Irrigation Water
Compliance Monitoring Programme
Annual Report
2012-2013

Technical Report 2013-100

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Taranaki Regional Council
Private Bag 713
STRATFORD

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Executive summary

This is the eleventh Annual Report issued by the Taranaki Regional Council (the Council) to report on compliance monitoring programmes associated with resource consents for abstraction of freshwater for irrigation purposes in Taranaki. The report covers the period 1 July 2012 – 30 June 2013. It encompasses the data collected for compliance monitoring for resource consents for pasture irrigation, horticultural and golf courses irrigation as per the recommendations from the previous reports. Every year the Council prepares a monitoring programme for all pasture irrigation water permits.

Water is a public resource and the authorisation to take it is granted through resource consent. Associated with that permission is a public expectation that the water will be used efficiently and will not be wasted – an expectation that can be better met if the actual amounts of water taken are accurately measured and recorded. Maintaining environmentally appropriate residual flow-rates in streams and rivers to protect aquatic habitat is of primary concern to the Council when assessing water take applications.

At 30 June 2013, a total of 76 resource consents to take and use freshwater for irrigation purposes were registered in the Council's databases. Of that number, 54 were for pasture irrigation, 12 for horticultural activities and 10 for recreational purposes (golf clubs). 64 consents authorised abstractions from surface water (84%) while 12 (16%) for groundwater.

Other water takes for general farm and water supply purposes have also been granted by the Council [dairy farm water takes in excess of the permitted 1.5 litres per second (L/s) or 50 cubic metres per day entitlement per property according to the Regional Fresh Water Plan for Taranaki, Rule 15], but as the water abstraction is not used for irrigation purposes they are not commented on in the main body of this report, but are commented on in Appendix II.

The 2012-2013 monitoring programme for irrigation water permits comprised three primary components; liaison with consent holders, site inspections, and data gathering, review and assessment for compliance. It was a busy season for the Council's hydrological unit, as the weather conditions meant the demand for irrigation was high. All irrigation had commenced by the middle of December.

Over the five month (summer irrigation) period, Mount Taranaki recorded between 71% and 77% of normal rainfall for which meant that rivers were running well below normal for the entire period. The low stream flows necessitated close and frequent monitoring by the Council to ensure ecological flows were maintained with those waterway's being used to supply water for irrigation. During the period under review compliance with residual flow conditions for surface water abstractions sites was assessed 86 times in 23 waterways.

The Council also carried out compliance monitoring inspections at 67 sites during the 2012-2013 irrigation season. The inspections included visual checks of the intake structures, screens, staff gauges, fencing around the pump sheds, downloading of datalogger data, and stream gaugings. All of the dataloggers were checked and the data downloaded where possible. There were four consents that had issues with faulty dataloggers, and two others were replaced this season.

All irrigators had ceased taking water for this purpose by the end of March 2013.

As happens each year, consent holder performance was assessed based on compliance with their authorised abstraction rates/volumes, maintenance of minimum residual flows, provision of abstraction records and all other general conditions of their consent(s).

The Council entered a total of 41 incidents over the course of the 2012-2013 period in relation to irrigation consents. This included 18 incidents for breaches of authorised abstraction rates and/or volumes over the course of the irrigation season. Fifteen of these received abatement notices for their non-compliance, while the other three had reasonable explanations as to why the breaches occurred, so no further action was taken. Further incidents entered by the Council related to the provision of abstraction records or other general non-compliance with consent conditions. Consent holders who did not provide records within the appropriate timeframe were warned that any failure to provide to comply with the reporting conditions of their consents in future would result in enforcement action being taken against them.

During the 2012-2013 year, 32% of irrigation consent holders in Taranaki achieved a high level of environmental performance and compliance with their consents, while 46% require improvement in their compliance performance. For reference, 35% of all consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents during the same period, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

It is important to note that inspections carried out by the Council identified that many flowmeter installations across the region have been sub-standard, compromising the accuracy of the abstraction data being recorded. Irrigators and the Council need to be confident that their equipment will work accurately and effectively, therefore it is preferred that a reputable contractor be hired for the installation water measuring and recording equipment. In addition to the conditions of resource consents for water abstractions, The Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 place further legislative requirements on holders of consents for water abstractions greater than 5 litres per second. These include specific requirements for the installation of water measuring devices, verification of the accuracy of water measuring devices and data reporting. The Regulations allow for a staged implementation of the requirements, dependent on abstraction rate. All abstractions are to be compliant with the Regulations by 10 November 2016. The Council will be actively monitoring the implementation of the Regulations during forthcoming monitoring periods.

This report includes recommendation 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 is the tenth Annual Report issued by the Taranaki Regional Council (the Council) to report on compliance monitoring programmes associated with resource consents for the abstraction of freshwater for irrigation purposes in Taranaki. The report covers the period 1 July 2012 – 30 June 2013. It also encompasses the data collected for compliance monitoring programmes for resource consents for pasture irrigation, horticultural and golf courses irrigation as per the recommendations from the previous report.

Irrigation in this report does not refer to any effluent (wastewater) application; it applies to the use of freshwater to supply dry soils with enough moisture for assisting in growing pasture. In pasture production, irrigation is mainly used to replace precipitation during periods of drought and to fulfil crop water requirements.

The irrigation requirements during the 2012-2013 season were significantly higher than previous years. The 2012-2013 summer period of 1 November 2012 to 31 March 2013, rainfall percentages for the region ranged between 51% and 87% of 'normal' rainfall volumes. The coastal margins of Taranaki were reasonably dry from October onwards, with a number of irrigators starting to exercise from the end of October and finishing at the end of March, as there was a good rainfall event over a couple of days that brought soil moisture levels up at the end of March. Due to the lower than normal rainfall, river levels were well below normal flows for the entire irrigation period, with mean annual low flows (MALF's) occurring from late February.

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 1991* (RMA), the Regional Freshwater Plan for Taranaki and the Council's obligations and general approach to monitoring sites though annual programmes, the resource consents held by pasture irrigators to take and use freshwater, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the consent holder's site/catchment.

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

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

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

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

1.1.3 The Resource Management Act 1991 and monitoring

The *Resource Management Act 1991* (RMA) primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

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

In its management of freshwater, the Taranaki Regional Council must:

- Sustain the potential of freshwater resources to meet the reasonably foreseeable needs of future generations;
- Safeguard the life-supporting capacity of freshwater and freshwater ecosystems;
- Avoid, remedy or mitigate any adverse effects of activities on the environment.

1.1.4 Regional Freshwater Plan

Section 14(1)(a) of the Act stipulates that no person may take, use, dam, or divert any water unless the activity is expressly allowed for by a resource consent, or a rule in a regional plan, or meets criteria set out in Section 14(3) of the Act.

The Regional Freshwater Plan for Taranaki (RFWP) became operative on 8 October 2001. It is a statutory document which outlines the Taranaki Regional Council's policy with respect to activities in relation to freshwater under the Act.

Rule 15 of the RFWP provides for the abstraction of up to 50 cubic metres per day (m^3/day)of surface water at a maximum rate of 1.5 litres per second (L/s) as a permitted activity for each certificate of title. The same provision applies for groundwater under Rule 48 pf the RFWP. The permitted allocations *(as of right entitlements)* allow for reasonable domestic and stock water needs without the need for a resource consent, provided that other conditions of the permitted rules are satisfied.

However, most irrigation abstractions demand significantly more water than the daily permitted allocation and consequently require resource consents. Appendix I gives an example of a typical set of conditions for a consent to take and use surface water for irrigation purposes.

Following the trend from previous years, there has been increased interest in pasture irrigation on dairy farms in Taranaki. Sources of water are rivers and streams, as these are the easiest and most economical options, but groundwater abstractions have become a possible alternative to supplement surface water use for irrigation.

1.1.5 Evaluation of environmental and consent performance

Besides discussing the various details of the performance and extent of compliance by the consent holder(s) 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 measurable environmental impacts, and/or, there were measurable 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 the end of the period under review, and/or, there were on-going issues around meeting resource consent conditions even in the absence of environmental effects. Abatement notices may have been issued.

- **Poor performance (environmental)** or **poor performance (administrative compliance)** indicates generally that the Council was 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.

1.1.6 Regional freshwater allocation

At 30 June 2012, a total of 76 current resource consents to take and use freshwater for irrigation purposes were registered in the Council's databases. Of that, 54 were for pasture irrigation, 12 for horticultural activities and 10 for recreational purposes (golf clubs). Sixty four consents licensed surface water abstraction (86%) while 12 (14%)

licensed groundwater abstractions (Figure 2). Figure 1 shows a pie chart of the distribution of the water allocated for irrigation purposes in Taranaki as of June 2013.

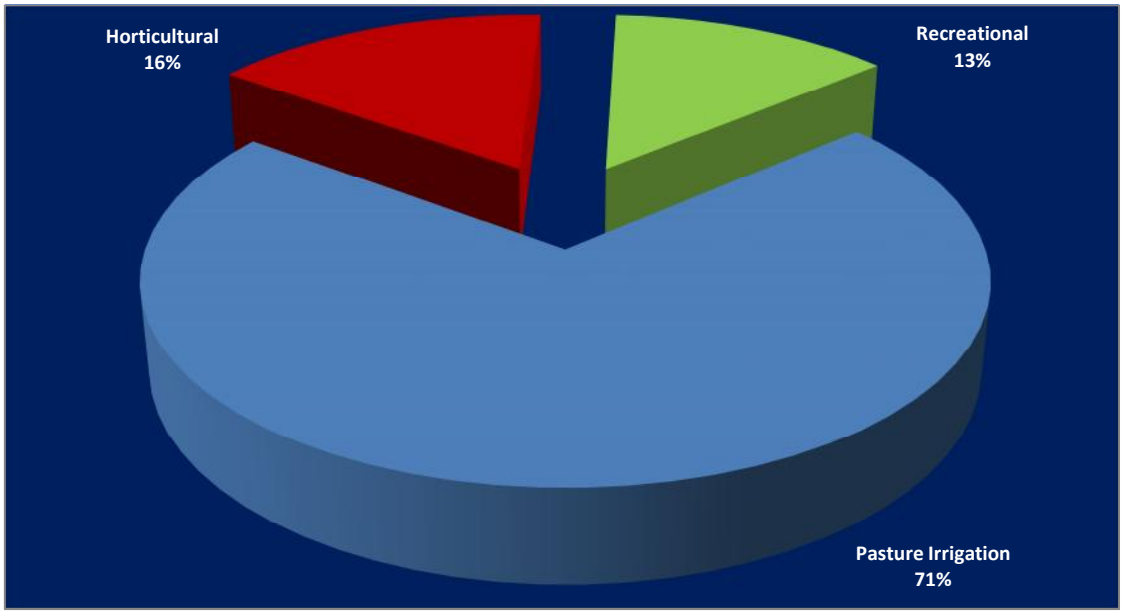

Figure 1 Percentage of water irrigation allocation per activity in the Taranaki Region

The breakdown of freshwater allocation in the region indicates that other uses[1] represent 69% of all water takes; pasture irrigation represents 22% of the total consented water abstractions. Other types of irrigation (golf courses and for horticultural purposes) add up to only 9% (Figure 2).

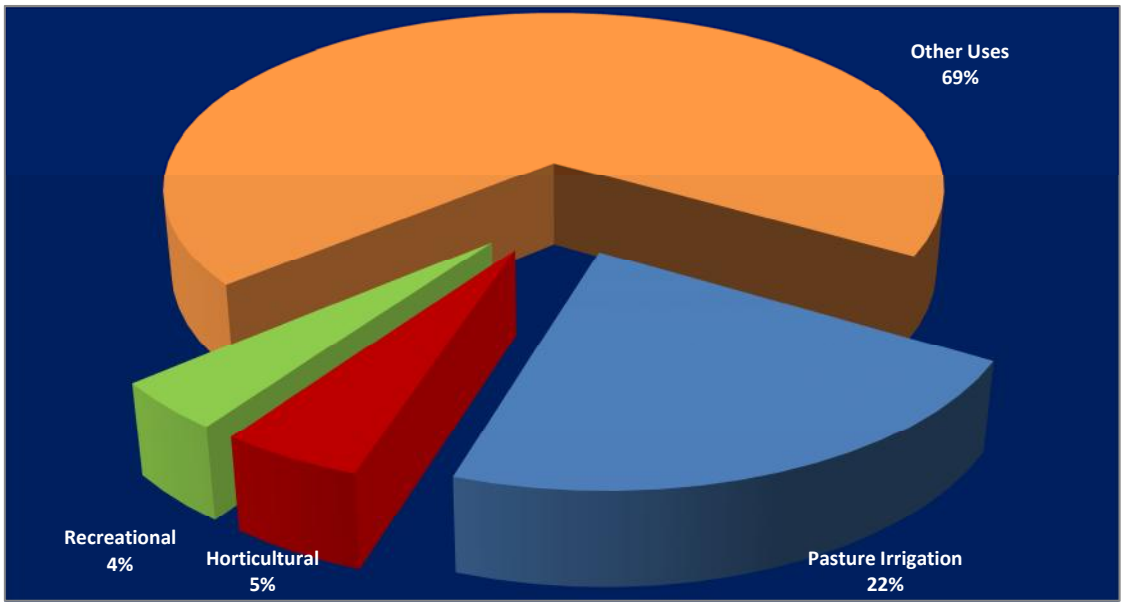

Figure 2 Total water abstractions – distribution by activity 2012-2013

[1] Includes: Aquaculture, Building Construction/Drainage/Flood Control, Chemical Processing/Manufacturing, Dairy Farm, Dairy Processing/Manufacturing, Dry Stock Farm, Hydrocarbon Exploration/Servicing Facilities, Landfills, Local Authorities, Meat and By-Product Processing, Petrochemical Processing, Piggery Farms, Poultry Farms, Power Generation – HydroPower Generation & Thermal, Quarries, Recreation/Tourism/Cultural, Road/Bridge Construction or Maintenance, Sewage Treatment, Swimming Pools, Timber Treatment or Sawmills, Water Supply or Treatment.

