. A bore completion report (drillers log) that includes:

    a) Name of bore owner.
    b) Location of the drilling project.
    c) Description of the drilling project.
    d) Project number or job reference, and resource consent number or permit if applicable.
    e) Start and finish dates of well/bore drilled.
    f) Drilling method used.
    g) Name and address of driller.
    h) Description of grouting method and volumes used.
    i) Well screen details.
    j) Name of personnel on site including driller, driller crew and supervisor.
    k) Name of person preparing the drilling log.
    l) Technique used and time for the well development.
    m) Any results of the tests for discharge of water.
    n) Well/bore location in GPS Coordinates.

    Shall be completed for the bore and provided to the Taranaki Regional Council within four weeks of the completion of construction of the bore.

11. 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.

12. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2011 and every six years thereafter, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 11 April 2008

For and on behalf of
Taranaki Regional Council

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 Co-operative Group Limited P O 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.

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.

Signed at Stratford on 18 April 2013

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix II

Monthly analytical monitoring results for the Kaupokonui Stream (sites KPK000655, KPK000660, KPK000679)

Sample date: 22 August 2012 (flow at Glenn Road – 4.15 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0900	0950	1040	River in high recession. Slight turbidity. Brown algal film.
Temperature	°C	9.4	9.2	9.6	
Conductivity	mS/m	8.2	8.5	8.8	
Turbidity	NTU	1.3	1.3	1.6	
pH	pH	7.6	7.6	7.7	
Total BOD	g/m^3	0.6	0.5	0.6	
Filtered BOD	g/m^3	0.6	<0.5	0.6	
Ammonia-N	g/m^3N	0.035	0.031	0.027	
Nitrate-N	g/m^3N	0.64	0.72	0.77	

Sample date: 27 September 2012 (flow at Glenn Road – 4.94 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0905	0945	1025	Near peak of small fresh. Noticeable turbidity. Brown algal film.
Temperature	°C	10.1	10.6	11.3	
Conductivity	mS/m	7.1	7.5	7.5	
Turbidity	NTU	3.8	3.1	3.4	
pH	pH	7.7	7.7	7.7	
Total BOD	g/m^3	0.8	0.6	0.7	
Filtered BOD	g/m^3	<0.5	<0.5	<0.5	
Ammonia-N	g/m^3N	0.017	0.015	0.013	
Nitrate-N	g/m^3N	0.31	0.37	0.40	

Sample date: 18 October 2012 (flow at Glenn Road – 3.25 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0815	0915	0945	Recent heavy rain. Rising river flow.. Highly turbid
Temperature	°C	10.6	10.9	11.1	
Conductivity	mS/m	7.4	7.4	7.2	
Turbidity	NTU	6.6	5.6	10	
pH	pH	7.6	7.6	7.4	
Total BOD	g/m^3	1.2	1.0	2.0	
Filtered BOD	g/m^3	0.7	0.6	1.2	
Ammonia-N	g/m^3N	0.042	0.039	0.075	
Nitrate-N	g/m^3N	0.33	0.35	0.31	

Sample date: 15 November 2012 (flow at Glenn Road – 1.34 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0825	0915	0955	River in recession after small fresh. Brown algal film.
Temperature	°C	11.5	12.1	14.3	
Conductivity	mS/m	8.8	9.8	9.9	
Turbidity	NTU	0.90	0.62	1.0	
pH	pH	7.8	7.8	7.9	
Total BOD	g/m^3	<0.5	0.8	0.9	
Filtered BOD	g/m^3	<0.5	<0.5	0.5	
Ammonia-N	g/m^3N	0.025	0.068	0.062	
Nitrate-N	g/m^3N	0.48	0.48	0.62	

Sample date: 13 December 2012 (flow at Glenn Road – 1.34 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0830	0910	0940	Moderate-low flow, slightly turbid
Temperature	°C	14.3	14.8	16.7	
Conductivity	mS/m	8.5	9.0	9.1	
Turbidity	NTU	0.76	0.84	0.74	
pH	pH	7.8	7.9	8.0	
Total BOD	g/m^3	0.5	0.6	0.6	
Filtered BOD	g/m^3	<0.5	<0.5	<0.5	
Ammonia-N	g/m^3N	0.020	0.015	0.012	
Nitrate-N	g/m^3N	0.30	0.38	0.40	

Sample date: 17 January 2013 (flow at Glenn Road – 1.07 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0745	0850	0925	Moderate-low flow, showers starting. Thin green-brown algal mat..
Temperature	°C	14.6	15.1	16.5	
Conductivity	mS/m	8.4	9.1	9.2	
Turbidity	NTU	1.0	1.4	1.3	
pH	pH	7.7	7.7	7.8	
Total BOD	g/m^3	0.8	1.1	1.1	
Filtered BOD	g/m^3	<0.5	<0.5	0.6	
Ammonia-N	$g/m^3/N$	0.015	0.047	0.034	
Nitrate-N	g/m^3N	0.26	0.34	0.34	

Sample date: 21 February 2013 (flow at Glenn Road – 0.80 m^3/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0755	0900	0930	Low flow, clear. Brown algal film and sediment-laden mat.
Temperature	°C	15.9	16.5	18.7	
Conductivity	mS/m	8.9	9.5	9.8	
Turbidity	NTU	0.59	0.54	0.54	

pH	pH	7.8	7.8	8.1	
Total BOD	g/m³	0.6	0.8	0.7	
Filtered BOD	g/m³	<0.5	<0.5	0.5	
Ammonia-N	g/m³/N	0.008	0.027	0.019	
Nitrate-N	g/m³N	0.19	0.28	0.26	

Sample date: 21 March 2011 (flow at Glenn Road – 1.00 m³/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0805	0915	0950	Low flow, brown film
Temperature	°C	11.6	12.3	14.3	
Conductivity	mS/m	7.6	7.9	8.0	
Turbidity	NTU	0.86	0.95	0.88	
pH	pH	7.6	7.7	7.8	
Total BOD	g/m³	<0.5	0.5	0.5	
Filtered BOD	g/m³	<0.5	0.5	<0.5	
Ammonia-N	g/m³/N	0.016	0.014	0.008	
Nitrate-N	g/m³N	0.26	0.30	0.30	

Sample date: 18 April 2013 (flow at Glenn Road – 3.63 m³/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0905	1015	1100	Inn fresh, brown with tannins. Brown algal film.
Temperature	°C	12.9	13.4	13.5	
Conductivity	mS/m	5.3	5.4	5.4	
Turbidity	NTU	2.7	2.6	2.0	
pH	pH	7.5	7.5	7.5	
Total BOD	g/m³	0.9	0.9	0.9	
Filtered BOD	g/m³	0.7	0.6	0.6	
Ammonia-N	g/m³/N	0.076	0.068	0.060	
Nitrate-N	g/m³N	0.19	0.24	0.23	

Sample date: 16 May 2013 (flow at Glenn Road – 1.22 m³/s)

Parameter	Unit	Site			Conditions
		1	2	3	
Time	NZST	0910	1000	1055	In recession, clear. Green mat.
Temperature	°C	9.8	10.0	11.0	
Conductivity	mS/m	8.2	8.5	8.6	
Turbidity	NTU	0.63	0.62	0.64	
pH	pH	7.7	7.7	7.8	
Total BOD	g/m³	0.5	<0.5	<0.5	
Filtered BOD	g/m³	<0.5	<0.5	<0.5	
Ammonia-N	g/m³/N	0.015	0.006	0.006	
Nitrate-N	g/m³N	0.28	0.32	0.32	

Appendix III

Biomonitoring reports

To Job Manager, James Kitto
From Scientific Officers, B Jansma
File 03-02-005-05/01; 0919-3; 0922-3; 0923-3; 0924-3; 4235-2; 4604-2; 6423-1
Report No BJ227
Doc No 1343656
Date 5 May 2014

Biomonitoring of the Kaupokonui River in relation to the Fonterra Kapuni farm and factory, October 2012

Introduction

This biological survey was the first of two scheduled in relation to the Fonterra Kapuni (formerly Lactose) factory in the 2012-2013 monitoring year. The results from surveys performed since the 2001-2002 monitoring year are discussed in reports listed in the references section of this report. The Waiokura Stream is monitored on an annual basis in the summer, and was not included in this summer survey.

This survey relates to the following consents held by Fonterra Kapuni Ltd:

0919 to discharge cooling water to the Kaupokonui River;
0922 to spray irrigate wastewater and stormwater to land in the Kaupokonui catchment;
0923 to spray irrigate wastewater and stormwater to land in the Kaupokonui (Waiokura) catchment;
0924 to discharge stormwater and cooling water to the Kaupokonui River;
4235 to discharge stormwater to the Kaupokonui River;
4604 to discharge stormwater to the Kaupokonui River
6423 to discharge stormwater from an inhalation grade lactose plant site into the Kaupokonui River

Methods

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from five sites in the Kaupokonui River in relation to discharges to the river and on to land in the catchment (Table 1, Figure 1) on 4 October 2012. The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Table 1 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

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

Macroinvertebrate taxa found in each sample were recorded as:

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

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

The MCI was designed as a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. MCI results can also reflect the effects of warm temperatures, slow current speeds and low dissolved oxygen levels, because the taxa capable of tolerating these conditions generally have low sensitivity scores. Usually more 'sensitive' communities (with higher MCI values) inhabit less polluted waterways.

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

Sub-samples of periphyton (algae and other microflora) taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths") at a microscopic level. The presence of masses of these organisms can be an indicator of organic enrichment within a stream.

Figure 1 Biomonitoring sites in the Kaupokonui River sampled in relation to Fonterra Kapuni factory discharges

Results and discussion

This survey was undertaken following a short period of receding flows in the Kaupokonui River, and followed 16 and 18 days after flow events in excess of three and seven times median flow respectively. The Kaupokonui River had a clear, uncoloured and swift flow at all sampling sites. River flow at the Glenn Road recorder site was 2.417m^3/sec, just over three times the mean annual low flow (0.755 m^3/sec) for the Kaupokonui River.

At the time of this morning survey, water temperatures in the Kaupokonui River ranged from 10.2°C to 12.7°C. Periphyton mats and algal filaments were patchy at all sites, with the exception of sites 3b and 4, which had only a slippery film of algae. Cobbles, gravel and boulders were the predominant substrate in the river.

Macroinvertebrate communities

Kaupokonui River

Historically the mid to lower reaches of the Kaupokonui River have shown the effects of nutrient enrichment from the surrounding farmland, and in past years (mainly prior to 2000) there have been a number of surveys showing detectable impacts of discharges from the lactose factory on the riverbed fauna. On many past sampling occasions, the sites immediately upstream and downstream of the Fonterra Kapuni factory supported moderate numbers of taxa, with relatively low proportions of 'sensitive' taxa (such as mayflies and stoneflies), resulting in median MCI values in the low 80s (Table 2). Since 1998 however, macroinvertebrate communities have improved throughout the reach and have shown higher numbers of taxa and MCI scores on most occasions. Median values for both the total data set and the results since 1998 are included in Table 2. Faunal results from this survey are presented in Table 3.

Table 2 Numbers of taxa and MCI values recorded previously in the Kaupokonui River (since 1985), together with current results

Site	Number of previous surveys	Numbers of taxa				MCI values			
		Median (all data)	Range (all data)	*Median (Nov 1998 to date)*	Current survey	Median (all data)	Range (all data)	*Median (Nov 1998 to date)*	Current survey
3b	43	23	13-28	*24*	25	101	68-124	*108*	125
4	57	22	8-32	*24*	26	91	65-122	*103*	128
5	38	23	11-28	*24*	23	93	65-120	*99*	121
6	57	20	4-30	*23*	23	89	40-125	*101*	117
7	48	17	7-31	*19*	21	89	57-108	*92*	110

Generally the summer (February to March) surveys have found lower proportions of 'sensitive' taxa resulting in lower MCI values than the spring (October to November) surveys (see Figures 3, 4, 5, 6 and 7).