Surface water is the predominant source for pasture irrigation; 47 of the 54 consented water abstractions are for abstractions from rivers and streams (Figure 3). Groundwater abstractions are mainly used as supplementary irrigation water supply. The relatively low yields from Taranaki's aquifers are not sufficient to supply an entire irrigation system. In addition, the capital and running costs of groundwater supply bores often make them uneconomic for use as a primary source of water for irrigation supply.

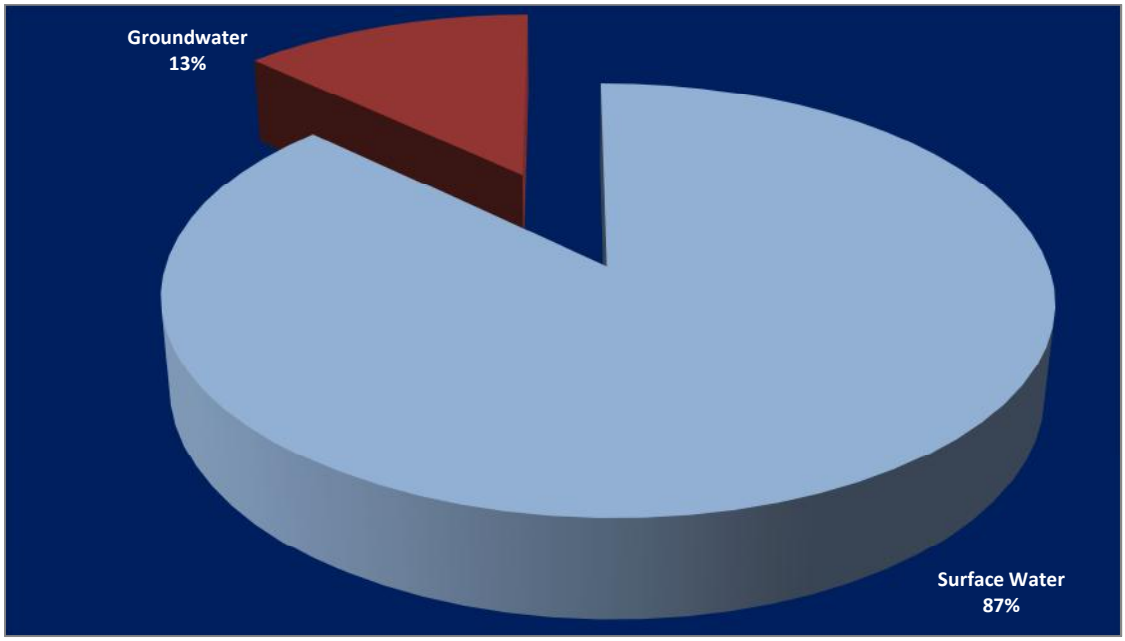

Figure 3 Source of water for pasture irrigation in Taranaki during the 2012-2013 period

Table 1 lists all the irrigation water consents issued by the Council to 30 June 2013 classified by type and source.

Table 1 Total consents granted for irrigation water in Taranaki to 30 June 2013

Consent	Consent Holder	Source	Type of Use
0017-3	Manaia Golf Club	Surface Water	Recreational
0124-5	Kaitake Golf Club Inc	Surface Water	Recreational
0132-3	Hawera Golf Club Inc	Surface Water	Recreational
0164-2	JR & DM Baker	Surface Water	Pasture Irrigation
0184-3	Inglewood Golf Club Inc	Surface Water	Recreational
0189-4	AI & KJ Williams	Surface Water	Pasture Irrigation
0270-2	Westown Golf Club Inc	Surface Water	Recreational
0278-4	NRGE Farms Limited/Oceanview Trust	Surface Water	Pasture Irrigation
0464-3	Oakura Farms Limited	Surface Water	Horticultural
0647-3	IG Cassie	Surface Water	Horticultural
0714-2	GD & HM McCallum	Groundwater	Pasture Irrigation

Consent	Consent Holder	Source	Type of Use
0721-3	MD Aiken Family Trust	Groundwater	Horticultural
0880-3	IHC New Zealand Inc (NORTH TARANAKI)	Surface Water	Horticultural
1193-3	Vickers B & NM & Church G & CG	Surface Water	Horticultural
1223-3	EO & CP Lander	Surface Water	Horticultural
1253-3	KA & RD Southall	Surface Water	Horticultural
1721-3	Manukorihi Golf Club Inc	Surface Water	Recreational
1877-3	Te Ngutu Golf Club Incorporated	Surface Water	Recreational
1879-3	Wairau Nurseries	Surface Water	Horticultural
2138-3	Riverside Farms Taranaki Ltd	Surface Water	Pasture Irrigation
3171-3	Taranaki Greenhouses Limited	Groundwater	Horticultural
3312-3	GH Lance	Groundwater	Horticultural
3859-2	Living Light 2000 Limited	Groundwater	Horticultural
4450-2	Waitara Golf Club Inc	Surface Water	Recreational
4494-2	CT & JM McDonald	Surface Water	Pasture Irrigation
4783-2	Larsen Trusts Partnership	Surface Water	Pasture Irrigation
4993-2	J & EG Sanderson	Surface Water	Pasture Irrigation
4994-2	J & EG Sanderson	Surface Water	Pasture Irrigation
5128-2	Coastal Country Farms Limited	Surface Water	Pasture Irrigation
5306-1	Kapuni Contractors Limited	Surface Water	Horticultural
5568-1	Cornwall Park Farms Limited	Surface Water	Pasture Irrigation
5570-2	Kaihihi Trust	Surface Water	Pasture Irrigation
5571-1	Jimian Limited	Surface Water	Pasture Irrigation
5623-1	WD & SC Morrison	Surface Water	Pasture Irrigation
5636-1	Waiwira Trust	Surface Water	Pasture Irrigation
5696-1	Kokako Road Limited	Surface Water	Pasture Irrigation
5709-2	KCCG Sole Trust	Surface Water	Pasture Irrigation
5773-1	Goodin FJ & Sons Limited	Surface Water	Pasture Irrigation
5778-1	Mara Trust	Surface Water	Pasture Irrigation
5781-2	Waikaikai Farms Limited	Surface Water	Pasture Irrigation
5791-1	AL & LA Campbell	Surface Water	Pasture Irrigation
5797-1	Pihama Farms Limited	Surface Water	Pasture Irrigation

Consent	Consent Holder	Source	Type of Use
5807-1	Dickie Roger Family Trust	Surface Water	Pasture Irrigation
5827-2	Walker & McLean Partnership	Surface Water	Pasture Irrigation
5829-1	Julian RM & MC Family Trust	Surface Water	Pasture Irrigation
5840-2	Gibbs G Trust	Surface Water	Pasture Irrigation
5863-2	Geary AR Trust (A R Geary)	Surface Water	Pasture Irrigation
5876-1	GA & RJ Dorn	Surface Water	Pasture Irrigation
5878-1	Woollaston Family Trust Partnership	Surface Water	Pasture Irrigation
5879-1	Hilldale Trust	Groundwater	Pasture Irrigation
5887-1	A & EN Barkla	Surface Water	Pasture Irrigation
5896-1	Kohi Investments Limited	Surface Water	Pasture Irrigation
5898-2	David Pease Family Trust	Surface Water	Pasture Irrigation
5950-1	WD & SC Morrison	Groundwater	Pasture Irrigation
5973-1	DR & AJ Gibson	Surface Water	Pasture Irrigation
6026-1	JR & DM Baker	Groundwater	Pasture Irrigation
6159-1	Pinehill Land Company Limited	Surface Water	Pasture Irrigation
6193-1	Cradles Farm Trust No 2	Groundwater	Pasture Irrigation
6292-1	New Plymouth Golf Club Inc	Surface Water	Recreational
6429-1	Leatherleaf Limited	Surface Water	Pasture Irrigation
6430-1	Ellingworth Margaret Trust	Surface Water	Pasture Irrigation
6486-1	GM & PJ Rutten Family Trust Partnership	Groundwater	Pasture Irrigation
6628-1	Hamblyn Family Trusts	Surface Water	Pasture Irrigation
7270-1	Ian Mantey Family Trust & Sally Mantey Family Trust	Surface Water	Pasture Irrigation
7346-1	Spenceview Farms	Surface Water	Pasture Irrigation
7372-1	Pukeone Partnership	Surface Water	Pasture Irrigation
7527-1	Pukeone Partnership	Surface Water	Pasture Irrigation
7528-1	Kereone Farms Limited	Surface Water	Pasture Irrigation
7626-1	NW & DM King	Surface Water	Pasture Irrigation
7733-2	Hawken Family Trust	Surface Water	Pasture Irrigation
7768-1	Carter AJ Limited	Surface Water	Pasture Irrigation
7781-1	D Krumm	Surface Water	Pasture Irrigation
7866-1	Stratford Golf Club Inc	Groundwater	Recreational

Consent	Consent Holder	Source	Type of Use
7895-1	Ohawe Farm	Surface Water	Pasture Irrigation
9561-1	Kereone Farms Limited	Groundwater	Pasture Irrigation
9577-1	SB & J May Family Trust	Surface Water	Pasture Irrigation

1.1.7 Irrigation zones

A regional study commissioned for the Taranaki Regional Council in 2002 (Rout, 2003) identified eight irrigation zones based mainly on climate. The zones were characterised by different parameters in terms of system management and financial return (Figure 4).

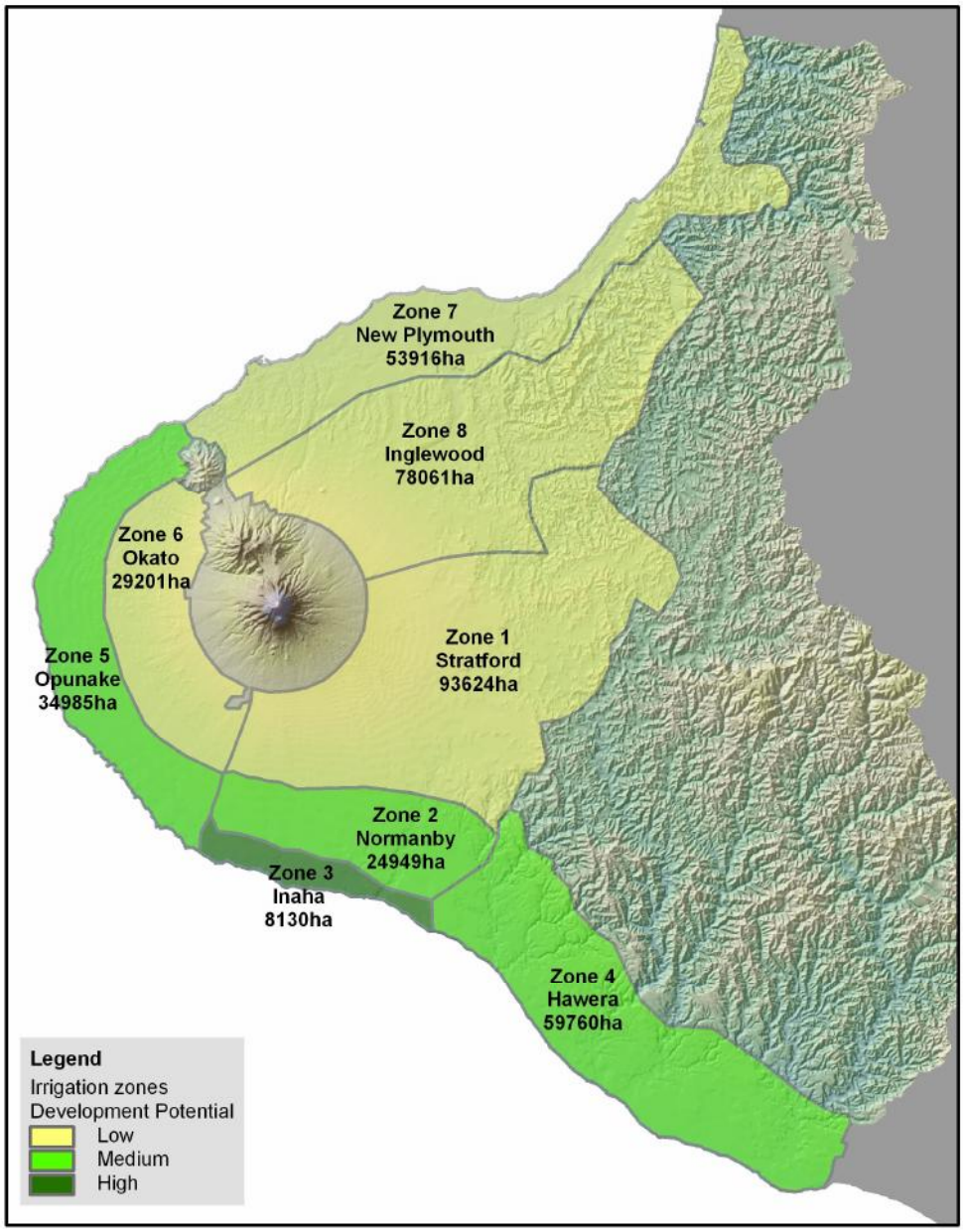

Figure 4 Pasture irrigation zones and development potential

The identified zones with the most potential for pasture irrigation requirements were: Normanby *Zone 2*; Inaha *Zone 3*; Hawera *Zone 4*; and Opunake *Zone 5*.

The modelling exercise predicted that pasture irrigation would be the most profitable for efficiently operated schemes in *Zones 2, 3, 4 and 5*, and generally less profitable in the other zones. The water demand modelled for Taranaki's eight irrigation zones are given in Table 2 below.

Table 2 Irrigation zones – modelled water demand (after Rout, 2003)

Zone No	Take rate (L/s / Ha)	Daily volume (m^3/Ha)	Annual volume (m^3/Ha)	Application depth (mm)
1	0.40	31	2,200	44
2	0.51	40	4,840	44
3	0.58	46	6,400	32
4	0.67	53	5,120	32
5	0.63	50	4,200	30
6	0.63	50	3,600	30
7	0.53	42	4,000	50
8	0.46	37	3,960	44

Figure 4 shows the pasture irrigation zones defined by Rout, 2003 and the development potential of those zones.

1.1.8 Irrigation in Taranaki

Most of the pasture irrigation in Taranaki takes place within a 10 km-wide belt of coastal land stretching from Oakura to Waitotara, with the rest of the sites located between Inglewood and Eltham (Figure 5).

The geographical patterns for the development of irrigation in the coastal region are influenced by a combination of meteorological, topographical and soil conditions. Coastal areas generally lower rainfall rates, a higher density of small streams, more exposure to drying winds, and have lighter and more freely-draining soils than in other parts of the province.

Irrigation in Taranaki dairy farms usually occurs over a 3 to 6 month period depending on location and climatic conditions. Irrigation typically commences in mid October-November and ends in late March-early April, with water uses peaking in January and February; a few farms, however, irrigate for longer periods.

Most irrigation water is sourced directly from run of streams; however, there are a number of projects being established on small spring-fed streams where flows are low especially during the summer season and where it is only possible to achieve irrigation through water harvesting and storage.

Figure 5 shows the distribution of all the consented water takes for the period under review within the eight zones defined by Rout, 2003.

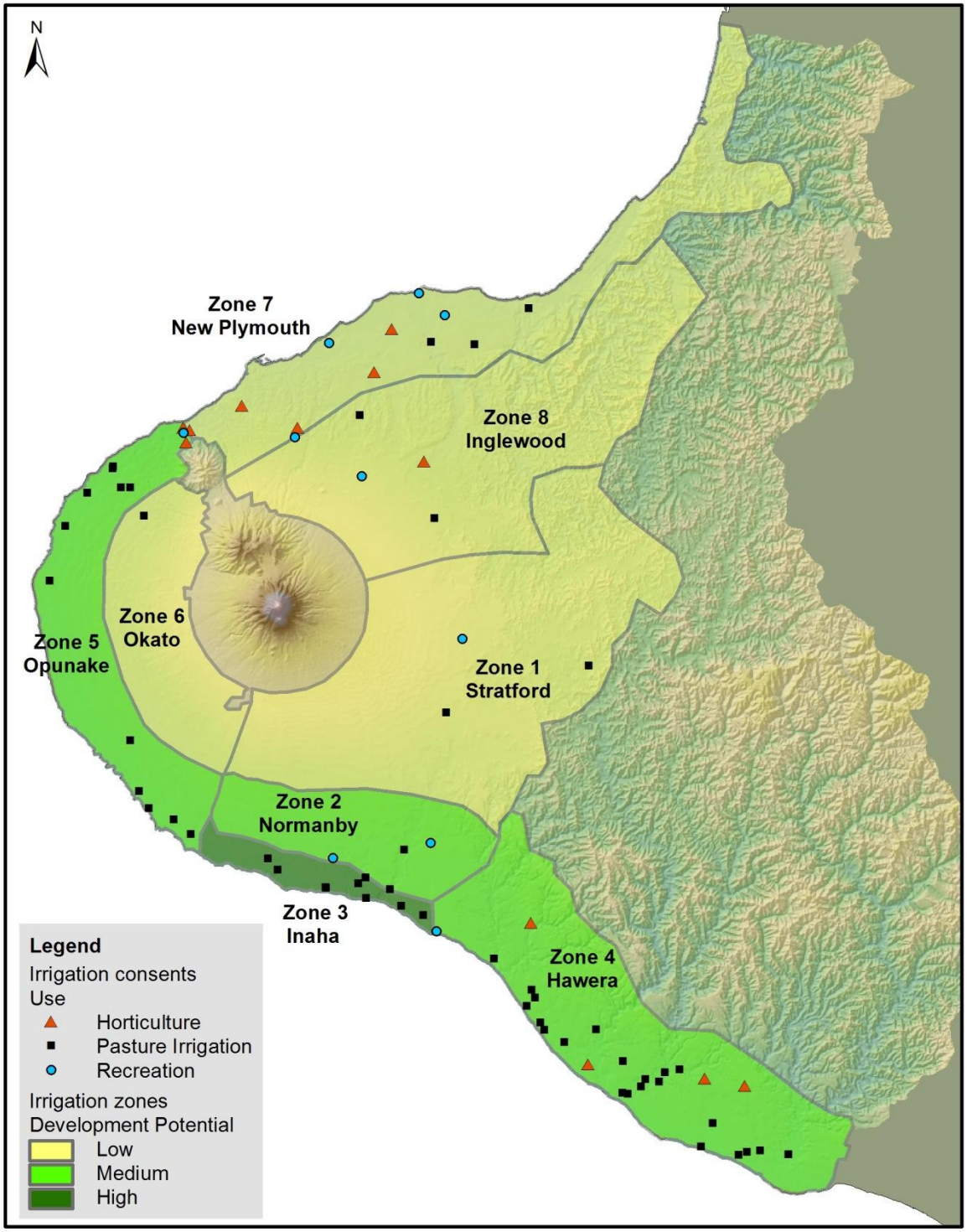

Figure 5 Distribution of all the consented water takes, defined by use, within the eight irrigation zones to 30 June 2013

1.1.9 Irrigation systems

In general there are two types of irrigation methods; surface and pressurised. The majority of irrigation systems currently in operation in the province fall in to the pressurised category. Pressurised systems can be further differentiated based on the method of operation and equipment used. A summary of the systems encountered in the region and some of their advantages and disadvantages are summarised below:

K-line and long-lateral types – Impact sprinklers mounted on moveable laterals (Photograph 1).

Advantages:

- low capital cost;
- are simple in construction and are relatively easy to operate;
- easily adapted to existing farm layouts and topography;
- allows low application rates;
- low operating pressures;
- K-lines particularly suited to windy conditions due to sprinkler cowling; and
- consists of flexible hoses line designed to ease irrigation applications.

Disadvantages:

- high maintenance; and
- high labour input to shift *(drag and drop).*

Photo 1 Mosaic of pictures depicting K-line and long-lateral type irrigation

Centre pivot type – spray nozzles mounted on a movable lateral (Photograph 2)

Advantages:

- large circulating area;
- allows versatility in application rates and return periods;
- low operating pressures;
- low maintenance;
- low labour input;
- frequently desirable on steep, rocky, or uneven soils;
- most are provided with automatic controls and metering equipment; and
- widely used both in New Zealand and worldwide.

Disadvantages:

- high capital cost; and
- not ideal where energy supply may be unreliable or expensive.

Photo 2 Mosaic of pictures depicting centre pivot

Travelling irrigators-spray nozzles mounted on fixed or rotating boom *(rotary boom, fixed boom, gun irrigator, effluent irrigator)* (Photograph 3)

Advantages:

- low capital cost;
- may cover a large irrigation area;
- simple operation; and
- allows some control with application rates.

Disadvantages:

- poor performance in windy conditions;
- uneven application, particularly at end of runs;
- not suited to irregular farm layout *(boom irrigators only)*; and
- high operating pressures *(hard hose gun irrigators only).*

Photo 3 Mosaic of pictures depicting travelling irrigator systems

The distribution of these types of irrigation systems in the province are charted below in Figure 6.

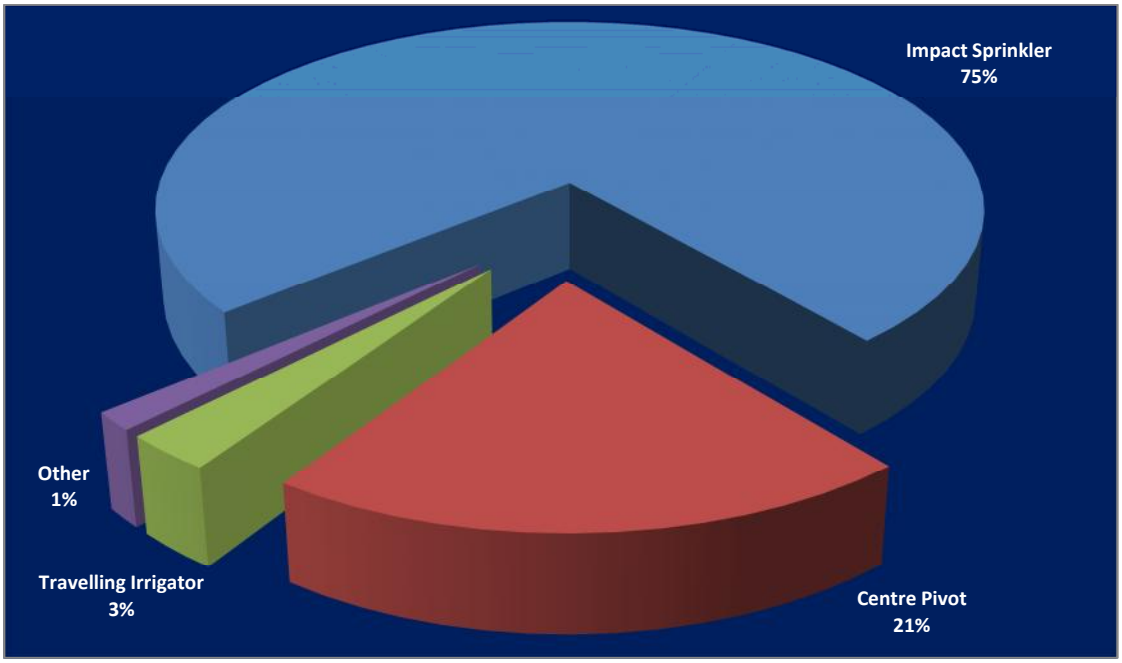

Figure 6 Percentage of irrigation system types in Taranaki

1.1.10 Water demand and availability

The establishment of new irrigation schemes in several catchments within Zones 2, 3, 4, and 5 (TRC, 2003), may be limited by the increasing demands and restricted availability of surface freshwater in these irrigation zones.

However, in spite of being a more costly option, the development of deep groundwater resources (well fields) will always be an alternative, provided the appropriate environmental considerations and scientific evaluations are conducted for new projects.

1.1.11 Environmental effects of exercising water permits

Environmental effects of water abstraction can include a loss of aquatic habitat and biodiversity, and impacts on cultural, recreational and aesthetic values of water-bodies. In an effort to reduce such impacts, the Council encourages the efficient use of water through technical irrigation system design, and maintenance and management practices that help with the achievement of high irrigation efficiencies.

Surface water abstractions
Expected periods of peak irrigation water demand normally coincide with periods of low flows in rivers and streams. During these periods, the Council closely monitors river flows and the exercise of water permits.

The majority of surface water permits for irrigation require the abstraction to cease when the flow in the abstracted waterway reaches, or falls below, a specified level. Policy 6.1.5 of the RFWP states that at least two-thirds of habitat within a rivers or streams at is to be retained at MALF. This figure has been derived for protection of habitat requirements for brown trout, and is considered conservative for native species.

For many smaller waterways, two-thirds habitat roughly equates to two-thirds MALF, however, the cut-off flow level on many irrigation abstraction consents is in practice generally set at MALF. It is the responsibility of the consent holder to ensure compliance with consent conditions at all times.

In certain coastal streams, and under certain flow conditions, tidal movements can result in the migration of saline water upstream from the coastal margin. The abstraction and application of saline or brackish water to land can have adverse effects on pumping and irrigation equipment, crops and soils.

Groundwater abstractions
The abstraction of groundwater for use in irrigation supply has the potential to lower groundwater levels in the vicinity of the pumping bore. The potential effects of any groundwater abstraction are thoroughly assessed by the Council during the processing of a resource consent application for a groundwater take.

Groundwater levels in coastal bores should be maintained above mean sea level to avoid the risk of sea water intrusion into freshwater aquifers. Water with elevated salinity is generally unsuitable for irrigation. Elevated levels of sodium, chloride, sulphate, and hardness resulting from sea water contamination can affect the taste and corrosiveness of water and can cause scale (Cameron & White, 2004). Irrigation with saline water reduces the ability of the plant's roots to take up water. In between irrigation cycles, as the soil moisture decreases, the salts in the soil concentrate to several times the initial value in irrigation water.

Fortunately in Taranaki, the risk of saltwater intrusion is minor due to the limited number of high yielding coastal bores. In any case, the Council does monitor water quality at four coastal sites as part of the irrigation consent compliance monitoring programmes to assess any changes in groundwater composition as a result of abstraction.

Nutrient loading
Irrigated pasture typically supports higher stock numbers compared with non-irrigated pasture and consequently a higher nutrient (nitrate) loading per hectare. This is particularly the case in areas where the underlying soils are sandy and free-draining.

Irrigation schemes in Zones 2, 3 and 4 occur in areas where groundwater is known to be at risk of nitrate contamination (TRC 1998, 2005). In these zones, careful management of irrigation water and fertiliser application regimes is required to minimise the risk of groundwater and surface water contamination with nitrates.

The implementation of riparian management plans, fencing and planting of riparian margins can further reduce the potential for any nutrient rich runoff from irrigated pasture entering surface water systems.

1.1.12 Stream flow measurements

Compliance with consent conditions set to safeguard the intrinsic values of Taranaki's streams is based on recognising that the taking of water is only allowed when there is water available above the minimum flows which have been set out in the consent. If flows drop below the minimum flow, then irrigation is to cease until there is adequate water to allow for irrigation without going below this set flow. To determine compliance the Council undertakes stream flow measurements by indirect and direct methods at control points usually upstream and/or downstream of water abstraction points.

These methods involve the measurements of velocity and cross-sectional areas which are used together to determine the flow rate.

Flow is measured by the speed of a mechanical current meter or Acoustic Doppler Velocimeter (ADV) (Photograph 4) attached to the end of the wading rod. Multiple readings are taken across the river to calculate the volume of water passing the point of measurement. Several measurements are carried out under a range of river levels until a rating curve is developed. A rating curve is the result of an approximate relationship between a staff gauge (the river level) and a flow rate. Once the rating curve has been developed, discharge values can be obtained by reading the staff gauge. Rating curves are continually verified and adjusted as physical conditions, such as cross sectional area or flow conditions change. These changes can be caused by factors such as weed growth, slumping or eroding banks, large freshes down the catchment and channel clearing or straightening.