In this October 2012 survey, all sampling sites supported between 21 and 26 taxa. These results were all similar to the site medians from data since 1998. MCI scores on the other hand were less consistent, as all sites recorded scores significantly higher than their median values for surveys since November 1998 (Stark, 1998). This meant that the MCI scores at all sites also exceeded their respective median values of the entire record (Table 2, Figure 2). All sites generally had similar numbers of taxa, with site 4 recording the maximum of 26. MCI scores generally decreased steadily in a downstream direction, although the highest score was recorded at site 4, located just upstream of the railway bridge. MCI scores ranged from

good to very good, indicating that land irrigation of wastewater and cooling waters discharges to the River had not adversely affected the Kaupokonui River macroinvertebrate community in the months prior to this survey. Contrary to that frequently recorded in most previous surveys, there was only a seven unit decrease in scores between sites 6 and 7, indicating reduced impact on the macroinvertebrate communities at site 7. In most previous surveys, the entry of Dunns Creek in this reach was likely to have contributed to a frequently recorded deterioration, although it will also be related to the natural decrease in MCI with distance downstream on the Taranaki ringplain, as these sites are separated by a stream distance of 9.5km.

Table 3 Macroinvertebrate fauna of the Kaupokonui River in relation to Fonterra Kapuni sampled on 4 October 2012

Taxa List	Site Number	MCI score	3b	4	5	6	7
	Site Code		KPK000655	KPK000660	KPK000679	KPK000685	KPK000880
	Sample Number		FWB12345	FWB12346	FWB12347	FWB12348	FWB12349
NEMATODA	Nematoda	3	-	-	-	R	R
ANNELIDA	Oligochaeta	1	-	-	-	-	R
MOLLUSCA	*Potamopyrgus*	4	R	C	R	R	R
EPHEMEROPTERA	*Ameletopsis*	10	-	-	-	-	R
	Austroclima	7	C	C	C	C	R
	Coloburiscus	7	VA	VA	A	A	A
	Deleatidium	8	XA	XA	XA	XA	XA
	Nesameletus	9	A	A	A	VA	R
PLECOPTERA	*Acroperla*	5	-	R	C	R	R
	Austroperla	9	-	R	-	R	-
	Megaleptoperla	9	R	-	R	R	-
	Zelandobius	5	R	R	R	R	R
	Zelandoperla	8	C	R	C	-	-
COLEOPTERA	Elmidae	6	VA	VA	A	A	C
	Hydraenidae	8	R	C	R	-	-
	Ptilodactylidae	8	R	-	-	-	-
MEGALOPTERA	*Archichauliodes*	7	A	A	C	C	A
TRICHOPTERA	*Aoteapsyche*	4	VA	XA	VA	A	A
	Costachorema	7	R	R	C	R	C
	Hydrobiosis	5	C	C	R	C	C
	Neurochorema	6	-	R	-	-	-
	Plectrocnemia	8	-	R	-	-	-
	Psilochorema	6	-	R	-	-	-
	Beraeoptera	8	VA	VA	VA	VA	R
	Confluens	5	R	-	-	-	-
	Helicopsyche	10	-	R	-	-	-
	Olinga	9	C	A	C	R	-
	Pycnocentrodes	5	A	VA	C	VA	A
	Zelolessica	7	R	-	-	-	-
DIPTERA	*Aphrophila*	5	A	VA	A	C	R
	Eriopterini	5	C	C	R	R	-
	Maoridiamesa	3	R	-	A	A	A
	Orthocladiinae	2	R	R	R	C	A
	Tanypodinae	5	R	-	-	-	-
	Tanytarsini	3	-	-	-	R	-
	Dolichopodidae	3	-	R	-	-	-
	Empididae	3	-	-	R	-	-
ACARINA	Acarina	5	-	-	-	-	R
		No of taxa	25	26	23	23	21
		MCI	125	128	121	117	110
		SQMCIs	7.1	6.1	7.2	7.4	7.3
		EPT (taxa)	15	18	14	14	12
		%EPT (taxa)	60	69	61	61	57

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

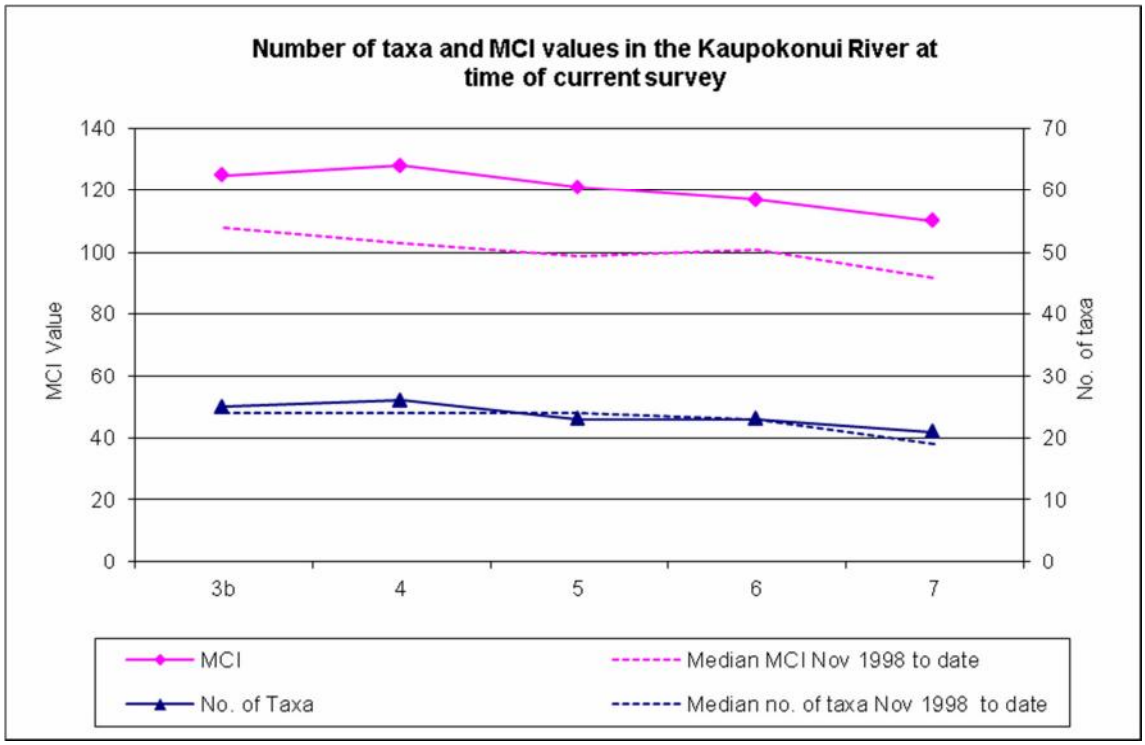

Figure 2 Numbers of taxa and MCI values recorded in the Kaupokonui River in this survey, together with median values from previous surveys (November 1998 to date)

The good MCI results are reinforced by the results of the microscopic scan, which checked for undesirable biological growths. No such growths were recorded at any site. The last time such growths were recorded, was during the spring 2010 survey, which recorded dense growths of filamentous bacteria at two sites.

Site 3b (KPK000655)

A moderate richness of twenty-five taxa was recorded at site 3b, upstream of the Fonterra Kapuni farm. This was similar to the long term median number of taxa recorded at this site to date (Table 3) and to the median richness of more recent records (since 1998). The community was characterised by nine taxa including three highly sensitive taxa (*Deleatidium* and *Nesameletus* mayfly and *Beraeoptera* caddisfly), five 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles, dobson fly larvae (*Archichauliodes*), caddisfly (*Pycnocentrodes*), and cranefly (*Aphrophila*)) and one 'tolerant' taxon (net-spinning caddisfly *Aoteapsyche*). This dominance represented a slight increase in the relative proportions of 'sensitive' to 'tolerant' taxa dominating the community, in comparison with the characteristic taxa found by the previous summer survey.

The low proportion of 'tolerant' taxa in the community (16% of taxa richness) was reflected in the MCI score (125) which was significantly higher than the previous summer survey score and also higher than the previous spring score at this site (Figure 3). The presence of eight 'highly sensitive' taxa indicated good preceding physicochemical water quality at this control site, above all Fonterra activities in the Kaupokonui River catchment.

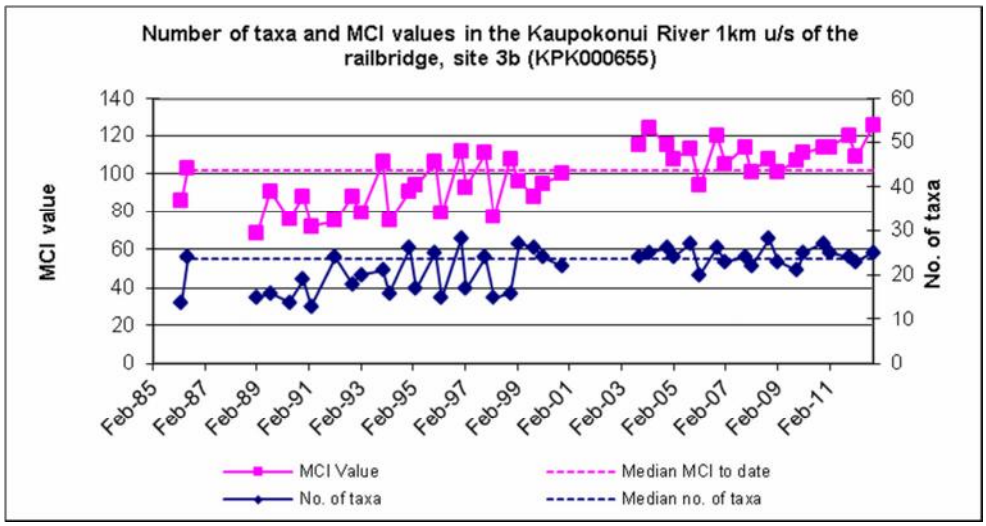

Figure 3 Numbers of taxa and MCI values recorded at site 3b in the Kaupokonui River since 1985

The MCI score of 125 units was higher than all previous MCI scores, being one unit higher than the maximum of all surveys undertaken at this site to date (Figure 3). It was also seventeen units higher than the median score for surveys since 1998 and twenty-four units higher than the median from all surveys conducted to date (Figure 2, Table 3) (Stark, 1998). The numerical dominance of the six 'sensitive' taxa resulted in a $SQMCI_s$ value of 7.1 units, 1.2 units higher than the $SQMCI_s$ value found at this site by the previous summer survey.

Site 4 (KPK000660)

A moderate richness of twenty-six macroinvertebrate taxa was recorded in the community at site 4, upstream of the Fonterra Kapuni weir and rail bridge, and downstream of the area of land irrigated by wastes from Fonterra Kapuni. Taxa richness was similar to the numbers of taxa recorded in recent monitoring years (Figure 4), and one more than that recorded at site 3b in this current survey (Table 3).

The community was characterised by four 'highly sensitive' taxa (mayfly (*Deleatidium* & *Nesameletus*) and *Beraeoptera* and *Olinga* caddisflies), five 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles, dobson fly larvae (*Archichauliodes*), *Pycnocentrodes* caddisfly and cranefly (*Aphrophila*)) and one 'tolerant' taxon (net-spinning caddisfly *Aoteapsyche*). No taxa experienced a significant change in abundance, although the net-spinning caddisfly *Aoteapsyche* increased in abundance from very abundant at site 3b to extremely abundant at site 4 (Table 3).

The MCI score at site 4 was three units higher than the score recorded upstream at site 3b (Stark, 1998), reflecting the similarities in community composition (Table 3). The MCI score was significantly higher (Stark, 1998) than the historic median recorded to date and the median of values since 1998 (Table 3, Figure 4), continuing a trend of higher than average values over the last nineteen surveys. This score was also six units higher than the previously recorded maximum at this site and higher than any previous score recorded at any of the five monitored sites to date. This indicates that preceding water quality at this site was well above average.