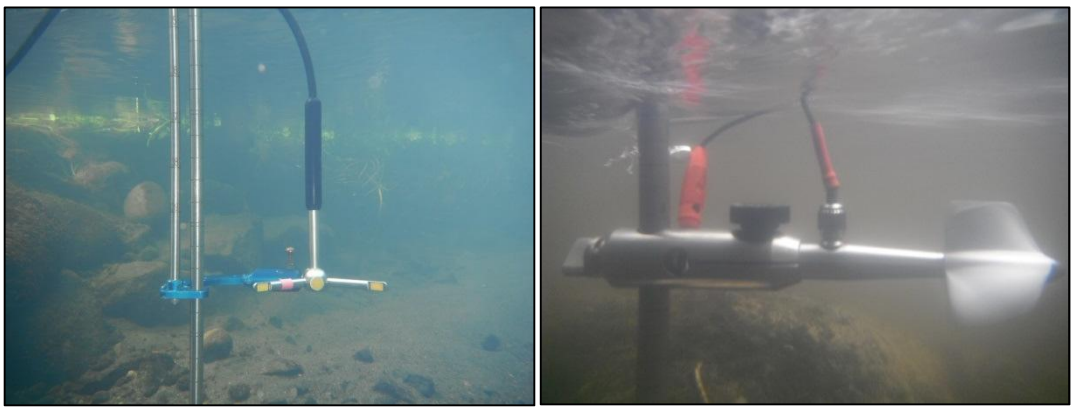

Photo 4 Mosaic of gauging flow meters calculating river flows

1.2 Irrigation water permits to June 2013

There were a total of 76 consents for the abstraction of freshwater for use in irrigation active across Taranaki as of 30 June 2013. This is the same number of active consents as at the conclusion of the previous 2011-2012 monitoring period.

During the period under review, two new consents were granted, two existing consents were renewed and two consents lapsed as they were not exercised within five years of being granted (Table 3).

Table 3 New, renewed and lapsed consents during 2012-2013

	Consent	Consent Holder	Catchment	Stream/River
New	9561-1	Kereone Farms Limited	Unnamed Catchment 1	Unnamed Stream 1
	9577-1	SB & J May Family Trust	Onaero	Unnamed Tributary
Renewed	4993-1	J & EG Sanderson	Otakeho	Otakeho
	4994-1	J & EG Sanderson	Kaupokonui	Kaupokonui
Lapsed	5905-1	N & K McColl	Patea	Chapmans Creek
	7161-1	Fleming/Kinaki Trust	Oaoiti	Oaoiti

In addition, four consents were transferred between July 2012 and June 2013, as listed in Table 4.

Table 4 Transferred consents during 2012-2013

Consent	New Consent Holder	Previous Consent Holder
3171-3	Taranaki Greenhouses Limited	Little Knoll Greenhouses
5128-1	Coastal Country Farms Limited	Rabobank New Zealand Limited
5709-1	KCCJ Sole Trust	KG & CJ Sole
6486-1	GM & PJ Rutten Family Trust Partnership	LM & PC Quintus Family Trust

1.3 Climatological data and irrigation requirements

The Taranaki Regional Council provides live on-site data on soil moisture, precipitation and temperature via its website. Eight sites long the southern coastline provides climatological information about the most intensively developed irrigation zones.

Rainfall has a direct impact not only on river and stream flows but on the amount of water for recharge reaching the province's aquifers, which also contribute baseflow to surface water systems. Rainfall recharge is critical to maintain groundwater levels and thus the potential to supply water in the zones where there is more pressure on the surface.

Accurate interpretation of climatological data is paramount for the planning, scheduling and operation of efficient irrigation systems. Precipitation and evapotranspiration data are fundamental to carrying out reliable water budget calculations and calculations of crop (pasture) water requirements. Crop water requirements can be defined as the depth of water needed to meet the water loss through evapotranspiration requirement, In other words, for any period of time, the net irrigation requirement is the amount of water which is not effectively provided by rainfall.

The calculated amounts of irrigation water to be efficiently applied to pasture, should also account for the water that is lost while transporting it from its source to the pasture root zone. Some of the losses that need to be estimated are those which occur due to leakage from pipelines, and evaporation from droplets sprayed through the air. To compensate for these losses, additional water must be pumped than that required to be stored in the pasture root zone. The gross irrigation requirement then, is the total amount that must be pumped which takes into consideration the irrigation efficiency.

The third variable that should be accounted for when planning and operating irrigation systems is the soil moisture. Some of the water that is required by the pasture may already be held in the soil, so it is critical to quantify it. There is no extra value in applying more water than the soil can hold, this only results in unnecessary costs and wastage. The only reliable way of knowing how much irrigated water can be stored in the soil at the time of irrigation is by measuring the soil moisture.

By measuring the soil moisture the irrigator can be more certain that:

- only the amount of water required by the plant is applied;
- leaching of nutrients is minimised;
- pasture growth and quality is maximised;
- the environmental impacts are minimised; and
- costs are reduced.

1.3.1 Droughts in Taranaki

Droughts are a normal, recurrent feature of climate. This phenomenon occurs almost everywhere though it features vary from region to region. Defining drought is difficult as it depends on need, physical differences in regions, and varying disciplinary perspectives. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in damage to crops and resultant loss of yields.

The 2012-2013 irrigation season started in October for many irrigators in the South Taranaki coastal areas, as rainfall percentages for the month were only around 50% of normal. November was also a dry month with only 39-79% of normal rainfall falling, while December had near normal rainfall totals. For January through to March 2013 rainfall was below normal for all sites, so irrigation demand was at its peak, with MALF's occurring from late February.

Mount Taranaki recorded between 71% and 77% of normal rainfall for the five month (summer irrigation) period, which meant that rivers were running well below normal for the entire period. All irrigation was started by the middle of December, with all

irrigators ceasing irrigation by the end of March 2013. Figure 7 shows the distribution of rainfall from 1 November 2012 to 31 March 2013.

Climate change scenarios suggest that Taranaki may experience more sever weather extremes in the form of dry spells as well as heavy rainfall events. The most severe droughts in Taranaki have been in 1969-1970, 1977-1978 and 2007-2008. Changes in drought risk for the Taranaki region indicate a slight increase in the southern coast of the region. Developing climatology assessments of drought for a region provides a greater understanding of its characteristics and the probability of recurrence at various levels of severity. Information of this type is extremely beneficial in the development of response and mitigation strategies and preparedness plans.

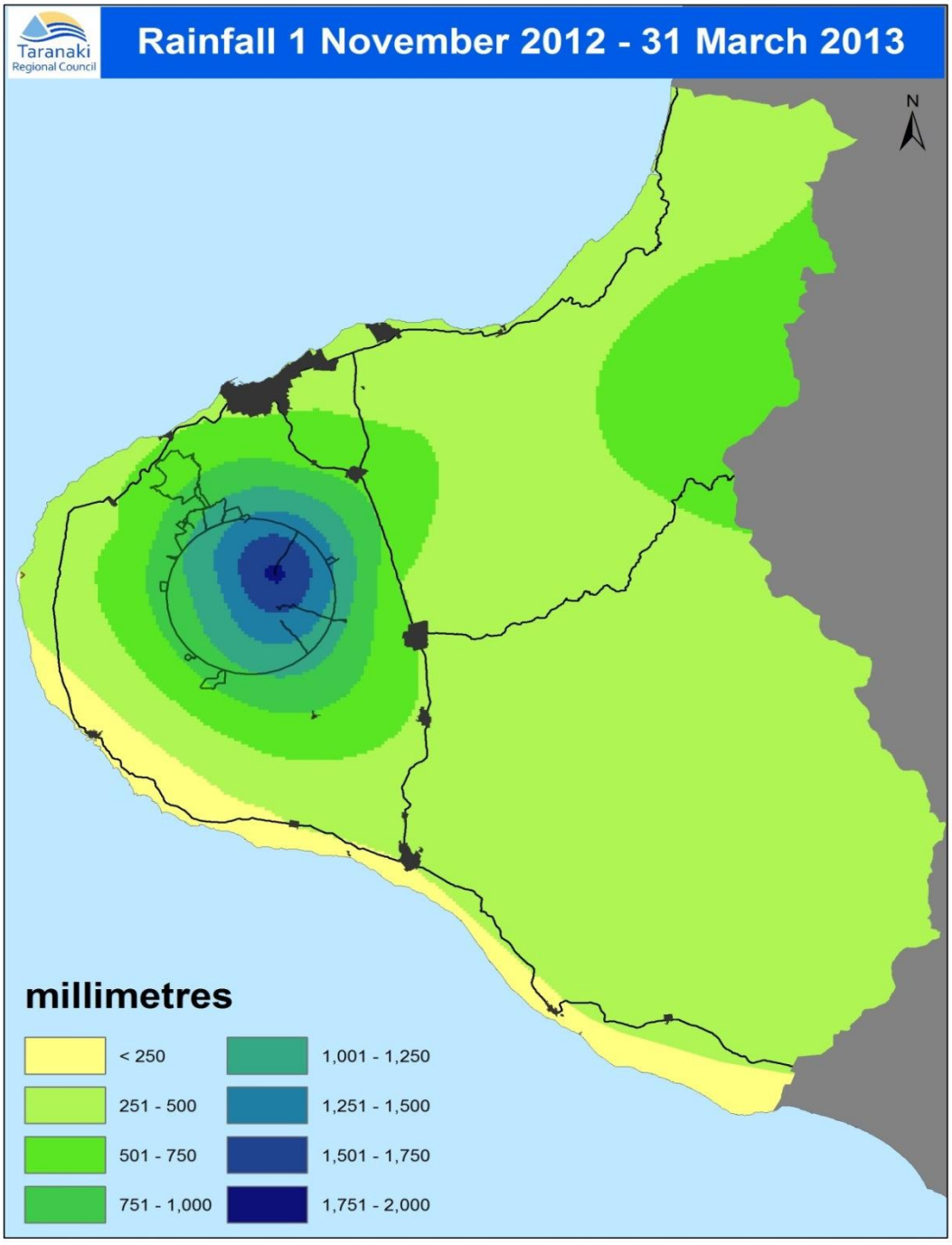

Figure 7 Distribution map of the total rainfall recorded from 1 November 2011 to 31 March 2013

1.4 Monitoring programme

1.4.1 Introduction

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

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

Every year the Council undertakes monitoring programmes for all pasture irrigation water permits. The programmes list all of the work that the Council could undertake during the forthcoming monitoring period and the cost of the activities to the consent holder. Because irrigation is climate dependent, the level of monitoring varies from year to year [as do associated costs]. Increased monitoring is generally required during drier years.

The 2012-2013 monitoring programmes for irrigation water permits are comprised of three primary components; liaison with consent holders, site inspections and the data review and assessment for compliance. In the sections, a brief discussion of these components is presented.

1.4.2 Programme liaison and management

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

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

1.4.3 Site inspections

During the period under review, the Council endeavoured to inspect all the water take compliance monitoring programmes in place. Additionally, the “not-otherwise monitored” activities comprising of golf clubs, horticultural irrigation schemes and stock and dairy shed takes were also inspected.

The 2012-2013 pasture irrigation monitoring programmes provided for an annual inspection of each pasture irrigation abstraction site, to assess/evaluate compliance with consent conditions. 95% of the active consents were inspected by the Council during the 2012-2013 period.

Site inspections are focused on the overall set-up of the irrigation equipment’s intake structures, a visual inspection and assessment of screenings, flow gauges, fences,

planting of riparian vegetation, flowmeters and datalogger devices are carried out in line with the conditions of each individual consent.

Monitoring programmes for surface water abstraction include checking compliance with the residual flow conditions of the consent. Residual flow conditions set minimum environmental flows to be maintained during pumping in the waterways downstream from the abstraction point. Compliance with the residual flow conditions is assessed through hydrological flow gaugings which are carried out during low flow conditions in summer. The results of residual flow monitoring are summarised in Section 2.3 and Table 8.

Observance of allocated maximum daily volume and flow rates are assessed by direct measurement where dataloggers were fitted to the intake of the irrigation system, recording all the abstraction data, or indirectly through calculations based on abstraction data submitted by the consent holder.

For sites where no datalogger is fitted, assessments of water takes for the 2012-2013 year were carried out by a combination of data obtained from the consent holder's records and information derived from previous calibration checks of the pump discharge rates.

Sites are normally not inspected if the Council receives information from the consent holder that the water permit is not to be exercised for that monitoring period. Inspection results are summarised in Section 2 below.

1.4.4 Mesuring and reporting of water takes

A special condition of all irrigation water abstraction permits requires the consent holder to keep a record of abstraction. The information is important to the Council to help manage the resource more sustainably and assess compliance. Likewise, the information is useful to users for the management of inputs to their operations, identifying energy savings, identifying leakages in their systems and making water efficiency gains[2].

The rates and volumes of water abstraction are measured using water meters. If a water meter is not installed following manufacturer's instructions and specifications, the data is not reliable as large errors may occur. The error produced by a valve installed immediately upstream of the flowmeter can be as much as 50%and errors produced by sharp bends upstream of the water meter can amount to up to 20% of the reading. Photograph 5 shows an example of a good installation of a flowmeter, while Photograph 6 shows an example of a poor installation of a flowmeter.

[2] Water Programme of Action Ministry for the Environment

Photo 5 Good installation of a flowmeter

Photo 6 Poor installation of a flowmeter

The Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 place further legislative requirements on holders of consents for water abstractions greater the 5 litres per second, unless the taking of the water is for non-consumptive purposes. These regulations will apply directly to existing consents without review of individual consents. The regulations will help improve the management of fresh water in Taranaki by ensuring accurate measurement of water takes. The regulations require:

- All water permits allowing the take of 5 L/s or more to collect and report records to a set minimum requirement[3];

[3] Refer to the document Resource Management (Measuring and Reporting of Water Takes) Regulations 2010. REF 2010/267.

- Measurement at the point where water is taken from a river, lake or groundwater system (unless otherwise approved by the Council to be in another location);
- Continuous records of daily volumes to be collected using an appropriate flowmeter with the data transferred to the Council on at least an annual basis;
- The flowmeter to meet an accuracy standard, and should be properly installed and calibrated independently every five years; and
- The consent holder to be responsible in recording and transferring the data to the Council.

All abstractions are to be compliant with the Regulations by 10 November 2016. The Council will be actively monitoring and enforcing the implementation of the Regulations during forthcoming monitoring periods.

The Council may also apply more stringent requirement on consent holders, such as the ability to require measurement of water takes below 5 L/s or further requirements for measurement over the minimum standards specified by the regulations.

The Council annually reminds consent holders (in late May/early June) requesting that their abstraction records be provided for the year ending 30 June by no later than 31 July of that year. The daily irrigation record should include:

- date/time when the pump was operated;
- water meter reading at start and end of day; and
- number of hours the pump was operated.

These records can be kept manually, or electronically using an approved datalogger.

Consent holders who had fitted an approved datalogger on their intake system in time to record water usage during 2012-2013 irrigation season, were not required to submit annual hard copy records to the Council for the period under review. Data logged on the dataloggers were downloaded in the field by Council staff, or were automatically transmitted through the radio or cellphone network to the Council.

By the end of 2012-2013 irrigation season, 45 dataloggers had been installed to electronically record abstraction data in relation to water takes for irrigation purposes, two of which were shared by multiple consent holders as their takes are at the same location.

Table 5 provides details of current irrigation takes which have dataloggers fitted.

Table 5 Dataloggers installed as of 30June

Consent	Consent Holder	Datalogger serial Nº	Installation Date	Malfunctioning
0017-3	Manaia Golf Club	AG3-0700	Oct-2013	No
0164-2	JR & DM Baker	41084152	Oct-2010	Yes[4]
0189-3	Al & KJ Williams	AG3-1145	Jun-2013	No

[4] Datalogger was found "dead " at annual inspection, was removed and sent away, so data could be retrieved and new battery be installed.

Consent	Consent Holder	Datalogger serial Nº	Installation Date	Malfunctioning
0270-2	Westown Golf Club Inc	41093229	Nov-2011	No
0714-2	GD & HM McCallum	41084139 41084137	Nov-2008 Nov-2008	Yes[5] Yes[5]
1721-3	Manukorihi Golf Club Inc	AG3-0114	Nov-2008	No
1877-3	Te Ngutu Golf Club	AG3-0029	Nov-2008	No
2138-3	Riverside Farms Taranaki Limited	AG3-0522	Dec-2010	No
4494-2	CT & JM McDonald	AG3-0484	Jan-2010	No
4783-2	Larsen Trust Partnership	AG3-0505	Nov-2010	No
4993-2	J & EG Sanderson	AG3-1114	Nov-2012	No
4994-2	J & EG Sanderson	AG3-1113	Nov-2012	No
5128-1	Coastal Country Farms Limited	AG3-0611	Nov-2010	No
5570-1	Kaihihi Trust	AG3-1151	Feb-2013	No
5571-1	Jimian Limited	AG3-1144	Dec-2012	No
5623-1	WD & SC Morrison	AG3-0447	Sep-2010	No
5636-1	Waiwira Trust	AG3-0525 AG3-0526	Jan-2011 Jan-2011	No No
5709-1	KCCJ Sole	AG3-0610	Nov-2010	No
5778-1	Mara Trust	302100436	Dec-2005	n/a[5]
5781-1	Waikaikai Farms Limited	AG3-1123	Nov-2012	No
5797-1	Pihama Farms Limited	AG3-0609	Nov-2010	No
5827-2	Walker & McLean Partnership No1	AG3-0406	Nov-2009	No
5829-1	Julian RM & MC Family Trust	12706	Nov-2012	No
5840-2	Gibbs G Trust	AG3-0406	Nov-2009	No
5863-1	Geary AR Trust	AG3-0356	Mar-2013	No
5876-1	GA & RJ Dorn	AG3-0142	Feb-2010	No
5879-1	Hilldale Trust	AG3-1124	Nov-2012	No
5896-1	Kohi Investments Limited	41081080	Nov-2008	No
5898-2	Pease David Family Trust	41081098	Feb-2008	Yes[5]
5950-1	WD & SC Morrison	OP4953	Dec-2011	No
5973-1	DR & AJ Gibson	AG3-0523	Sep-2011	No

[5] Site not inspected, as no irrigation took place during the season. Therefore unable to assess the condition of the datalogger.

Consent	Consent Holder	Datalogger serial Nº	Installation Date	Malfunctioning
6026-1	JR & DM Baker	41084153	Jan-2009	No
6159-1	Pinehill Land Company Limited	302100277	Nov-2004	n/a[6]
6193-1	Cradles Farm Trust No 2	30210050	Dec-2003	n/a[6]
6292-2	New Plymouth Golf Club Inc	AG3-1086	Nov-2012	No
6429-1	Leatherleaf Limited	AG3-0527	Dec-2011	No
6430-1	Ellingworth Margaret Trust	AG3-0593	Jan-2011	No
6486-1	GM & PJ Rutten Family Trust Partnership	302100143	Dec-2003	n/a[6]
6628-1	Hamblyn Family Trust	AG3-0524	Jan-2012	No
7346-1	Spenceview Farms	OP5313	Jul-2012	No
7372-1	Pukeone Partnership	AG3-0563	Sep-2010	No
7527-1	Pukeone Partnership	AG3-1110	Nov-2011	No
7528-1	Kereone Farms LImited	AG3-1110	Nov-2011	No
7895-1	Ohawe Farms	41112296	Mar-2013	No
9561-1	Kereone farms Limited	AG3-0040	Jan-2013	No

Over the course of the 2012-2013 monitoring year, all of the dataloggers were checked and downloaded where possible. Data was unable to be downloaded from four of the dataloggers due to electrical failure.

All abstraction data gathered as part of the monitoring programme is reviewed and then stored in the Council's hydrometric database. All records are available to the public on request.

The results of the 2012-2013 annual abstraction data review are summarised in Section 2 of this report.

2. Results

During the 2012-2013 monitoring period, 43 out of a total of 54 current consents to take and use water for pasture irrigation were exercised. Seventeen consents were not exercised, with three of those not yet operational.

The results of the monitoring carried out by the Council over the course of the 2012-2013 monitoring period are outlined below in sections 2.1 to 2.7 and are summarised in Tables 6 to 11.

2.1 Site Inspections

During 2012-2013 irrigation season, the Council carried out compliance monitoring inspections at 67 sites (Table 6), compared to 64 inspections carried out for the 2011-2012 irrigation season. The inspections included visual checks of the intake structures, screens, staff gauges, fencing around the pump sheds, downloading of datalogger and stream gauging as described in Section 1.1.12. The results of compliance monitoring of allocated abstraction rate and volume are given in sections 2.3 and 2.4.

The assessment of efficient use of water has proven to be a difficult task to carry out as most of the irrigation events take place at night when inspections are not conducted (unless there is an obvious waste of water). Assessments of losses for deep percolation, drifting or ponding need to be evaluated at the on-farm level and can easily be missed when only one inspection per year is carried out.

When manual data is received from the consent holder, daily abstraction records are processed, formatted and incorporated into the Council's hydrological database. Inspection notes are also recorded in the Council's database. Table 6 lists the consents inspected during the period being reviewed and reported on.

Table 6 Sites inspected during 2012-2013 to assess consent compliance

Consent	Consent Holder
0017-3	Manaia Golf Club
0124-5	Kaitake Golf Club Inc
0164-2	JR & DM Baker
0184-3	Inglewood Golf Club Inc
0189-4	AI & KJ Williams
0270-2	Westown Golf Club Inc
0278-4	NRGE Farms Limited/Oceanview Trust
0464-3	Oakura Farms Limited
0647-3	IG Cassie
0880-3	GD & HM McCallum
1193-3	Vickers B & NM & Church G & CG
1223-3	EO & CP Lander

Consent	Consent Holder
1721-3	Manukorihi Golf Club Inc
1877-3	Te Ngutu Golf Club Incorporated
2138-3	Riverside Farms Taranaki Limited
3171-3	Taranaki Greenhouses Limited
3312-3	GH Lance
4450-2	Waitara Golf Club Inc
Consent	**Consent Holder**
4494-2	Ct & JM McDonald
4783-2	Larsen Trusts Partnership
4993-2	J & EG Sanderson
4994-2	J & EG Sanderson
5128-2	Coastal Country Farms Limited
5568-1	Cornwalll Park Farms Limited
5570-2	Kaihihi Trust
5571-1	Jimian Limited
5623-1	WD & SC Morrison
5636-1	Waiwira Trust
5696-1	Kokako Road Limited
5709-2	KCCG Sole Trust
5773-1	Goodin FJ & Sons Limited
5778-1	Mara Trust
5781-2	Waikaikai Farms Limited
5791-1	AL & LA Campbell
5797-1	Pihama Farms Limited
5807-1	Dickie Roger Family Trust
5827-1	Walker & McLean Partnership
5829-1	Julian RM & MC Family Trust
5840-2	Gibbs G Trust
5863-2	Geary AR Trust
5876-1	GA & RJ Dorn
5878-1	Woollaston Family Trust Patnership
5879-1	Hilldale Trust

Consent	Consent Holder
5887-1	A & EN Barkla
5896-1	Kohi Investments Limited
5898-2	David Pease Family Trust
5950-1	WD & SC Morrison
5973-1	DR & AJ Gibson
6026-1	JR & DM Baker
6193-1	Cradles Farm Trust No 2
6292-1	New Plymouth Golf Club Inc
6429-1	Leatherleaf Limited
6628-1	Hamblyn Family Trusts
7270-1	Ian Mantey Family Trust & Sally Mantey Family Trust
7346-1	Spenceview Farms
7372-1	Pukeone Partnership
7527-1	Pukeone Partnership
7528-1	Kereone Farms Limited
7626-1	NW & DM King
7733-2	Hawken Family Trust
7768-1	Carter AJ Limited
7781-1	D Krumm
7866-1	Stratford Golf Club Inc
7895-1	Ohawe Farms
9561-1	Kereone Farms Limited

2.2 Non – exercised consents

Of the 76 resource consents granted to date for water abstractions for irrigation purposes, 17 were not exercised during 2012-2013 year (Table 7).

Table 7 Consents non-exercised during 2012-2013

Consent	Consent Holder
0184-3	Inglewood Golf Club Inc
0189-4	AI & KJ Williams
0464-3	Oakura Farms Limited
0721-3	MD Aiken Family Trust

Consent	Consent Holder
1193-3	Vickers B & NM & Church G & CG
5306-1	Kapuni Contractors Limited
5696-1	Kokako Road Limited
5878-1	Woollaston Family Trust Partnership
6159-1	Pinehill Land Company Limited
6193-1	Cradles Farm Trust No 2
6486-1	GM & PJ Rutten Family Trust Partnership
7270-1	Ian Mantey Family Trust & Sally Mantey Family Trust
7626-1	NW & DM King
7733-2	Hawken Family Trust
7866-1	Stratford Golf Club Inc
9561-1	Kereone Farms Limited
9577-1	SB & J May Family Trust

2.3 Groundwater quality results

During the period under review, groundwater samples were obtained from a total of four coastal sites to assess salinity levels in aquifers being pumped. The results indicate groundwater salinities in the range expected in coastal areas. Further sampling of these bores during forthcoming monitoring periods will allow changes in groundwater salinity levels to be detected.

The results of the sampling carried out are presented below in Table 8.

Table 8 Groundwater quality results

Consent	Site code	Chloride (g/m^3)	Conductivity (mS/m)	pH	Sodium (g/m^3)	Temperature (^{o}C)
0714-2	GND1149	65.2	37.9	7.85	41.2	14.3
	GND1150	29.6	27.4	7.66	29.8	14.1
5950-1	GND1203	32.8	31.3	8.49	61.4	14.0
6026-1	GND1233	68.1	47.3	7.03	41.3	13.3

2.4 Residual flow compliance

The 2012-2013 irrigation season was busy for the Council's hydrological unit in respect of abstraction compliance monitoring, as the weather conditions meant that the demand for irrigation was high. Stream flows were below normal during the season,

which meant there was close and frequent monitoring required to ensure ecological flows were maintained.

During the period under review, compliance with residual flow conditions for surface water abstraction sites was assessed 86 times in 23 waterways. Flow gaugings were carried out between 11 December 2012 and 11 April 2013. Table 9 lists the consents assessed for residual flow compliance and the dates of the monitoring.

The periods when the stream gaugings activities take place coincide with the periods of low flows. Of the 86 gaugings, flow volumes were measured below residual flow requirements on 38 occasions. In these instances, irrigators taking water from the respective water bodies were required to stop taking until further notice. All irrigators ceased taking water following notification by the Council.

Photo 7 shows a stream gauging activity taking place downstream of one of the consented water takes.