The $SQMCI_s$ value for this (6.1 units) was a significant 1.0 unit lower than that at site 3b (Stark, 1998) (Table 3), primarily due to the aforementioned increased abundance of 'tolerant' net-spinning caddisfly. This score indicates that the community was dominated by

'sensitive' taxa and this was further confirmation that the community had not been recently adversely affected by land irrigation upstream of this site.

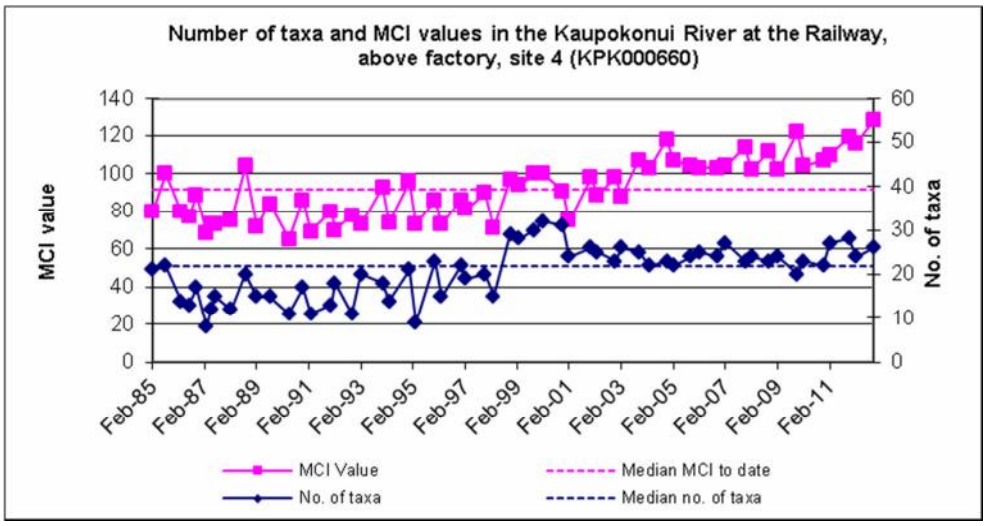

Figure 4 Numbers of taxa and MCI value recorded at site 4 in the Kaupokonui River since February 1985

In prior surveys some of the apparent deterioration between sites 3b and 4 has been attributed to the impacts of dairy shed wastes assimilation in the receiving waters of the inflowing tributary a short distance upstream of site 4. No such deterioration was found by this survey.

Site 5 (KPK000679)

A moderate richness of twenty-three macroinvertebrate taxa was found at site 5, downstream of the cooling water discharges from Fonterra Kapuni. This was similar to the median number of taxa recorded at this site since 1998 (Table 3, Figure 2). This richness was also similar to that recorded at site 4 located upstream of the cooling water discharges.

The community was characterised by three 'highly sensitive' taxa (mayfly (*Deleatidium* & *Nesameletus*) and *Beraeoptera* caddisflies), three 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles and cranefly (*Aphrophila*)) and two 'tolerant' taxa (net-spinning caddisfly *Aoteapsyche* and *Maoridiamesa* midge larvae) (Table 3).

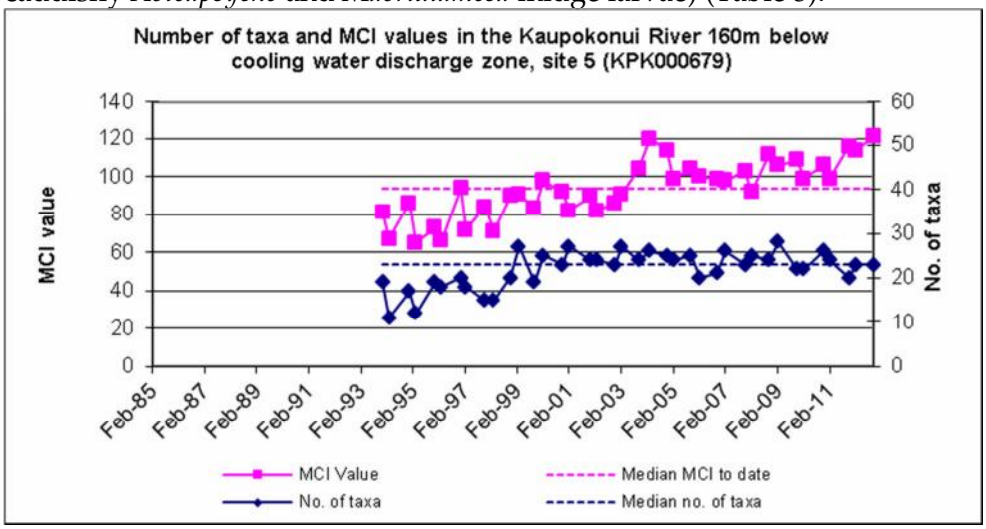

Figure 5 Numbers of taxa and MCI values recorded since December 1993 at site 5 in the Kaupokonui River

The MCI score (121 units) was the highest recorded at this site to date, slightly higher than that recorded in the previous summer survey, and higher than most of the preceding surveys' scores, especially those prior to 2003 (Figure 5). It was also significantly higher than the median of scores from all surveys to date (Figure 2, Table 2). The MCI score was an insignificant seven units less than that recorded at site 4 upstream of the cooling water spray discharge, which represents no real change in condition. This is further reinforced by the absence of sewage fungus and taxa indicative of enrichment (e.g. C*hironomus* blood worms).

The $SQMCI_S$ value (7.2 units) was a significant 1.1 units higher than that recorded at site 4, but similar to that recorded at site 3b. This increase from site 4 is primarily due to the reduced abundance of 'tolerant' net-spinning caddisfly, which dropped from extremely abundant at site 4 to very abundant at site 5. These changes are not indicative of impacts from the cooling water discharge.

It should be noted that the historical MCI median at this site was lowered by some poor results in the 1980s and early 1990s caused by wastes entering the river via the cooling water discharge. Surveys in recent years had found no sign of the 'sewage fungus' growths that were recorded at site 5 in several of the 1980s and early 1990s surveys. However, an extensive 'sewage fungus' outbreak occurred in this reach of the river during the autumn-winter months of 2007. Mats of filamentous bacteria and protozoa ('heterotrophic growths') were found on the substrate by the late summer survey of 2008, coincident with the deterioration in the macroinvertebrate community at this site at that time, and in the spring 2010 survey bacterial growths were again recorded, although there was no significant deterioration in the macroinvertebrate community. At that time subtle impacts, such as the appearance of *Chironomus* blood worms, suggested that the degree of impact was potentially approaching a 'tipping point' after which deterioration in the macroinvertebrate community was more likely, provided the poor quality discharge continued. The current survey did not record either sewage fungus or *Chironomus* blood worms, indicating that this poor quality discharge has ceased.

Site 6 (KPK000685)

A moderate richness of twenty-three taxa was recorded at site 6, at Skeet Road, a further 700 m below the cooling water discharges. This was similar to the median numbers of taxa since 1998 for this site and also the historical median. It was also similar to that found at the nearest upstream site 5 (Table 2, Figure 2 and Figure 6).

This community was characterised by similar taxa as site 5 (three 'highly sensitive' taxa (mayfly (*Deleatidium* & *Nesameletus*) and *Beraeoptera* caddisflies), three 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles and *Pycnocentrodes* caddisfly)) and two 'tolerant' taxa (net-spinning caddisfly *Aoteapsyche* and *Maoridiamesa* midge larvae)) (Table 3). This represented very little change in the abundance of 'sensitive' taxa.

The MCI score of 117 was 28 units higher than the historical median for this site and 16 units higher than the median of scores recorded since 1998 (both statistically significant differences (Stark, 1998)). This follows the previous spring survey which recorded the highest MCI score of the 58 surveys undertaken to date (Figure 2, Table 2). The current score is the third highest recorded at this site to date. Figure 6 indicates that the MCI score at this site can be variable, and as the current result is significantly higher than the respective median score, there is no indication of deterioration in community health at this site in the current survey.

The $SQMCI_S$ (7.4 units) was similar to that recorded at site 5, suggesting little change in community health. Only two taxa changed significantly in abundance at this site, and this lack of change resulted in the lack of change in $SQMCI_S$ score. Unlike in the spring 2010 survey, *Chironomus* blood worms and 'sewage fungus' were not recorded at Skeet Road. This indicates that the subtle effect caused by the discharge(s) from the Fonterra Kapuni site in that spring survey was not repeated in the current survey. It is therefore considered that there was no significant adverse effect on the macroinvertebrate communities recorded at this site.

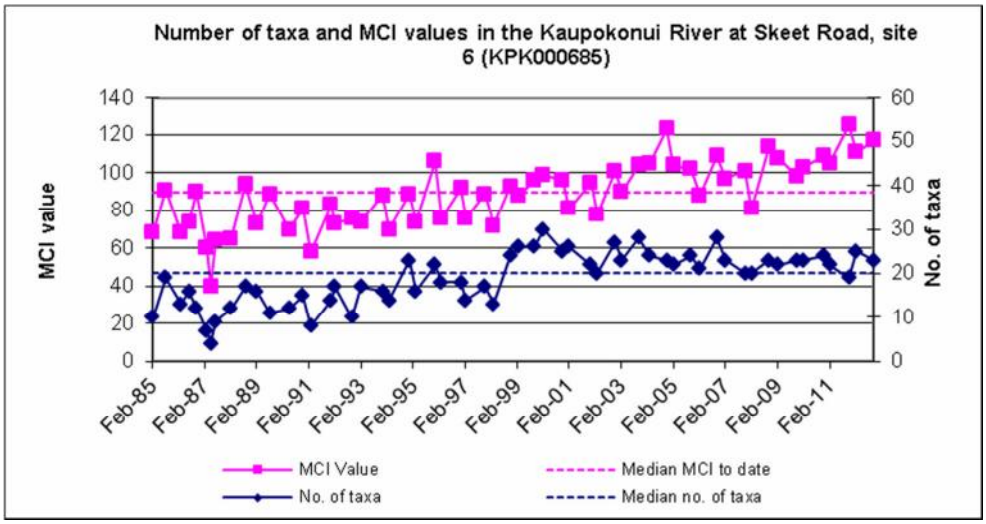

Figure 6 Numbers of taxa and MCI values recorded at site 6 in the Kaupokonui River, at Skeet Road, since February 1985

Site 7 (KPK000880)

A moderate richness of twenty-one macroinvertebrate taxa was recorded at site 7, at Upper Glenn Road (Table 2), slightly higher than both the long term median and the median richness of surveys since 1998. Four 'highly sensitive' taxa were present in this community, less than that found at the other four upstream sites, but a slight improvement on that recorded in most previous surveys. Characteristic taxa included one 'highly sensitive' taxon (*Deleatidium* mayfly), three 'moderately sensitive' taxa (*Coloburiscus* mayfly, elmid beetles, and caddisfly (*Pycnocentrodes*)) and three 'tolerant' taxa (net-spinning caddisfly *Aoteapsyche,* and *Maoridiamesa* and orthoclad midge larvae). Despite the distance between these sites 6 and 7 and a degree of natural deterioration in macroinvertebrate communities normally found in a downstream direction, community composition is usually relatively similar between sites 6 and 7. This has been repeated somewhat in the current survey, with eighteen taxa being common to both communities.