Table 9 Stream gaugings carried out for residual flow compliance

Gauging Number	River	Site	Stage (m)	Flow (L/s)	Date/Time	Consent
8160	Waitotara	Below Moumahaki Confluence	-	8,160	11/Dec/2012 11:39	7527-1, 7528-1
8169	Mangaroa	D/s Schrider Take Site	0.353	144	19/Dec/2012 10:33	4494-2, 5636-1
8178	Waiokura	Winks Rd	0.221	94	11/Jan/2012 09:59	5827-2, 5840-2
8179	Waiokura	Winks Rd	0.250	142	15/Jan/2012 12:37	5827-2, 5840-2
8180	Waiokura	Winks Rd	0.237	121	15/Jan/2012 13:39	5827-2, 5840-2
8195	Waiweranui	0278-3	-	495	24/Jan/2013 14:23	0278-3
8196	Kaihihi	SH45	0.390	461	29/Jan/2013 09:30	5128-1, 5570-1, 5773-1, 5778-1
8197	Taungatara	SH45	0.260	556	29/Jan/2013 13:21	5829-1
8198	Oeo	5797-1	0.400	100	29/Jan/2013 15:01	5797-1
8200	Otahi 2	Ihaia Rd	0.445	90	29/Jan/2013 11:51	5973-1
8204	Ouri	SH45	0.400	208	31/Jan/2013 10:28	5791-1
8205	Inaha	Lower Inaha Rd	0.328	145	31/Jan/2013 12:32	5887-1
8206	Waihi 5	Denby Rd	0.376	16	31/Jan/2013 15:35	5898-2
8211	Waihi 5	Denby Rd	0.483	31	04/Feb/2013 13:28	5898-2
8212	Waiokura	Winks Rd	0.322	330	05/Feb/2013 10:48	5827-2, 5840-2
8213	Waihi 5	Denby Rd	0.935	135	05/Feb/2013 13:36	5898-2
8215	Waihi 5	Denby Rd	0.545	29	07/Feb/2013 12:30	5898-2
8216	Waihi 5	Denby Rd	0.543	31	07/Feb/2013 13:24	5898-2
8217	Waihi 5	Denby Rd	0.663	53	07/Feb/2013 14:39	5898-2

Gauging Number	River	Site	Stage (m)	Flow (L/s)	Date/Time	Consent
8218	Otahi 2	Ihaia Rd	0.480	189	08/Feb/2013 8:55	5973-1
8219	Taungatara	SH45	0.301	782	08/Feb/2013 10:32	5829-1
8220	Oeo	5797-1	0.496	179	08/Feb/2013 12:29	5797-1
8226	Werekino	Gray Rd	-	72	08/Feb/2013 12:40	0189-3
8227	Otahi 2	Ihaia Rd	0.580	135	11/Feb/2013 10:21	5973-1
Gauging Number	**River**	**Site**	**Stage (m)**	**Flow (L/s)**	**Date/Time**	**Consent**
8228	Ouri	SH45	0.414	219	11/Feb/2013 11:45	5791-1
8229	Oeo	5797-1	0.424	122	11/Feb/2013 13:00	5797-1
8230	Inaha	Lower Inaha Rd	0.360	188	11/Feb/2013 14:35	5887-1
8243	Waitara	Bertrand Rd	1.104	8,740	14/Feb/2013 12:38	6628-1
8245	Ouri	SH45	0.400	221	14/Feb/2013 12:47	5791-1
8246	Otahi 2	Ihaia Rd	0.450	122	14/Feb/2013 14:03	5973-1
8251	Waiau 2	Below 7372	0.213	102	14/Feb/2013 11:43	7372-1
8252	Wairoa	Kohi Beach Farm	0.347	170	14/Feb/2013 13:32	4783-2
8253	Wairoa	DS Dam	0.025	60	14/Feb/2013 14:56	5807-1
8255	Waiweranui	0278-3	-	397	15/Feb/2013 11:00	0278-3
8258	Mangaroa	D/s Schrider Take Site	0.201	81	19/Feb/2013 9:49	4494-2, 5636-1
8259	Mangaroa	McDonalds Farm	0.347	78	19/Feb/2013 11:17	4494-2, 5636-1
8260	Inaha	Lower Inaha Rd	0.350	155	19/Feb/2013 13:35	5887-1
8264	Werekino	Grays Rd	-	37	20/Feb/2013 8:03	0189-3
8265	Waiweranui	0278-3	-	357	21/Feb/2013 9:22	0278-3
8277	Ouri	SH45	0.400	185	27/Feb/2013 12:06	5791-1
8278	Taungatara	SH45	0.264	535	27/Feb/2013 13:25	5829-1
8279	Kaihihi	SH45	0.342	300	27/Feb/2013 19:19	5128-1, 5570-1, 5773-1, 5778-1
8282	Waiau	Below 7372	0.183	95	01/Mar/2013 11:00	7372-1
8283	Wairoa	Kohi Beach Farm	0.375	210	01/Mar/2013 12:40	4783-2
8284	Wairoa	DS Dam	0.040	41	01/Mar/2013 15:25	5807-1
8285	Waitara	Bertrand Rd	1.032	6,955	27/Feb/2013 13:35	6628-1
8286	Waitotara	Below Moumahaki Confluence	-	42,264	26/Feb/2013 12:10	7527-1, 7528-1
8288	Waitotara	Hawken Rd	-	10,890	26/Feb/2013 18:16	7527-1, 7528-1

Gauging Number	River	Site	Stage (m)	Flow (L/s)	Date/Time	Consent
8296	Kokako	Kokako Rd	0.605	13	06/Mar/2013 9:21	5896-1
8297	Mangaroa	D/s Schrider Take Site	0.219	62	06/Mar/2013 11:03	4494-2, 5636-1
8298	Mangaroa	McDonalds Farm	0.305	59	06/Mar/2013 12:23	4494-2, 5636-1
8301	Kaupokonui	Rama Rd	-	1,178	25/Feb/2013 14:12	4994-2
8303	Otakeho	Sandersons - SH45	-	340	25/Feb/2013 15:24	4993-2
8312	Kapoaiaia	Lighthouse	0.556	252	26/Feb/2013 13:43	5709-1
8314	Kaihihi	SH45	0.325	225	08/Mar/2013 8:24	5128-1, 5570-1, 5773-1, 5778-1
8315	Taungatara	SH45	0.255	501	08/Mar/2013 10:32	5829-1
8321	Punehu	SH45	0.186	247	13/Mar/2013 11:41	5876-1
8323	Otakeho	Sandersons - SH45	-	280	13/Mar/2013 13:49	4993-2
8324	Kaupokonui	Rama Rd	-	1,056	03/Mar/2013 14:53	4994-2
8330	Kaihihi	SH45	0.3	231	15/Mar/2013 15:13	5128-1, 5570-1, 5773-1, 5778-1
8331	Waiau	Below 7372	0.2	91	14/Mar/2013 10:03	7372-1
8332	Wairoa	DS Dam	0.1	99	14/Mar/2013 12:12	5807-1
8333	Wairoa	US Reservoir	-	259	14/Mar/2013 13:39	5807-1
8334	Tangahoe	DS Railway Bridge	-	701	15/Mar/2013 10:16	6430-1
8335	Kaikura	Proposed Dam (7346)	-	32	15/Mar/2013 11:56	7346-1
8344	Kapoaiaia	Lighthouse	0.545	230	14/Mar/2013 15:29	5709-1
8350	Kaihihi	Coast	1.739	179	15/Mar/2013 14:35	5773-1
8354	Waingongoro	SH45	0.325	983	12/Mar/2013 14:28	2138-3
8362	Taungatara	SH45	0.257	496	25/Mar/2013 13:20	5829-1
8363	Oeo	5797-1	0.402	85	25/Mar/2013 15:01	5797-1
8364	Kaihihi	SH45	0.331	285	25/Mar/2013 12:30	5128-1, 5570-1, 5773-1, 5778-1
8366	Kaihihi	Coast	-	243	25/Mar/2013 15:02	5773-1
8368	Waihi 5	Denby Rd	0.585	23	25/Mar/2013 13:10	5898-2
8373	Waiokura	Winks Rd	0.220	89	26/Mar/2013 14:00	5827-2, 5840-2
8374	Inaha	Lower Inaha Rd	0.334	118	26/Mar/2013 15:58	5887-1
Gauging Number	**River**	**Site**	**Stage (m)**	**Flow (L/s)**	**Date/Time**	**Consent**
8375	Inaha	Lower Inaha Rd	0.350	126	27/Mar/2013 9:57	5887-1
8380	Kaihihi	SH45	0.320	249	28/Mar/2013 11:24	5128-1, 5570-1, 5773-1, 5778-1

Gauging Number	River	Site	Stage (m)	Flow (L/s)	Date/Time	Consent
8386	Inaha	Lower Inaha Rd	0.353	128	04/Apr/2013 12:19	5887-1
8389	Wairoa	Kohi Beach Farm	0.404	208	04/Apr/2013 11:30	4783-2
8390	Wairoa	DS Dam	0.115	278	04/Apr/2013 12:29	5807-1
8391	Wairoa	US Reservoir	-	264	04/Apr/2013 13:21	5807-1
8403	Waitotara	Hawken Rd	-	8,881	09/Apr/2013 17:14	7527-1, 7528-1
8404	Kaihihi	SH45	0.318	237	09/Apr/2013 8:53	5128-1, 5570-1, 5773-1, 5778-1
8407	Kaihihi	Coast	-	166	09/Apr/2013 12:35	5773-1
8410	Kaihihi	SH45	0.369	393	09/Apr/2013 14:28	5773-1
8415	Waiau 2	Below 7372	0.220	122	11/Apr/2013 13:55	7372-1

Photo 7 Stream gauging

2.5 Compliance with abstraction rate and volumetric limits

Compliance with abstraction rate and volume is assessed for all consent holders from whom data is available[6]. Compliance with abstraction rate limits was determined either by direct measurement or by calculating from records submitted by the consent holder.

Of the consents for which data was received, 63% were within compliance for flow-rate allocation. There appeared to be a number of issues with flow meters and dataloggers not providing accurate information, as six consents looked to have extreme breaches with both rate and volume, which were not possible given the intake pipe diameter of

[6] Nine dataloggers were not checked, as no irrigation occurred during the 2012-2013 period.

those setups. Further investigation, in the way of verifying the flow meter rate, is required for these setups before any further action is taken against the consent holders. Non compliance with consent conditions for abstraction rate and volume is discussed further in Section 3.

During the monitored period 6 consent holders did not submit records to the Council on time; details on these consents are reported under Section 2.5.

Table 10 displays the information for consents that were found to be in breach of the allocated flow-rate or volumetric amount at any time during the exercising of the consent during the 2012-2013 review period. These consent holders were advised of their breaches and that they needed to ensure this did not occur in the following season, otherwise enforcement action may follow.

It is considered that a consent breaches abstraction limits when the exceedance is greater than 5% of the consented limit.

Table 10 Consents breached for exceeding allocation limits during 2012-2013

Consent	Consent Holder	Source	Breach
0017-3	Manaia Golf Club	Surface Water	Volumetric
0164-2	JR & DM Baker	Surface Water	Volumetric/Rate
1721-3	Manukorihi Golf Club Inc	Surface Water	Rate
1877-3	Te Ngutu Golf Club Incorporated	Surface Water	Rate
2138-2	Riverside Farms Taranaki Ltd	Surface Water	Rate
4494-2	CT & JM McDonald	Surface Water	Rate
5570-2	Kaihihi Trust	Surface Water	Volumetric/Rate
5709-2	KCCG Sole	Surface Water	Rate
5773-1	Goodin FJ & Sons Limited	Surface Water	Volume
5827-2	Walker & McLean Partnership	Surface Water	Volumetric/Rate
5896-1	Kohi Investments Limited	Surface Water	Volumetric/Rate
5898-2	David Pease Family Trust	Surface Water	Rate
5973-1	DR & AJ Gibson	Surface Water	Rate
6026-1	JR & DM Baker	Groundwater	Rate
6292-1	New Plymouth Golf Club	Surface Water	Rate
6429-1	Leatherleaf Limited	Surface Water	Rate
6628-1	Hamblyn Family Trust	Surface Water	Volumetric/Rate
7372-1	Pukeone Partnership	Surface Water	Volumetric/Rate

2.6 Record keeping compliance

For the 2011-2012 review period, abstraction records were received on time from all but six water abstraction consent holders who exercised their permits (Table 11). Written notifications and telephone calls received advising the non-exercising of consents were also taken as provision of records. Consent holders who have dataloggers fitted to their intake systems are exempted from providing data to the Council at the data collection is yearly undertaken by Council's staff as part of the compliance monitoring programmes. In the 2012-2013 season, there were four dataloggers that malfunctioned.

Table 11 Consents for which data was not received by the Council as at 31 July 2013 for the 2012-2013 irrigation season

Consent	Consent Holder	Received?
0647-3	IG Cassie	No
1223-3	EO & CP Lander	No
3171-3	Taranaki Greenhouses Limited	No
3312-3	GH Lance	No
5568-1	Cornwall Park Farms Limited	No
5887-1	A & EN Barkla	No

There were 55 consent holders that exercised their consents for the 2012-2013 season and data records were received from 89% of them. Forty-five had dataloggers fitted and 8 provided manual records.

2.7 Irrigation water usage 2012-2013

Water use for irrigation is based on consent holder abstraction records. The following general comments can be made from the processed irrigation data:

- Of the non-exercised consents during 2012-2013, 38% of the irrigation systems were not yet operational. Thirteen consents were not exercised even though the irrigation systems were in place.
- There were 18 breached for exceeding limits on allocated rates and volumes compared to 2011-2012 where there were 5 breaches.
- Records were received from 89% of the consent holders that exercised their consent in the 2012-2013 season.
- All the golf clubs exercised their water rights during 2012-2013.
- Two new consents for pasture irrigation were granted during the period under review.
- On November 2012 the Measurement and Reporting of Water Takes regulations 2010 came into force for all water takes above 20 L/s, meaning that the consent

holder has to verify their flowmeter every 5 years and that the flowmeter is tamperproof, records accurately, is installed as best practice and is done so by a verified person.

- Water harvesting has been an alternative to on-demand stream abstraction that farmers are considering more and more as part of their on-farm, water management

2.8 Investigations, interventions, and incidents

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

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including 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, there were 41 incidents recorded by the Council that were associated with consent holders. All of these related to breaching one or more of their consent conditions. The incidents are listed in Table 12, showing the consent, consent holder, details of the incident and the outcome.