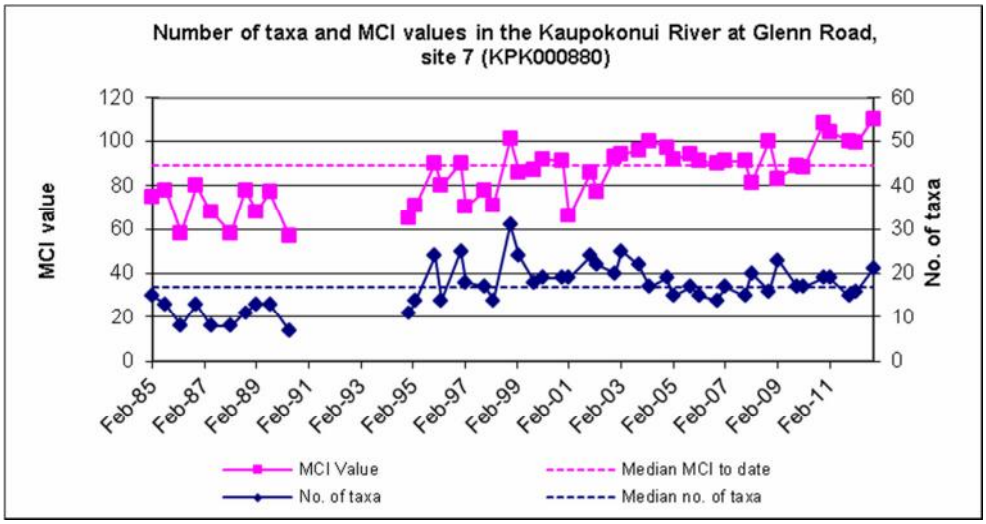

Figure 7 Numbers of taxa and MCI values recorded at site 7 in the Kaupokonui River, since February 1985

The proportion of 'sensitive' taxa (71% of taxa number) in this community resulted in a MCI score at this site of 110 units. This score is eighteen units higher than the median of scores since 1998, and twenty one units higher than the historic median at this site (Table 2, Figure 7), both statistically significant differences (Stark, 1998). This MCI score is higher than all previous scores recorded at this site, and follows the last four surveys which have all recorded MCI scores well above average. This indicates an extended period of above average health (Figure 7). However, the current MCI score was seven units less than that recorded at site 6, some 9 km upstream. This is consistent with the typical trend though this reach, which is typified by a decrease of approximately 1 to 2 MCI units/km, attributable to the natural downstream deterioration in macroinvertebrate communities found in most ring plain streams and rivers.

The $SQMCI_S$ score (6.7) on the other hand did not show a significant decrease, being only 0.1 units lower than the score at the nearest upstream site (Table 3). This lack of change was principally due to extreme abundance of the 'highly sensitive' mayfly *Deleatidium*, which strongly dominated the community. Generally, there is decreasing trend in $SQMCI_S$ score between sites 6 and 7, (especially in the summer surveys). This is usually due to the distance between the sites and the influence of the Dunns Creek, which joins between the two sites. Occasionally, there is little difference, due to site 6 showing impacts from the cooling water discharge. In the current survey, the lack of difference is not due to any cooling water influence, but due to site 7 recording a much improved community health. The lack of 'sewage fungus' at this site also supports the conclusion that there was no deterioration at site 7.

Summary and Conclusions

The Council's standard 'kick-sampling' technique was used to collect streambed macroinvertebrates from five sites in the Kaupokonui River on 4 October 2012. Samples were sorted and identified to provide the number of taxa (richness), MCI and $SQMCI_S$ scores for each site. The samples were also scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths") at a microscopic level.

The 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.

In the Kaupokonui River, taxa richnesses were similar to median richnesses, while MCI scores indicated very healthy communities at all sites. The MCI scores at all five sites were significantly higher than their median scores, with four sites recording new maxima. All sites showed improvement from those recorded by the February 2012 survey, which is a fairly typical trend for a spring survey. The survey continued to show that the Kaupokonui River generally has good quality macroinvertebrate communities throughout the reach surveyed. The standout site during the current survey was site 4 just upstream of the railway bridge, which recorded the highest MCI score of the current survey (128), thirty-seven units higher than its respective long term median. This MCI score was also higher than any other score recorded at any of the sites to date.

It can be concluded that the factory's cooling water discharges did not result in a significant adverse effect on the macroinvertebrate communities, which shows continued recovery from that recorded in the 2010 spring survey. That survey recorded the presence of sewage fungus and *Chironomus* blood worms, both indicative of enrichment, at sites 5 and 6, at least 800 metres downstream of the site. Neither was recorded in the following three surveys, or in the current survey, indicating that the discharge that caused the previous result has either ceased, or improved in quality. In addition, there was no deterioration in the macroinvertebrate community between sites upstream and downstream of spray irrigation of wastes onto land (but upstream of the cooling water discharge) from the Fonterra Kapuni factory in the current survey.

MCI values continued to indicate in general that macroinvertebrate communities were in good condition, being above median MCI scores from surveys conducted since 1998 for all sites. Similarities in community composition, including the characteristic taxa, were generally consistent for all sites, although there was some subtle variation at site 7. Although there was deterioration in MCI score recorded between sites 6 and 7 (in the lower reaches), it was not a statistically significant result, and it is also a result commonly recorded in this stream, usually due to natural deterioration in communities in a downstream direction, typical of Taranaki ringplain rivers and streams. However, in the current survey, this deterioration was more related to the good result recorded at site 6, as site 7 still recorded an improved result relative to historical data. The conclusion that there was a lack of deterioration at site 7 is supported by the lack of deterioration in the $SQMCI_S$ score through this reach, an atypical result.

The trend of improvement in communities noted in recent years adjacent to the factory was generally continued in this survey, following a break in the trend in February 2008 survey, which also recorded the additional presence of 'undesirable heterotrophic growths' on the riverbed. The spring 2010 survey also recorded such growths at two sites, although only subtle impacts were recorded in the macroinvertebrate communities. No such growth was recorded in the current survey.

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To Job Manager, James Kitto
From Scientific Officers, B Jansma
File 03-02-005-05/01; 0919-3; 0922-3; 0923-3; 0924-3; 4235-2; 4604-2; 6423-1
Report No BJ228
Doc No 1344099
Date 6 May 2014

Biomonitoring of the Kaupokonui River in relation to the Fonterra Kapuni farm and factory, February 2013.

Introduction

This biological survey was the second of two scheduled in relation to the Fonterra Kapuni (formerly Lactose) factory in the 2012-2013 monitoring year. The results from surveys performed since the 2001-2002 monitoring year are discussed in reports listed in the references section of this report. The Waiokura Stream is monitored on an annual basis in the summer, and was included in this summer survey.

This survey relates to the following consents held by Fonterra Kapuni Ltd:

0919 to discharge cooling water to the Kaupokonui River;
0922 to spray irrigate wastewater and stormwater to land in the Kaupokonui catchment;
0923 to spray irrigate wastewater and stormwater to land in the Kaupokonui (Waiokura) catchment;
0924 to discharge stormwater and cooling water to the Kaupokonui River;
4235 to discharge stormwater to the Kaupokonui River;
4604 to discharge stormwater to the Kaupokonui River
6423 to discharge stormwater from an inhalation grade lactose plant site into the Kaupokonui River

Methods

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from five sites in the Kaupokonui River in relation to discharges to the river and on to land in the catchment and two sites in the Waiokura Stream to monitor discharges to land in this catchment (Table 1, Figure 1) on 15 February 2013. The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Table 1 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

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

Macroinvertebrate taxa found in each sample were recorded as:

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

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

The MCI was designed as a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. MCI results can also reflect the effects of warm temperatures, slow current speeds and low dissolved oxygen levels, because the taxa capable of tolerating these conditions generally have low sensitivity scores. Usually more 'sensitive' communities (with higher MCI values) inhabit less polluted waterways.

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

Sub-samples of periphyton (algae and other microflora) taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths") at a microscopic level. The presence of masses of these organisms can be an indicator of organic enrichment within a stream.

Figure 1 Biomonitoring sites in the Kaupokonui River sampled in relation to Fonterra Kapuni factory discharges

Results and discussion

This survey was undertaken following a short period of receding flows in the Kaupokonui River, and followed 9 and 10 days after flow events in excess of three and seven times median flow respectively. The Kaupokonui River had a clear, uncoloured and swift flow at all sampling sites. River flow at the Glenn Road recorder site was 0.905m^3/sec, just over the mean annual low flow (0.755 m^3/sec) for the Kaupokonui River.

At the time of this morning survey, water temperatures in the Kaupokonui River ranged from 17.3°C to 16.3°C. Periphyton mats and algal filaments were patchy at all sites, with the exception of site 7 which had widespread mats, and site 3b which had only a slippery film of algae. Cobbles, gravel and boulders were the predominant substrate in the river. The Waiokura Stream sites had a finer substrate, with the bed primarily comprised of gravels and cobbles, with increased proportions of sand and silt than in the Kaupokonui Stream. Aquatic vegetation grew throughout the stream at site D, with the macrophyte *Myriophyllum* dominating. Algae were noted as only a slippery film on the substrate at site U, while site D also supported patches of algal filaments.

Macroinvertebrate communities

Kaupokonui River

Historically the mid to lower reaches of the Kaupokonui River have shown the effects of nutrient enrichment from the surrounding farmland, and in past years (mainly prior to 2000) there have been a number of surveys showing detectable impacts of discharges from the lactose factory on the riverbed fauna. On many past sampling occasions, the sites immediately upstream and downstream of the Fonterra Kapuni factory supported moderate numbers of taxa, with relatively low proportions of 'sensitive' taxa (such as mayflies and stoneflies), resulting in median MCI values in the low 80s (Table 2). Since 1998 however, macroinvertebrate communities have improved throughout the reach and have shown higher numbers of taxa and MCI scores on most occasions. Median values for both the total data set and the results since 1998 are included in Table 2. Faunal results from this survey are presented in Table 3.

Table 2 Numbers of taxa and MCI values recorded previously in the Kaupokonui River (since 1985), together with current results

Site	Number of previous surveys	Numbers of taxa				MCI values			
		Median (all data)	Range (all data)	*Median (Nov 1998 to date)*	Current survey	Median (all data)	Range (all data)	*Median (Nov 1998 to date)*	Current survey
3b	44	24	13-28	*24*	26	102	68-125	*109*	110
4	58	22	8-32	*24*	27	92	65-128	*103*	115
5	59	23	11-28	*24*	27	94	65-121	*99*	111
6	58	20	4-30	*23*	24	90	40-125	*101*	106
7	49	17	7-31	*19*	18	89	57-110	*92*	100

Generally the summer (February to March) surveys have found lower proportions of 'sensitive' taxa resulting in lower MCI values than the spring (October to November) surveys (see Figures 3, 4, 5, 6 and 7).

In this February 2013 survey, all sampling sites supported between 18 and 27 taxa. These results were all similar to the site medians from data since 1998. MCI scores on the other

hand were less consistent, although all sites recorded scores similar to or higher than their median values for surveys since November 1998. This meant that the MCI scores at all sites also exceeded their respective median values of the entire record (Table 2, Figure 2). All sites generally had similar numbers of taxa, with sites 4 and 5 recording the maximum of 27. MCI scores generally decreased steadily in a downstream direction, although the highest score was recorded at site 4, located just upstream of the railway bridge. MCI scores ranged from 100 to 115 units, reflecting good water quality, indicating that land irrigation of wastewater and cooling waters discharges to the River had not adversely affected the Kaupokonui River macroinvertebrate community in the months prior to this survey. Contrary to that frequently recorded in most previous surveys, there was only a six unit decrease in scores between sites 6 and 7, indicating reduced impact on the macroinvertebrate communities at site 7. In most previous surveys, the entry of Dunns Creek in this reach was likely to have contributed to a frequently recorded deterioration, although it will also be related to the natural decrease in MCI with distance downstream on the Taranaki ringplain, as these sites are separated by a stream distance of 9.5km.

The good MCI results are reinforced by the results of the microscopic scan, which checked for undesirable biological growths. No such growths were recorded at any site. The last time such growths were recorded, was during the spring 2010 survey, which recorded dense growths of filamentous bacteria at two sites.

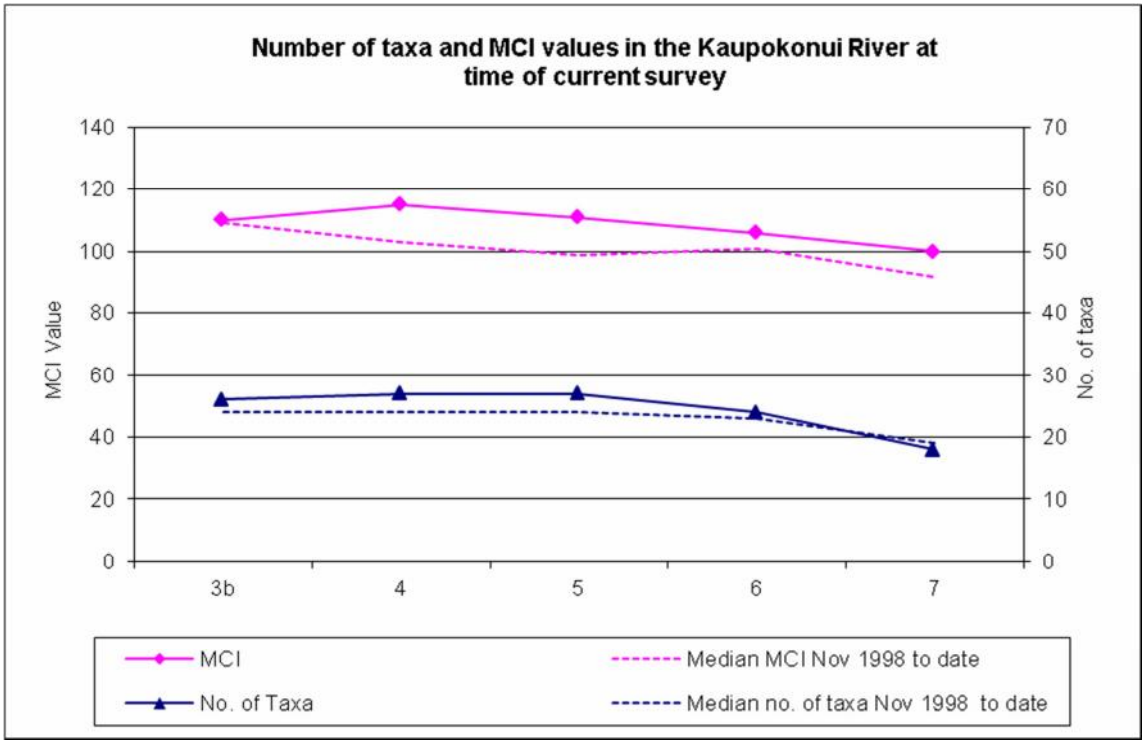

Figure 2 Numbers of taxa and MCI values recorded in the Kaupokonui River in this survey, together with median values from previous surveys (November 1998 to date)

Table 3 Macroinvertebrate fauna of the Kaupokonui River in relation to Fonterra Kapuni sampled on 15 February 2013

Taxa List	Site Number	MCI score	3b	4	5	6	7
	Site Code		KPK000655	KPK000660	KPK000679	KPK000685	KPK000880
	Sample Number		FWB13079	FWB13080	FWB13081	FWB13082	FWB13083
PLATYHELMINTHES	*Cura*	3	-	-	-	R	-
NEMERTEA	Nemertea	3	R	A	C	R	A
ANNELIDA	Oligochaeta	1	-	C	C	C	C
	Lumbricidae	5	-	R	-	-	-
MOLLUSCA	*Potamopyrgus*	4	R	VA	C	A	A
CRUSTACEA	*Paracalliope*	5	-	R	-	-	-
EPHEMEROPTERA	*Austroclima*	7	A	A	C	C	A
	Coloburiscus	7	VA	A	A	A	C
	Deleatidium	8	XA	XA	XA	XA	XA
	Nesameletus	9	A	C	C	C	R
PLECOPTERA	*Megaleptoperla*	9	R	R	R	-	-
	Stenoperla	10	-	-	R	-	-
	Zelandoperla	8	-	R	-	R	-
COLEOPTERA	Elmidae	6	VA	VA	A	VA	A
	Hydraenidae	8	C	C	C	R	-
MEGALOPTERA	*Archichauliodes*	7	A	VA	A	A	A
TRICHOPTERA	*Aoteapsyche*	4	XA	XA	XA	VA	XA
	Costachorema	7	C	R	C	C	R
	Hydrobiosis	5	C	C	C	A	A
	Neurochorema	6	R	R	R	-	-
	Psilochorema	6	-	R	-	R	-
	Beraeoptera	8	C	A	C	R	-
	Olinga	9	C	C	R	-	-
	Oxyethira	2	R	-	-	-	-
	Pycnocentrodes	5	C	C	C	A	A
DIPTERA	*Aphrophila*	5	VA	A	A	C	R
	Eriopterini	5	R	R	R	R	-
	Corynoneura	3	-	-	R	-	-
	Maoridiamesa	3	VA	-	A	C	C
	Orthocladiinae	2	VA	R	A	A	VA
	Tanypodinae	5	R	-	-	-	-
	Tanytarsini	3	R	-	R	C	R
	Muscidae	3	C	-	R	-	-
	Austrosimulium	3	R	R	R	R	-
	Tabanidae	3	-	R	-	-	-
	Tanyderidae	4	-	-	-	-	R
		No of taxa	26	27	27	24	18
		MCI	110	115	111	106	100
		SQMCIs	5.6	5.9	5.9	6.7	5.6
		EPT (taxa)	12	14	13	11	8
		%EPT (taxa)	46	52	48	46	44
'Tolerant' taxa	'Moderately sensitive' taxa			'Highly sensitive' taxa			

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site 3b (KPK000655)
A moderate richness of twenty-six taxa was recorded at site 3b, upstream of the Fonterra Kapuni farm. This was similar to the long term median number of taxa recorded at this site to date (Table 3) and to the median richness of more recent records (since 1998). The community was characterised by ten taxa including two highly sensitive taxa (*Deleatidium* and *Nesameletus* mayfly), five 'moderately sensitive' taxa (mayfly (*Austroclima* and *Coloburiscus*), elmid beetles, dobson fly larvae (*Archichauliodes*), and cranefly (*Aphrophila*)) and three 'tolerant' taxa (net-spinning caddisfly *Aoteapsyche* and midge larvae (orthoclad & *Maoridiamesa*). This dominance represented a slight decrease in the relative proportions of 'sensitive' to 'tolerant' taxa dominating the community, in comparison with the characteristic taxa found by the previous spring survey.

The moderate proportion of 'tolerant' taxa in the community (35% of taxa richness) was reflected in the MCI score (110) which was significantly lower than the previous spring survey score and but similar to the previous summer score at this site (Figure 3). The presence of six 'highly sensitive' taxa indicated good preceding physicochemical water quality at this control site, above all Fonterra activities in the Kaupokonui River catchment.

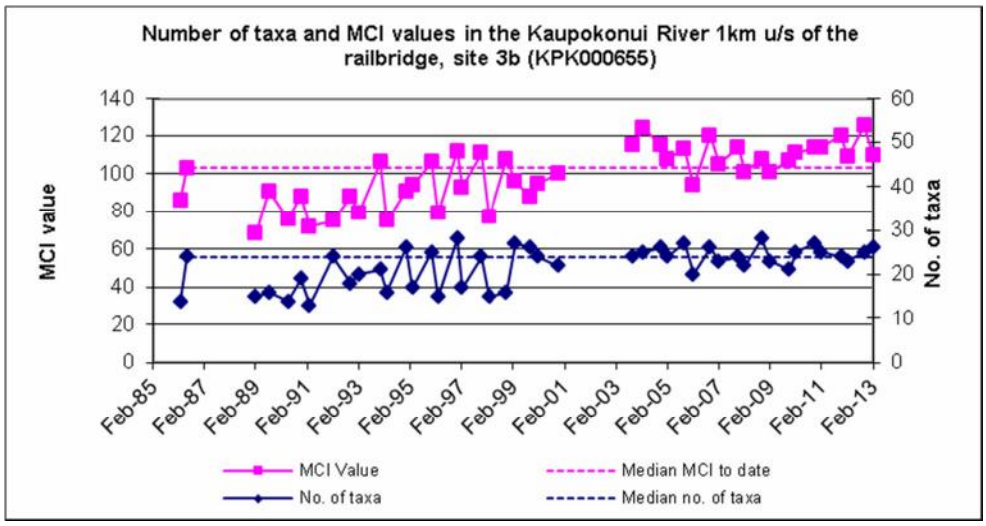

Figure 3 Numbers of taxa and MCI values recorded at site 3b in the Kaupokonui River since 1985

The MCI score of 110 units was well within the range recorded in recent surveys (Figure 3). It was only one unit higher than the median score for surveys since 1998 and eight units higher than the median from all surveys conducted to date (Figure 2, Table 3). The relative balance in the numerical dominance of 'sensitive' and 'tolerant' taxa resulted in a $SQMCI_s$ value of 5.6 units, 1.5 units lower than the $SQMCI_s$ value found at this site by the previous summer survey.

Site 4 (KPK000660)
A moderate richness of twenty-seven macroinvertebrate taxa was recorded in the community at site 4, upstream of the Fonterra Kapuni weir and rail bridge, and downstream of the area of land irrigated by wastes from Fonterra Kapuni. Taxa richness was similar to the numbers of taxa recorded in recent monitoring years (Figure 4), and one more than that recorded at site 3b in this current survey (Table 3).

The community was characterised by two 'highly sensitive' taxa (mayfly (*Deleatidium*) and *Beraeoptera* caddisflies), five 'moderately sensitive' taxa (mayfly (*Austroclima* and

Coloburiscus), elmid beetles, dobson fly larvae (*Archichauliodes*) and cranefly (*Aphrophila*)) and three 'tolerant' taxa (nemertean worms, *Potamopyrgus* snails and net-spinning caddisfly *Aoteapsyche*). Five taxa experienced a significant change in abundance, all 'tolerant' taxa, two of which increased in abundance, three which decreased (Table 3).

The MCI score at site 4 was five units higher than the score recorded upstream at site 3b (Stark, 1998), reflecting the similarities in community composition (Table 3). The MCI score was significantly higher (Stark, 1998) than the historic median recorded to date and the median of values since 1998 (Table 3, Figure 4), continuing a trend of higher than average values over the last twenty surveys. This indicates that this site had experienced good water quality in the weeks prior to this survey.

The $SQMCI_s$ value for this (5.9 units) was an insignificant 0.3 unit higher than that at site 3b (stark, 1998) (Table 3), primarily due to both sites being dominated by the same two taxa, as both *Deleatidium* mayfly and the net-spinning caddisfly *Aoteapsyche* were both extremely abundant at both sites. This score indicates that the community contained a healthy proportion of 'sensitive' taxa (for a summer survey) and this was further confirmation that the community had not been recently adversely affected by land irrigation upstream of this site.