Table 12 Consents found to be in breach and the incidents registered

Consent	Consent Holder	Reason incident lodged	Outcome
0017-3	Manaia Golf Club	Datalogger not tamperproof and no verification completed. Also breached daily volume on numerous occasions	14 day letter, followed by an abatement notice. Datalogger verified 16/09/13 and tamper proofed
0164-2	JR & DM Baker	Datalogger battery was flat. Data erroneous/corrupt. Breached volume/rate	Due to the unforeseeable nature of the problem, Council staff worked with the consent holder to rectify the problems, by removing the datalogger and sending it away for the batteries to be replaced and then reinstalling it for the 2013-2014 season. The battery started to fail half way through the season, which caused erroneous readings (spikes) in the data

Consent	Consent Holder	Reason incident lodged	Outcome
0184-3	Inglewood Golf Club Inc	Groundwater bore drilled without consent and water abstracted from bore without consent	The Council determined that there was no need for a consent to drill the bore. A flow test is to be carried out by Council staff to determine abstraction rate, to see if a consent to take water from the bore is required
0647-3	IG Cassie	Failed to provide abstraction records	Due to the minor nature of non-compliance, the Council decided not to take any further action. However, an abatement notice will be issued if this does occur again in the future
0714-2	GD & HM McCallum	2x datalogger batteries were flat. Cables damaged on one datalogger. Records not complete	Due to the unforeseeable nature of the problem, Council staff worked with the consent holder to rectify the problems, by removing the dataloggers and sending them away for the batteries to be replaced and then reinstalling them for the 2013-2014 season. Cables were mended
1223-3	EO & CP Lander	Failed to provide abstraction records	Due to the minor nature of non-compliance, the Council decided not to take any further action. However, an abatement notice will be issued if this does occur again in the future
1721-3	Manukorihi Golf Club Inc	Breached rate on numerous occasions	14 day letter followed by an abatement notice. Applied for a change to their consent conditions.
1877-3	Te Ngutu Golf Club Incorporated	Breached rate on numerous occasions	14 day letter followed by an abatement notice. Applied for a change to their consent conditions
2138-2	Riverside Farms Taranaki Ltd	Breached rate on numerous occasions	14 day letter followed by an abatement notice. Consent under application to increase rate
3171-3	Taranaki Greenhouses Limited	Failed to provide abstraction records	Due to the minor nature of non-compliance, the Council decided not to take any further action. However, an abatement notice will be issued if this does occur again in the future
3312-3	GH Lance	No permanent label, no flowmeter and no datalogger & therefore no records kept	Flowmeter was actually present. Due to the small scale of taking, the Council decided not to take any further action. However, an abatement notice will be issued if it has not been rectified by 2013-2014 season
3312-3	GH Lance	No datalogger and no records	Due to the small scale of taking, the Council decided not to take any further action. However, an abatement notice will be issued if it has not been rectified by 2013-2014 season
4494-2	CT & JM McDonald	Datalogger power off and no battery back up. Also breached rate on numerous occasions	14 day letter followed by an abatement notice. Battery back up installed. Consent change occurred to change abstraction rate

Consent	Consent Holder	Reason incident lodged	Outcome
4993-2	J & EG Sanderson	Datalogger and flowmeter not tamperproof.	14 day letter followed by an abatement notice. Consent holder got tamperproof stickers installed on flowmeter, but flowmeter was not hardwired into the system, as required by consent conditions. To be rectified before irrigating in the 2013-2014 season.
4993-2	J & EG Sanderson	Flowmeter not tamperproof and concerns over readings being erroneous	14 day letter followed by an abatement notice. Consent holder has organised electrician to look at flowmeter and make flowmeter tamperproof
4994-2	J & EG Sanderson	Datalogger and flowmeter not tamperproof	14 day letter followed by an abatement notice. Consent holder has organised electrician to reinstall datalogger and make flowmeter tamperproof
4994-2	J & EG Sanderson	Datalogger missing and flowmeter not tamperproof	14 day letter followed by an abatement notice. Consent holder has organised electrician to reinstall datalogger and make flowmeter tamperproof
Consent	**Consent Holder**	**Reason incident lodged**	**Outcome**
5568-1	Cornwall Park Farms Limited	No measuring device	No action was taken, but this needs to be completed before 2013-2014 irrigation starts, otherwise an abatement notice will be issued
5570-2	Kaihihi Trust	Breached volume and rate on numerous occasions	14 day letter followed by an abatement notice. Consent holder has installed a variable speed pump
5571-2	Jimian Limited	Power to flowmeter flat	Due to the setup being a portable pump, there is no mains power supply; it simply runs on a battery. Consent holder will ring contact Council when irrigation has finished for the season, so Council can read flowmeter before it is put away for the winter
5623-1	WD & SC Morrison	No verification has been completed	To be completed prior to irrigating in the 2013-2014 season
5709-2	KCCG Sole	Breached rate on numerous occasions	14 day letter followed by an abatement notice. No further action taken.
5773-1	Goodin FJ & Sons Limited	Breached volume. Records not complete for season. No verification completed. Flowmeter not installed as best practice. Taking from a pond, which they are not consented for.	14 day letter sent to consent holder. Change in consent conditions carried out

Consent	Consent Holder	Reason incident lodged	Outcome
5797-1	Pihama Farms Limited	Taking below residual flow cutoff	Advised to cease taking, which consent holder did. Advised could not take until water level was above a certain height on staff gauge
5827-2	Walker & McLean Partnership	Breached volume and rate on numerous occasions	14 day letter followed by an abatement notice. In discussion with consent holder and Council, it was determined that the consent holder firstly needed to establish age and condition of flow meter. Provide verification of flow meter and manufacturer specifications, re pipe lengths required u/s and d/s of meter
5829-1	Julian RM & MC Family Trust	Abstraction records did not cover entire season and datalogger date/time incorrect, so unable to ascertain when irrigation actually started to occur	No action taken, Council staff liaising with consent holder to ensure problem is resolved before irrigation begins in 2013-2014
5863-1	Geary AR Trust (A R Geary)	No flowmeter present	Abatement notice issued. Flow meter installed 14/02/13
5878-1	Woollaston Family Trust Partnership	No flowmeter present	Abatement notice issued. Flow meter to be installed prior to irrigating in 2013-2014
5887-1	A & EN Barkla	Failed to provide abstraction records	14 day letter sent. No action taken, abatement notice will be issued if this occurs again in the future
5896-1	Kohi Investments Limited	Taking below residual flow cutoff	Advised to cease taking, which consent holder did. Advised could not take until water level above a certain height on staff gauge
5896-1	Kohi Investments Limited	Breached volume and rate on numerous occasions	14 day letter followed by an abatement notice. Battery started to fail half way through the season, which causes erroneous readings (spikes) in the data. Datalogger removed to replace batteries and then reinstalled. Also early renewal and change of conditions was applied for
5898-2	David Pease Family Trust	Incomplete records and breached rate on a number of occasions	14 day letter followed by an abatement notice. The battery started to fail half way through the season, which causes erroneous readings (spikes) in the data. Datalogger removed to replace batteries and then reinstalled
5950-1	WD & SC Morrison	Incomplete records	Records retrieved from Waterforce. No further action required
5973-1	DR & AJ Gibson	Taking below residual flow cutoff	Advised to cease taking, which consent holder did. Advised could not take until water level above a certain height on staff gauge

Consent	Consent Holder	Reason incident lodged	Outcome
5973-1	DR & AJ Gibson	Breached rate on numerous occasions	14 day letter, followed by an abatement notice
6026-1	JR & DM Baker	Datalogger battery was flat. Breached rate	Due to the unforeseeable nature of the problem, Council staff worked with the consent holder to rectify the problems, by removing the datalogger and sending it away for the batteries to be replaced and then reinstalling it for the 2013-2014 season. The battery started to fail half way through the season, which caused erroneous readings (spikes) in the data. Manual records were kept
Consent	**Consent Holder**	**Reason incident lodged**	**Outcome**
6292-1	New Plymouth Golf Club	Breached rate on numerous occasions	14 day letter, followed by an abatement notice
6429-1	Leatherleaf Limited	Breached rate on 2 occasions	14 day letter sent. The breaches related to a coupling bursting off, which caused the pump to take at a greater rate for a short period of time. No further action was taken
6628-1	Hamblyn Family Trust	Breached volume and rate on a number of occasions. Also meter not verified	14 day letter, followed by an abatement notice
7372-1	Pukeone Partnership	Breaching abstraction rate	14 day letter, followed by an abatement notice. Flowmeter faulty, to be further investigated by the consent holder
7372-1	Pukeone Partnership	Breaching rate and volume	14 day letter, followed by an abatement notice. Flowmeter faulty, to be further investigated by the consent holder

3. Discussion

In drafting and reviewing conditions on water take permits and in implementing monitoring programmes, the Council assesses the "effects on the environment" as much as it is appropriate for each water take source. Monitoring programmes are therefore not only based on existing permit conditions, but also on the obligations of the Act to assess the effects on the environment from the exercising of consents.

Improving the efficiency of water use is a key outcome by the Water Programme of Action. Water is a public resource and the permission to take is granted through a resource consent. Associated with that permission is a public expectation that can be better met if the actual amounts of water taken are accurately monitored. Measuring actual water used is part of demonstrating and measuring progress towards more efficient water use.

3.1 Discussion of site performance

Each year the Council assesses consent holder performances based on compliance with allocated abstraction rates and maximum daily volumes, protection of minimum residual flows, and the provision of abstraction records.

The examination of the data supplied to the Council, revealed that 18 (33%) of the consent holders from 55 of the exercised consents breached limits for rate/volume abstracted.

As noted earlier, the number of poorly installed water meters (flowmeters) has become a concern for the Council. Most resource consents for water takes issued by the Council have specific conditions about the installation of a water meter device. A reliable and accurate flowmeter is crucial to providing good information to the consent holder and the Council alike.

To comply with Taranaki Regional Council requirements, the water meter should:

- Have an accuracy of +/- 5% under field conditions, with calibration certified.
- Be simple to operate and read.
- Be tamper-proof and sealed.
- Be capable of continuous measurements in cubic meters.
- Include a pulse output that is compatible with the dataloggers recommended by the Council.
- Have sufficient pipe length for Council to use a strap-on meter for periodic checks. Pipe length should be at least 10 times the diameter before the meter and five times the diameter after the meter or manufacturer's specifications (Figure 8).
- A detailed plan of the installed meter and distances to any potential turbulence sources (e.g. elbows, bends, valves, etc) shall be submitted to the Council within 30 working days of the installation to certify that the flowmeter has been installed to the manufacturer's specifications.

It is important that the contractors hired for the installation of the flowmeter do so in accordance with the manufacturer's specifications. Good installations leave sufficient straight length of pipe between gate valves, elbows, etc and the flowmeter to ensure there is no turbulence in the water passing through the meter, which reduces accuracy.

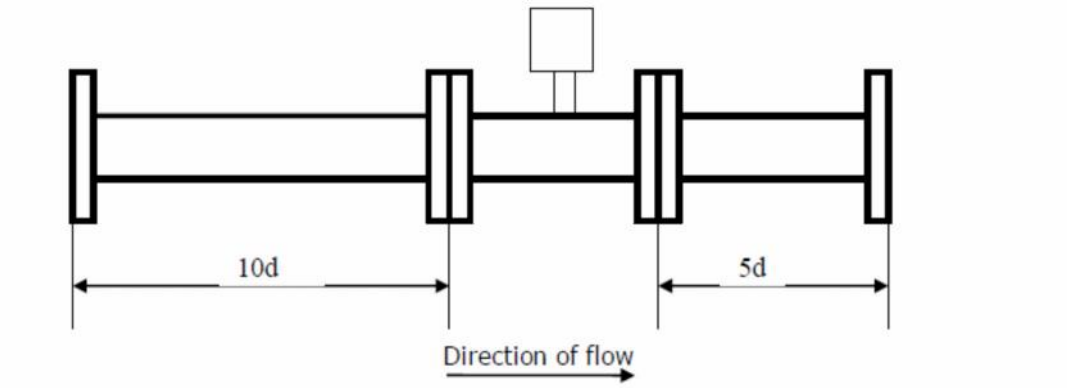

Figure 8 Flowmeters: Pipe layout recommendations

Most flowmeters should be installed so that there is a significant run of straight pipe before and after the location of the flowmeter. This is intended to allow the straight

pipe run to "smooth out" any turbulence produced by the presence of valves, filters, chemical injectors and diffusers, and changes in pipe direction. This type of turbulence produces error in the reading of most flow meters. Flowmeter errors can be quite large if installed incorrectly. The error produced by a gate valve or a butterfly valve upstream of a flowmeter can be as much as 50-60%; the error produced from a partially closed ball valve can be as much as 50% for flowmeters. Chemical injectors can produce significant error in the flowmeter reading also[7].

3.1.1 Compliance issues

Eighteen consents were found to be in breach of the abstraction limits as discussed in Section 2.4. The following are the graphs of the data against the limits set on the water permits.

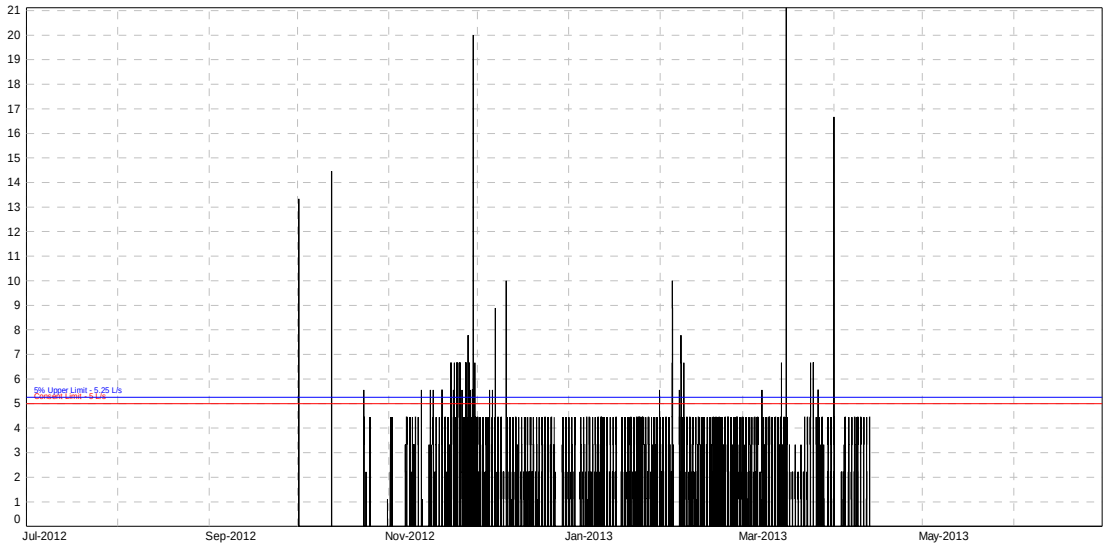

Figure 9 Amounts and dates of exceedance of abstraction rate for consent 0017-3

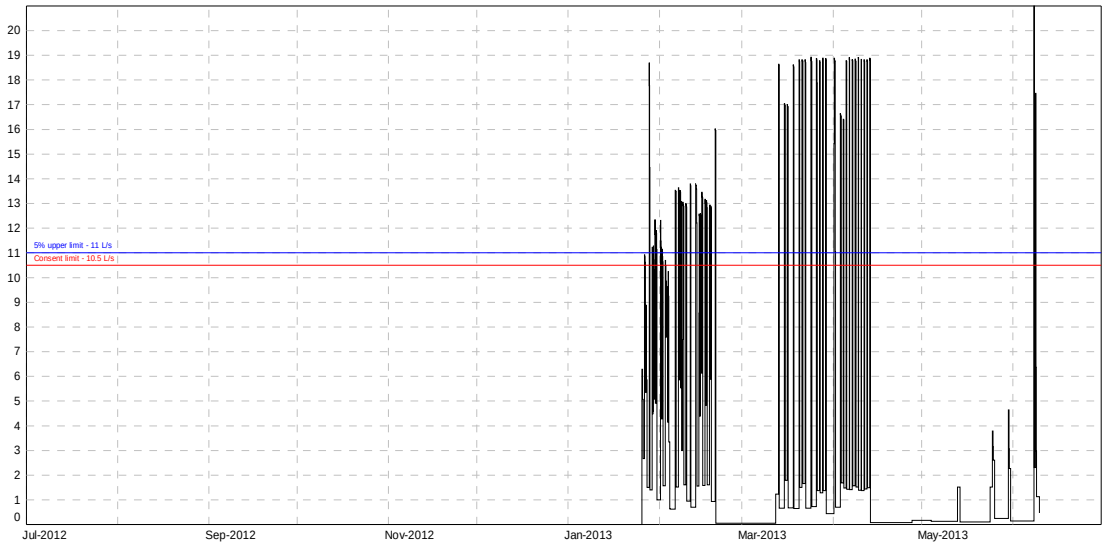

Figure 10 Amounts and dates of exceedance of abstraction rate for consent 0164-2

[7] Global Water Instrumentations; FLOW METERS: PIPE LAYOUT RECOMMENDATIONS. www.globalw.com