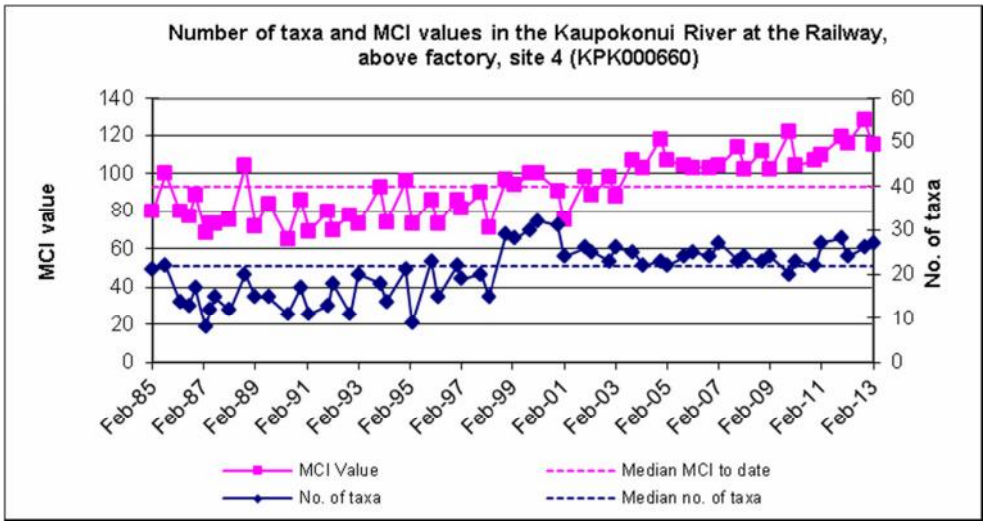

Figure 4 Numbers of taxa and MCI value recorded at site 4 in the Kaupokonui River since February 1985

In prior surveys some of the apparent deterioration between sites 3b and 4 has been attributed to the impacts of dairy shed wastes assimilation in the receiving waters of the inflowing tributary a short distance upstream of site 4. No such deterioration was found by this survey.

Site 5 (KPK000679)

A moderate richness of twenty-seven macroinvertebrate taxa was found at site 5, downstream of the cooling water discharges from Fonterra Kapuni. This was slightly higher than the median number of taxa recorded at this site since 1998 (Table 3, Figure 2). This richness was equal to that recorded at site 4 located upstream of the cooling water discharges.

The community was characterised by one 'highly sensitive' taxon (mayfly (*Deleatidium*)), four 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles, dobsonfly larvae

(Archichauliodes) and cranefly (*Aphrophila*)) and three 'tolerant' taxa (net-spinning caddisfly *Aoteapsyche* and *Maoridiamesa* and orthoclad midge larvae) (Table 3).

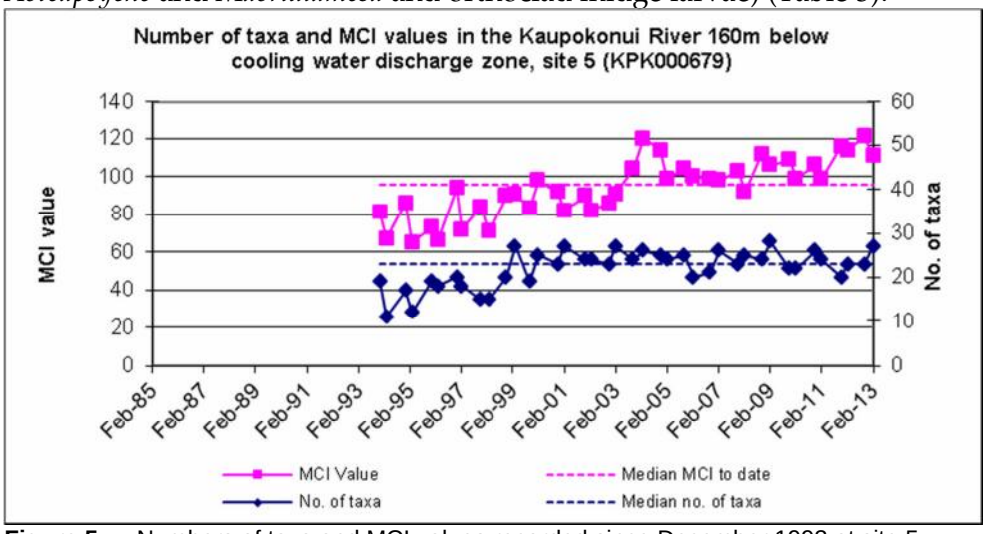

Figure 5 Numbers of taxa and MCI values recorded since December 1993 at site 5 in the Kaupokonui River

The MCI score (111 units) was the similar to that recorded in the previous three surveys and higher than most of the earlier surveys' scores, especially those prior to 2003 (Figure 5). It was also significantly higher (Stark, 1998) than the median of scores from all surveys to date (Figure 2, Table 2). The MCI score was an insignificant four units less than that recorded at site 4 upstream of the cooling water spray discharge, which represents no real change in condition. This is further reinforced by the absence of sewage fungus and taxa indicative of enrichment (e.g. C*hironomus* blood worms).

The $SQMCI_S$ value (5.9 units) was equal to that recorded at site 4, and similar to that recorded at site 3b. As with sites 3b and 4, the community at this site was dominated by *Deleatidium* mayfly and the net-spinning caddisfly *Aoteapsyche,* which were both extremely abundant. This explains the similarity in $SQMCI_S$ values between these sites, and overall, is not indicative of impacts from the cooling water discharge.

It should be noted that the historical MCI median at this site was lowered by some poor results in the 1980s and early 1990s caused by wastes entering the river via the cooling water discharge. Surveys in recent years had found no sign of the 'sewage fungus' growths that were recorded at site 5 in several of the 1980s and early 1990s surveys. However, an extensive 'sewage fungus' outbreak occurred in this reach of the river during the autumn-winter months of 2007. Mats of filamentous bacteria and protozoa ('heterotrophic growths') were found on the substrate by the late summer survey of 2008, coincident with the deterioration in the macroinvertebrate community at this site at that time, and in the spring 2010 survey bacterial growths were again recorded, although there was no significant deterioration in the macroinvertebrate community. At that time subtle impacts, such as the appearance of *Chironomus* blood worms, suggested that the degree of impact was potentially approaching a 'tipping point' after which deterioration in the macroinvertebrate community was more likely, provided the poor quality discharge continued. The current survey did not record either sewage fungus or *Chironomus* blood worms, indicating that this poor quality discharge has ceased.

Site 6 (KPK000685)
A moderate richness of twenty-four taxa was recorded at site 6, at Skeet Road, a further 700 m below the cooling water discharges. This was similar to the median numbers of taxa since 1998 for this site and also the historical median. It was also similar to that found at the nearest upstream site 5 (Table 2, Figure 2 and Figure 6).

This community was characterised by similar taxa as site 5 (one 'highly sensitive' taxon (mayfly (*Deleatidium*)), five 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles, dobsonfly larvae (*Archichauliodes*) and caddisfly (*Hydrobiosis* and *Pycnocentrodes*)) and three 'tolerant' taxa (net-spinning caddisfly *Aoteapsyche* and orthoclad midge larvae)) (Table 3). This represented very little change in the abundance of 'sensitive' taxa.

The MCI score of 106 was sixteen units higher than the historical median for this site but only five units higher than the median of scores recorded since 1998. Although this result is less than that recorded in the previous three surveys, it is still higher than most previous surveys undertaken to date (Figure 2, Table 2). Figure 6 indicates that the MCI score at this site can be variable, and as the current result is significantly higher than the respective long-term median score, there is no indication of deterioration in community health at this site in the current survey.

The $SQMCI_s$ (6.7 units) was the highest recorded in the current survey, and was 0.8 unit higher than to that recorded at site 5, suggesting little change in community health. No two taxa changed significantly in abundance at this site (from site 5), and this lack of change resulted in the lack of change in $SQMCI_S$ score. Unlike in the spring 2010 survey, *Chironomus* blood worms and 'sewage fungus' were not recorded at Skeet Road. This indicates that the subtle effect caused by the discharge(s) from the Fonterra Kapuni site in that spring survey was not repeated in the current survey. It is therefore considered that there was no significant adverse effect on the macroinvertebrate communities recorded at this site.

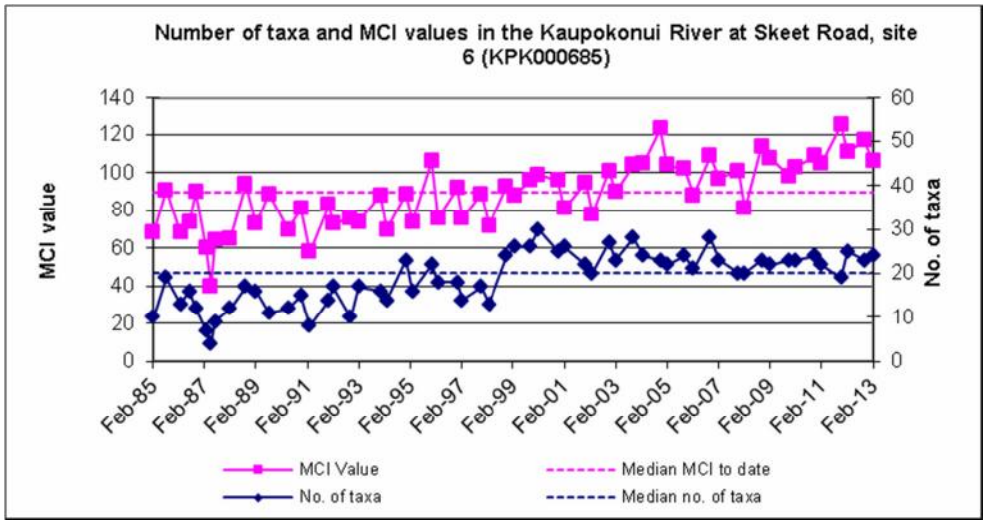

Figure 6 Numbers of taxa and MCI values recorded at site 6 in the Kaupokonui River, at Skeet Road, since February 1985

Site 7 (KPK000880)
A moderate richness of eighteen macroinvertebrate taxa was recorded at site 7, at Upper Glenn Road (Table 2), similar to both the long term median and the median richness of surveys since 1998. Two 'highly sensitive' taxa were present in this community, less than that found at the other four upstream sites, but similar to that recorded in most previous

surveys. Characteristic taxa included one 'highly sensitive' taxon (*Deleatidium* mayfly), five 'moderately sensitive' taxa (*Austroclima* mayfly, elmid beetles, dobsonfly larvae (*Archichauliodes*) and caddisfly (*Hydrobiosis* and *Pycnocentrodes*)) and four 'tolerant' taxa (nemertean worms, *Potamopyrgus* snails, net-spinning caddisfly *Aoteapsyche,* and orthoclad midge larvae). Despite the distance between these sites 6 and 7 and a degree of natural deterioration in macroinvertebrate communities normally found in a downstream direction, community composition is usually relatively similar between sites 6 and 7. This has been repeated somewhat in the current survey, with sixteen taxa being common to both communities.

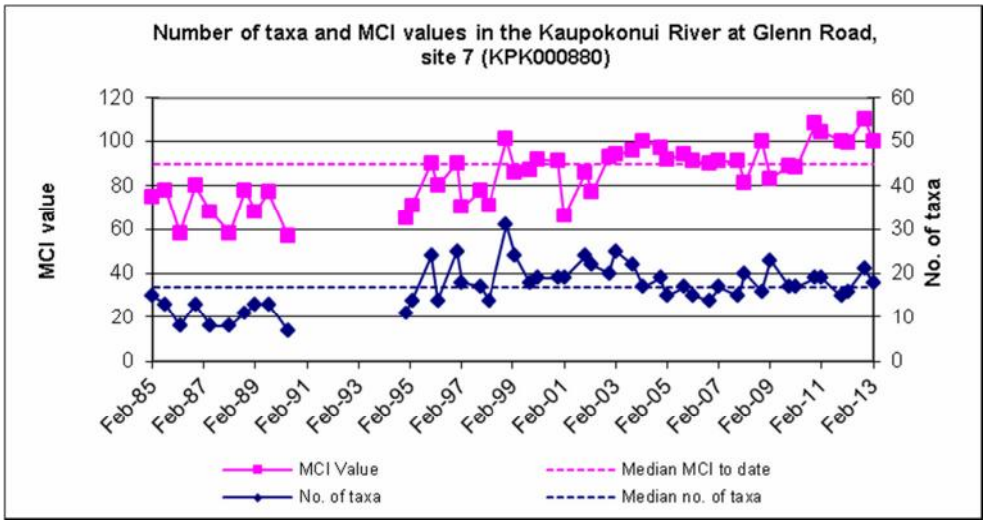

Figure 7 Numbers of taxa and MCI values recorded at site 7 in the Kaupokonui River, since February 1985

The proportion of 'sensitive' taxa (61% of taxa number) in this community resulted in a MCI score at this site of 100 units. This score is eight units higher than the median of scores since 1998, and eleven units higher than the historic median at this site (Table 2, Figure 7), the latter a statistically significant difference (Stark, 1998). This MCI score is similar to that recorded in the last four surveys, which have all recorded MCI scores well above average. This indicates an extended period of above average health (Figure 7). However, the current MCI score was six units less than that recorded at site 6, some 9 km upstream. This is consistent with the typical trend though this reach, which is typified by a decrease of approximately 1 to 2 MCI units/km, attributable to the natural downstream deterioration in macroinvertebrate communities found in most ring plain streams and rivers.

The $SQMCI_S$ score (5.6) on the other hand did show a significant decrease, being 1.1 units lower than the score at the nearest upstream site (Table 3). This change was principally due to increased abundance of net-spinning caddisfly (*Aoteapsyche*) and nemertean worms, both 'tolerant' taxa. Generally, there is decreasing trend in $SQMCI_S$ score between sites 6 and 7, (especially in the summer surveys). This is usually due to the distance between the sites and the influence of the Dunns Creek, which joins between the two sites. Occasionally, there is little difference, due to site 6 showing impacts from the cooling water discharge. In the current survey, there is no evidence of a cooling water influence, indicating that this deterioration can be largely attributed to natural downstream deterioration. The lack of 'sewage fungus' at this site also supports the conclusion that there was no deterioration at site 7.

Waiokura Stream

The Waiokura Stream was included in the biological monitoring programme for the first time in the 2002-2003 monitoring year, to monitor effects from irrigation of wastewater and stormwater from the Fonterra Kapuni site onto land in the Waiokura Stream catchment. The location of the irrigation areas in relation to the biological (and water quality) monitoring sites is shown in Figure 8. This was the twelfth biological survey related to this monitoring programme conducted at the two sites in this stream and results from this survey are summarised in Table 4, with full results given in Table 5. No 'heterotrophic growths' were seen on the bed of the stream nor were any found microscopically by this survey at either of the two sites.

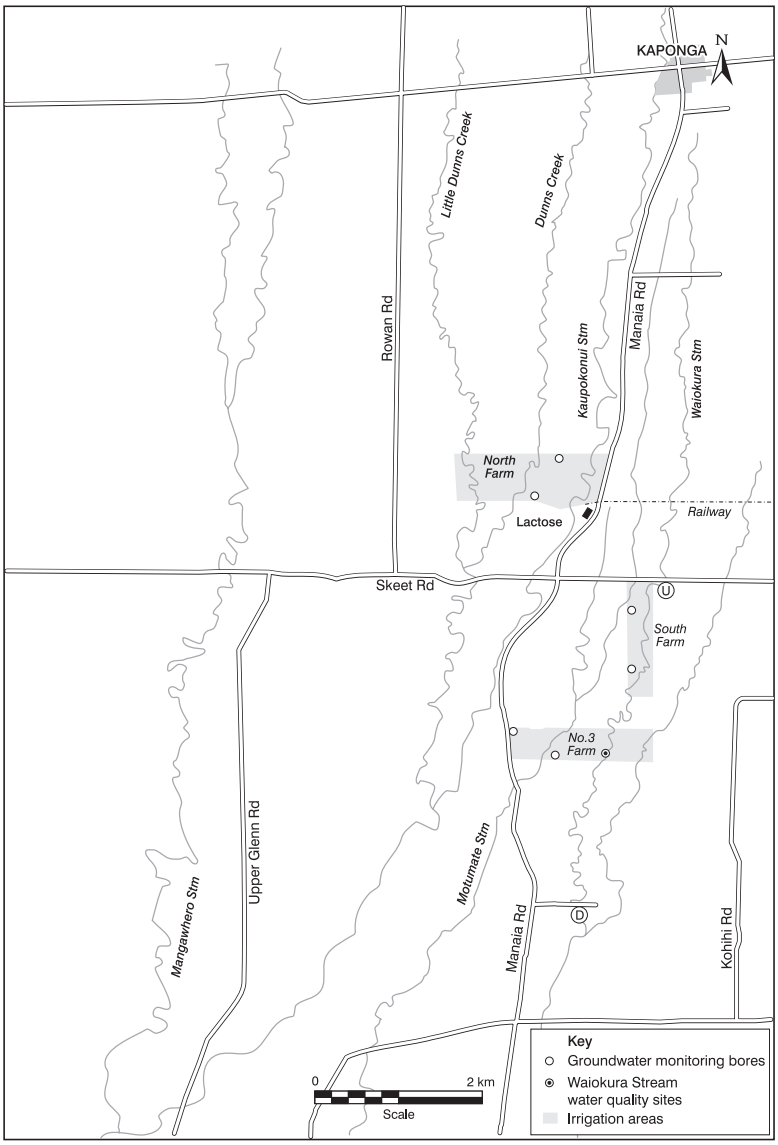

Figure 8 Waiokura Stream biomonitoring site (U and D) locations in relation to Fonterra Kapuni wastes irrigation

Table 4 Numbers of taxa and MCI values recorded previously in the Waiokura Stream, together with current results

Site	Number of previous surveys	Numbers of taxa			MCI values		
		Median	Range	Feb 2013	Median	Range	Feb 2013
U	16	23	18-28	29	98	88-114	101
D	11	22	15-27	27	90	81-103	99

Table 5 Macroinvertebrate fauna of the Waiokura Stream in relation to Fonterra, Kapuni land irrigation of wastes, sampled on 15 February 2013

Taxa List	Site Number	MCI score	U	D
	Site Code		WKR000500	WKR000650
	Sample Number		FWB13084	FWB13085
NEMERTEA	Nemertea	3	R	R
ANNELIDA	Oligochaeta	1	R	C
MOLLUSCA	*Ferrissia*	3	-	R
	Potamopyrgus	4	VA	XA
CRUSTACEA	Ostracoda	1	-	R
	Paracalliope	5	-	C
	Paraleptamphopidae	5	-	C
	Paranephrops	5	R	-
EPHEMEROPTERA	*Austroclima*	7	XA	XA
	Coloburiscus	7	A	R
	Deleatidium	8	VA	XA
	Nesameletus	9	R	R
	Zephlebia group	7	VA	A
PLECOPTERA	*Zelandobius*	5	C	-
COLEOPTERA	Elmidae	6	XA	XA
MEGALOPTERA	*Archichauliodes*	7	A	VA
TRICHOPTERA	*Aoteapsyche*	4	VA	VA
	Costachorema	7	-	R
	Hydrobiosis	5	C	C
	Psilochorema	6	R	C
	Beraeoptera	8	R	-
	Oeconesidae	5	R	-
	Oxyethira	2	R	R
	Pycnocentria	7	R	C
	Pycnocentrodes	5	C	XA
	Triplectides	5	-	R
	Zelolessica	7	R	-
DIPTERA	*Aphrophila*	5	C	R
	Harrisius	6	R	-
	Maoridiamesa	3	R	-
	Orthocladiinae	2	R	-
	Polypedilum	3	C	R
	Tanytarsini	3	C	-
	Austrosimulium	3	A	R
	Tanyderidae	4	R	R
ACARINA	Acarina	5	-	R
		No of taxa	29	27
		MCI	101	99
		SQMCIs	6.2	6.0
		EPT (taxa)	14	12
		%EPT (taxa)	48	44

'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site U (WKR000500)
A relatively high richness of twenty-nine taxa was recorded at site U, upstream of the Fonterra wastes irrigation areas. This number of taxa was six taxa higher than the median and the highest recorded to date, of the small number of surveys undertaken at this site (Table 4). The community was characterised by one 'highly sensitive' taxon (mayfly (*Deleatidium*), five 'moderately sensitive' taxa (mayfly (*Austroclima*, *Coloburiscus* and *Zephlebia*), elmid beetles and dobsonfly larvae (*Archichauliodes*)), and three 'tolerant' taxa (*Potamopyrgus* snails, net-spinning caddisfly *Aoteapsyche* and sandfly larvae (*Austrosimulium*)) (Table 5).

The MCI value of 101 units was three units higher than that recorded in the previous survey, but similar to the median of previous values recorded from the sixteen previous surveys at this site (Table 5, Figure 9) and reflected the moderate proportion of 'tolerant' taxa (38% of taxa richness) in the community (Table 5). The $SQMCI_s$ score of 6.2 units was near the maximum of the range of previously recorded values at this site, and reflected the dominance of 'sensitive' taxa in particular (Table 5).

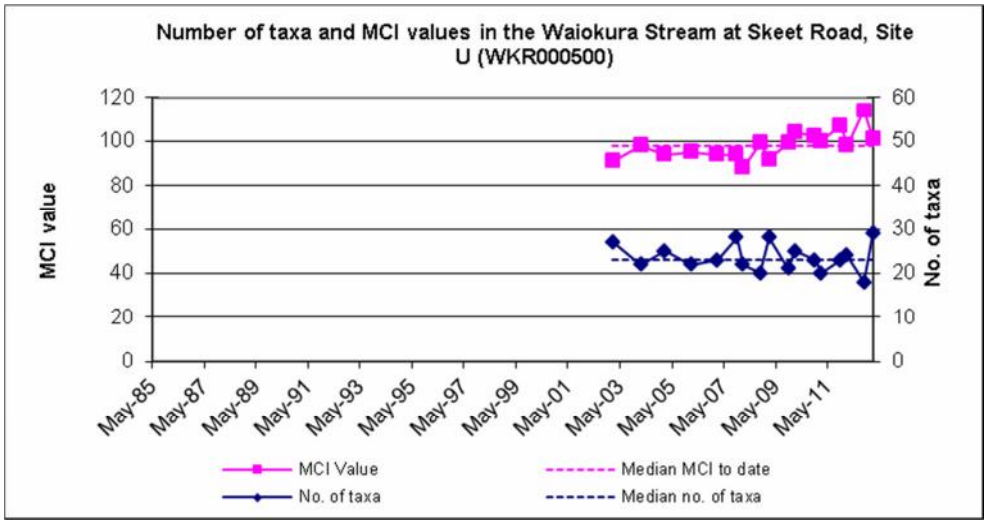

Figure 9 Numbers of taxa and MCI values recorded at site U in the Waiokura Stream since February 1985

Site D (WKR000650)
A moderately high of twenty-seven taxa was recorded at this site downstream of the wastes irrigation areas in the Waiokura Stream catchment. This was similar to that recorded at site U and equal to the maximum taxa number previously recorded at this downstream site (Table 2). With the exception of *Austrosimulium* sandfly larvae, those taxa that dominated the community at site U were also dominant at this site, with the addition of one 'moderately sensitive' taxon (*Pycnocentrodes* caddisfly) (Table 5). This is despite a significant change in habitat with macrophytes, which were absent at site U, being present throughout the stream at this site.

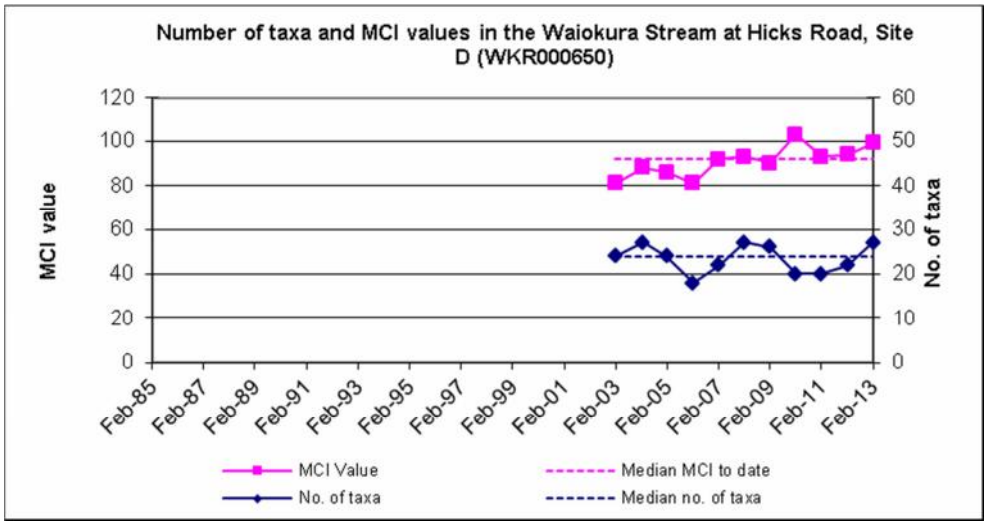

Figure 10 Numbers of taxa and MCI values recorded at site D in the Waiokura Stream since February 1985

A moderate proportion of 'tolerant' taxa (37% of taxa richness) was present at this site, which was reflected in the MCI value of 99 units. This score was five units higher than that recorded in the previous survey, was the second highest MCI score recorded to date at this site, and nine units above the median of the eleven surveys performed at this site (Table 5, Figure 10) (Stark, 1998). The MCI score was an insignificant two units less than that recorded upstream at site U, which indicates little difference in water quality between these two sites. Despite seven significant changes in individual taxon abundance between the sites, the $SQMCI_s$ did not differ significantly from site U, upstream of the irrigation areas (Table 5). As the main changes in index scores is attributable to differences in habitat between the two sites, the similarity in community health was encouraging, and indicated that wastes discharged from the Fonterra Kapuni site on to land in the Waiokura Stream catchment have not had a recent detrimental effect on the communities of this stream.

Summary and Conclusions

The Council's standard 'kick-sampling' technique was used to collect streambed macroinvertebrates from five sites in the Kaupokonui River and two sites in the Waiokura Stream on 15 February 2013. Samples were sorted and identified to provide the number of taxa (richness), MCI and $SQMCI_S$ scores for each site. The samples were also scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths") at a microscopic level.

The 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.

In the Kaupokonui River, taxa richnesses were similar to median richnesses, while MCI scores indicated healthy communities at all sites. The MCI scores at all five sites were similar to or higher than their median scores. All sites showed some reduction in community health

from those recorded by the October 2012 survey, which is a fairly typical trend for a summer survey. The survey continued to show that the Kaupokonui River generally has good quality macroinvertebrate communities throughout the reach surveyed. The standout site during the current survey was site 4 just upstream of the railway bridge, which recorded the highest MCI score of the current survey (115), twenty-three units higher than its respective long term median.

It can be concluded that the factory's cooling water discharges did not result in a significant adverse effect on the macroinvertebrate communities, which shows continued recovery from that recorded in the 2010 spring survey. That survey recorded the presence of sewage fungus and *Chironomus* blood worms, both indicative of enrichment, at sites 5 and 6, at least 800 metres downstream of the site. Neither was recorded in the following four surveys, or in the current survey, indicating that the discharge that caused the previous result has either ceased, or improved in quality. In addition, there was no deterioration in the macroinvertebrate community between sites upstream and downstream of spray irrigation of wastes onto land (but upstream of the cooling water discharge) from the Fonterra Kapuni factory in the current survey.

MCI values continued to indicate in general that macroinvertebrate communities were in good condition, being above median MCI scores from surveys conducted since 1998 for all sites. Similarities in community composition, including the characteristic taxa, were generally consistent for all sites, although there was some subtle variation at site 7. Although there was deterioration in MCI score recorded between sites 6 and 7 (in the lower reaches), it was not a statistically significant result, and it is also a result commonly recorded in this stream, usually due to natural deterioration in communities in a downstream direction, typical of Taranaki ringplain rivers and streams. However, in the current survey, this deterioration was more related to the good result recorded at site 6, as site 7 still recorded an improved result relative to historical data. The $SQMCI_S$ score however did indicate the presence of some natural deterioration at site 7, as this score reduced by 1.1 units from site 6, a statistically significant result.

The trend of improvement in communities noted in recent years adjacent to the factory was generally continued in this survey, following a break in the trend in February 2008 survey, which also recorded the additional presence of 'undesirable heterotrophic growths' on the riverbed. The spring 2010 survey also recorded such growths at two sites, although only subtle impacts were recorded in the macroinvertebrate communities. No such growth was recorded in the current survey.

The Waiokura Stream communities indicated that conditions during this survey were similar to or better than during the relatively limited number of previous surveys at these two sites to date. The MCI value recorded at the downstream site was less than that recorded upstream (but not significantly so), and both values were similar to or above their respective medians. There were only subtle changes in macroinvertebrate community compositions between the sites despite some differences in habitat, principally the increase in macrophytes downstream. These community differences were insignificant and not indicative of recent impacts of wastewater irrigation within the Waiokura Stream catchment.

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Appendix IV

Groundwater monitoring data

SITE	DATE	TIME	LEVEL	TEMP	CONDY	PH	NNN	CL	NA	NH4	COD
		NZST	m	°C	mS/m@20C	pH	g/m³ N	g/m³	g/m³	g/m³ N	g/m³
Farm 1											
GND0636	28-Aug-12	13:20	2.26	12.9	30.7	6.7	3.72	36.7	20.8	0.009	<5
GND0636	30-Oct-12	12:45	2.67	13.5	28.0	6.4	6.25				
GND0636	08-Jan-13	10:35	3.37	13.6	29.3	6.4	6.61	35.2	24.9	<0.003	<5
GND0636	25-Mar-13	10:35	3.74	13.9	29.7	6.4	7.48				
GND0636	30-May-13	12:30	3.89	13.8	29.9	6.4	6.91	35.5	26.1	0.011	<5
GND0636	26-Jun-13	12:45	3.52	13.7	30.0	6.5	7.40				
GND0637	28-Aug-12	13:00	3.52	14.1	69.4	6.5	17.8	55.8	73.6	0.031	6
GND0637	30-Oct-12	12:30	3.97	14.2	66.6	6.4	14.9				
GND0637	08-Jan-13	10:50	4.96	14.2	65.3	6.4	12.6	45.8	71.2	<0.003	7
GND0637	25-Mar-13	10:20	5.77	14.8	38.3	6.5	5.13				
GND0637	30-May-13	12:20	6.15	13.7	37.7	6.5	5.22	44.7	43.1	0.013	11
GND0637	26-Jun-13	12:30	3.52	13.7	37.5	6.6	5.39				
Farm 2											
GND2049	28-Aug-12	10:05	2.24	13.2	36.6	6.5	13.4	43.2	29.9	0.059	<5
GND2049	30-Oct-12	10:10	2.60	13.5	35.2	6.4	11.8				
GND2049	08-Jan-13	08:20	3.30	14.0	35.0	6.5	12.3	39.8	29.4	<0.003	<5
GND2049	25-Mar-13	08:20	3.80	14.1	36.1	6.4	12.3				
GND2049	30-May-13	10:25	3.58	14.0	35.4	6.4	13.1	43.3	31.2	0.005	<5
GND2049	26-Jun-13	09:45	2.66	14.0	34.4	6.5	11.9				
GND0638	28-Aug-12	11:05	2.18	14.1	64.4	6.6	6.16	48.2	68.2	<0.003	<5
GND0638	30-Oct-12	10:25	2.87	14.3	71.5	6.5	6.96				
GND0638	08-Jan-13	09:10	3.08	14.7	68.0	6.6	9.70	58.2	76.0	<0.003	39
GND0638	25-Mar-13	09:00	3.49	15.0	68.2	6.5	7.82				
GND0638	30-May-13	11:05	3.68	15.2	65.4	6.5	8.32	55.8	84.0	<0.003	8
GND0638	26-Jun-13	10:50	2.25	15.1	62.2	6.6	9.90				
GND2050	28-Aug-12	10:30	2.30	13.5	66.8	6.8	11.7	63.2	91.3	0.024	<5
GND2050	30-Oct-12	10:40	2.68	14.3	69.0	6.6	12.0				
GND2050	08-Jan-13	08:40	2.91	14.4	53.3	6.8	0.02	50.1	55.4	0.433	21
GND2050	25-Mar-13	08:35	3.12	14.5	54.4	6.8	0.06				
GND2050	30-May-13	10:40	3.05	14.3	50.1	6.8	0.12	49.8	54.1	0.418	7
GND2050	26-Jun-13	10:10	2.57	14.1	49.8	7.0	10.3				

SITE	DATE	TIME	LEVEL	TEMP	CONDY	PH	NNN	CL	NA	NH4	COD
		NZST	m	°C	mS/m@20C	pH	g/m³ N	g/m³	g/m³	g/m³ N	g/m³
Farm 3											
GND2051	28-Aug-12	12:25	2.65	13.9	30.1	6.6	7.15	34.6	24.2	<0.003	<5
GND2051	30-Oct-12	11:55	3.15	14.3	30.2	6.4	6.16				
GND2051	08-Jan-13	10:05	3.74	14.2	29.6	6.5	5.25	36.5	23.8	<0.003	<5
GND2051	25-Mar-13	09:50	4.22	14.2	30.8	6.5	5.66				
GND2051	30-May-13	11:55	4.06	13.9	31.0	6.5	5.76	50.0	29.5	0.011	<5
GND2051	26-Jun-13	11:50	4.46	14.1	31.2	6.5	5.96				
GND0641	28-Aug-12	11:45	1.17	13.6	58.5	6.6	12.4	71.3	49.5	0.006	5
GND0641	30-Oct-12	11:25	1.40	13.7	62.8	6.5	15.2				
GND0641	08-Jan-13	09:40	2.21	14.4	60.9	6.5	12.5	76.9	49.3	<0.003	10
GND0641	25-Mar-13	09:25	2.94	15.7	58.2	6.6	8.18				
GND0641	30-May-13	11:25	1.49								
GND0639	28-Aug-12	10:20	2.44	13.7	56.6	7.0	15.6	60.6	105	0.006	<5
GND0639	30-Oct-12	10:35	3.17	13.7	66.6	6.9	19.1				
GND0639	08-Jan-13	08:30	3.65	13.7	64.2	7.1	16.6	79.5	118	<0.003	19
GND0639	25-Mar-13	08:30	4.22								
GND0639	30-May-13	10:35	>4.18								
GND2052	28-Aug-12	11:30	2.14	13.7	37.6	6.6	4.54	51.9	44.7	0.211	<5
GND2052	30-Oct-12	11:15	2.64	14.2	29.7	6.7	0.29				
GND2052	08-Jan-13	09:30	3.13	14.2	29.2	6.8	<0.01	45.6	34.8	0.443	29
GND2052	25-Mar-13	09:15	3.33	14.7	41.4	6.5	5.53				
GND2052	30-May-13	11:15	3.16	14.6	31.2	6.6	0.03	47.3	41.8	0.047	<5
GND2052	26-Jun-13	11:15	1.89	13.9	33.9	6.6	5.68				
GND0700	28-Aug-12	11:55	1.55	13.6	67.3	6.8	12.0	91.3	92.5	0.003	6
GND0700	30-Oct-12	11:35	2.39	14.1	57.4	6.7	8.12				
GND0700	08-Jan-13	09:45	2.74	14.5	42.8	6.7	3.13	70.8	60.6	<0.003	13
GND0700	25-Mar-13	09:35	3.16	14.4	61.4	6.6	8.82				
GND0700	30-May-13	11:30	3.12	14.2	36.3	6.8	0.23	60.5	52.5	0.012	5
GND0700	26-Jun-13	11:30	1.91	14.5	60.5	6.8	3.80				