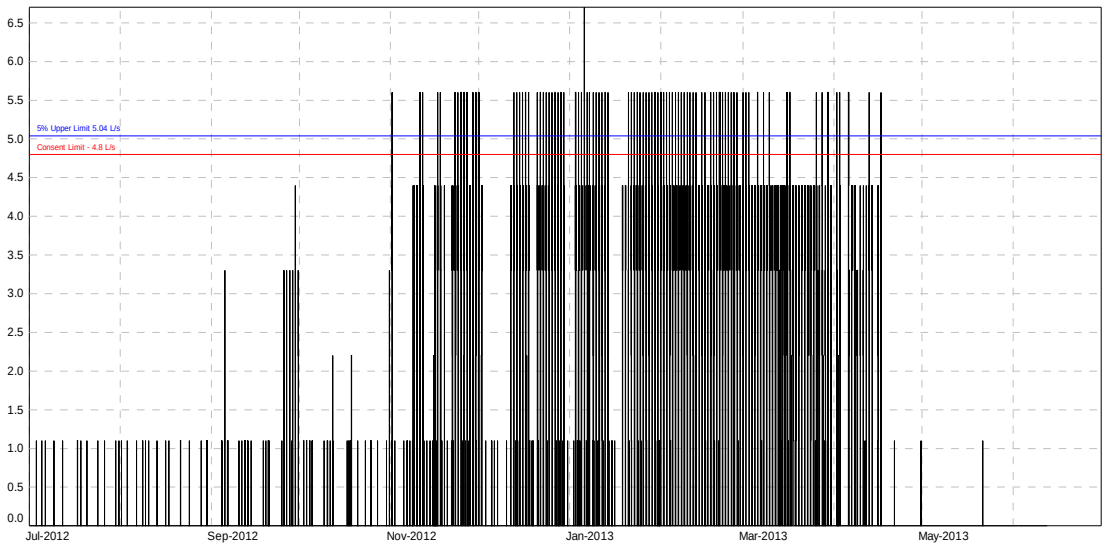

Figure 11 Amounts and dates of exceedance of abstraction rate for consent 1721-3

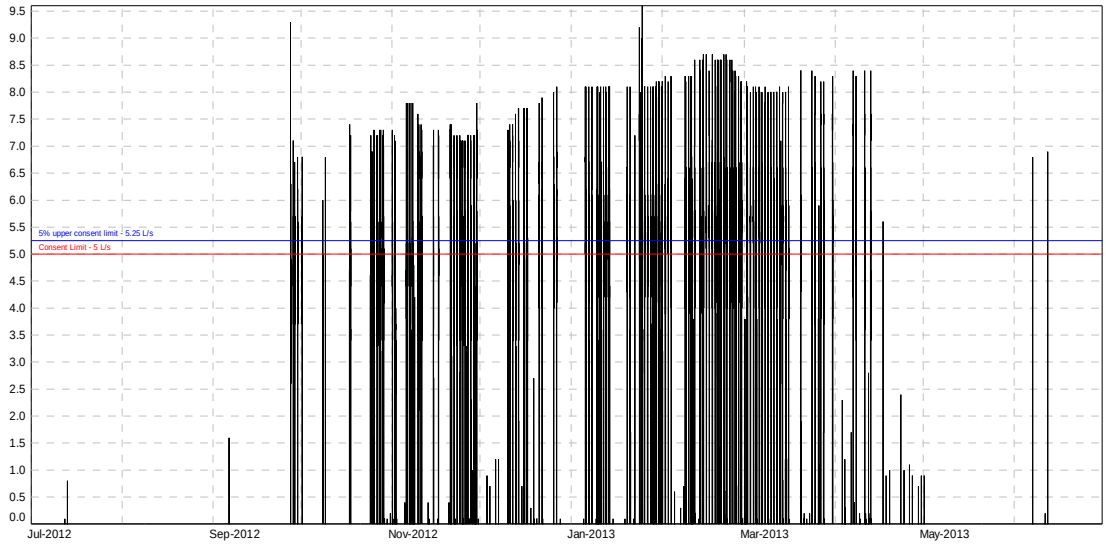

Figure 12 Amounts and dates of exceedance of abstraction rate for consent 1877-3

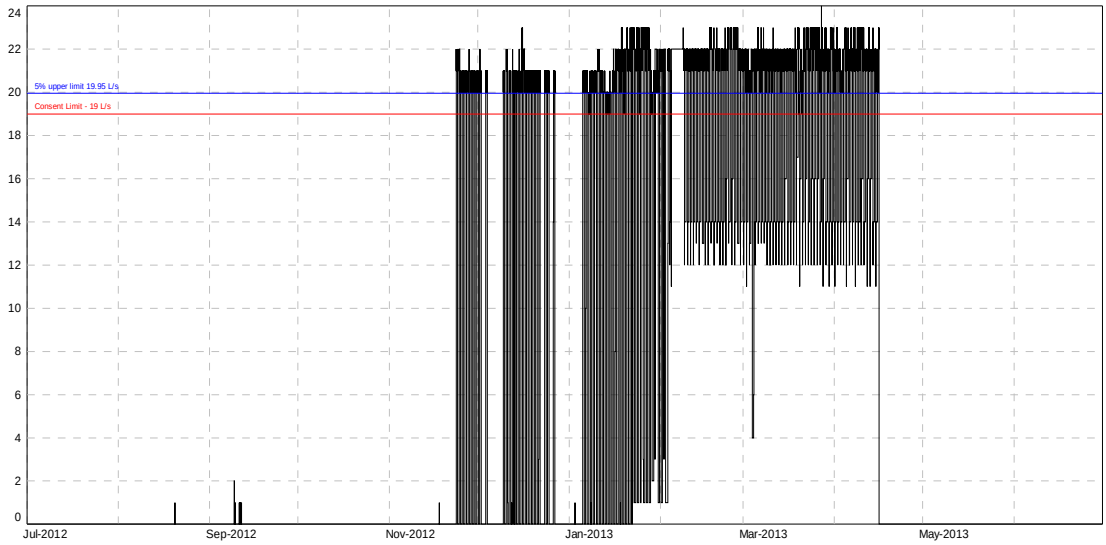

Figure 13 Amounts and dates of exceedance of abstraction rate for consent 2138-2

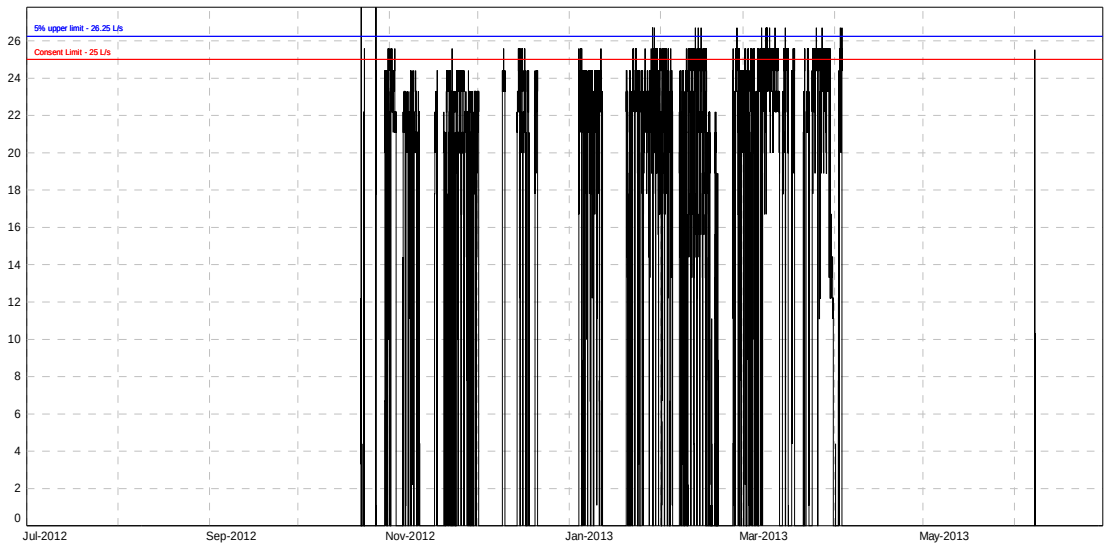

Figure 14 Amounts and dates of exceedance of abstraction rate for consent 4494-2

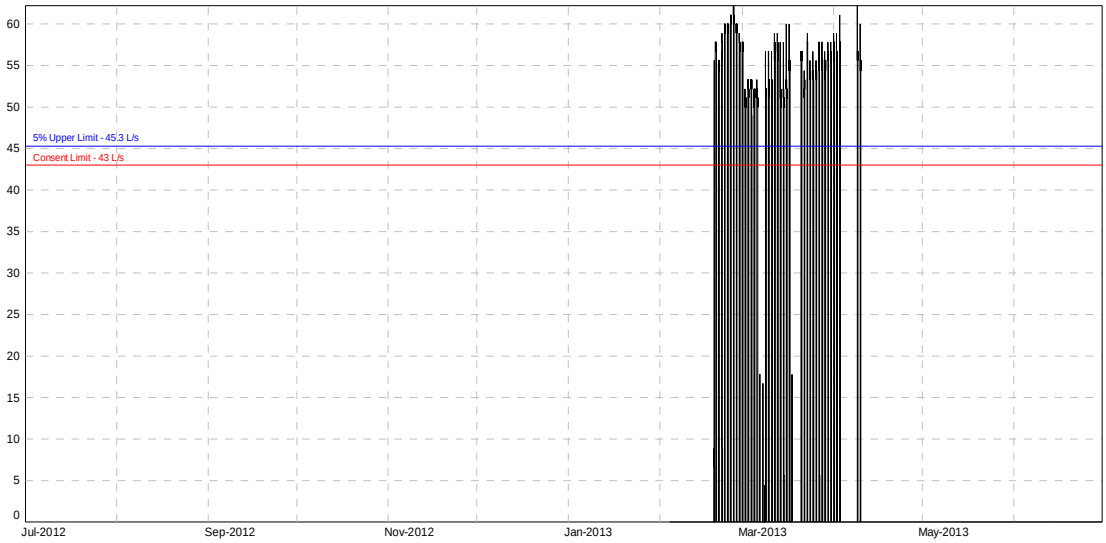

Figure 15 Amounts and dates of exceedance of abstraction rate for consent 5570-2

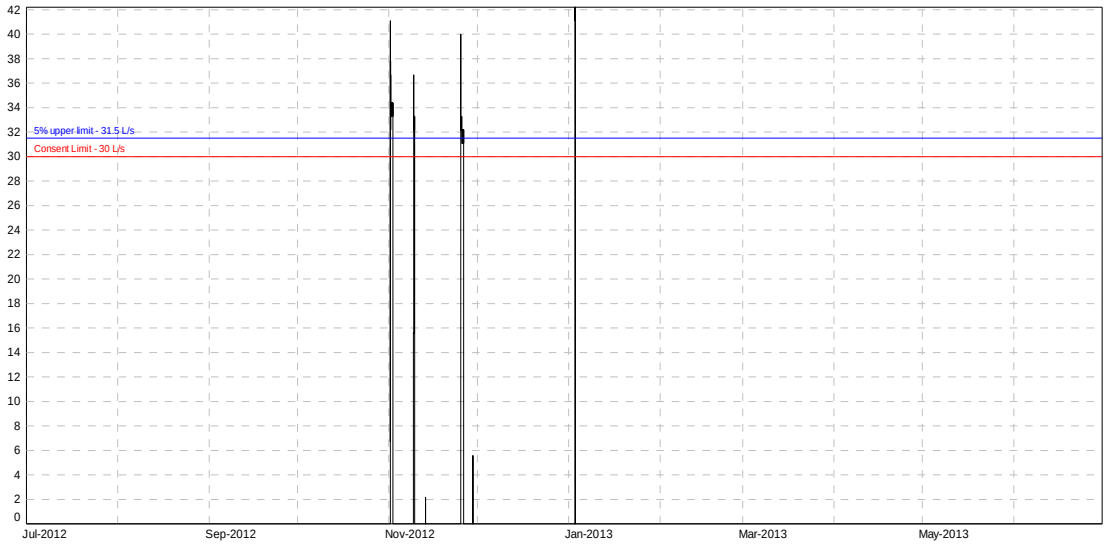

Figure 16 Amounts and dates of exceedance of abstraction rate for consent 5709-2

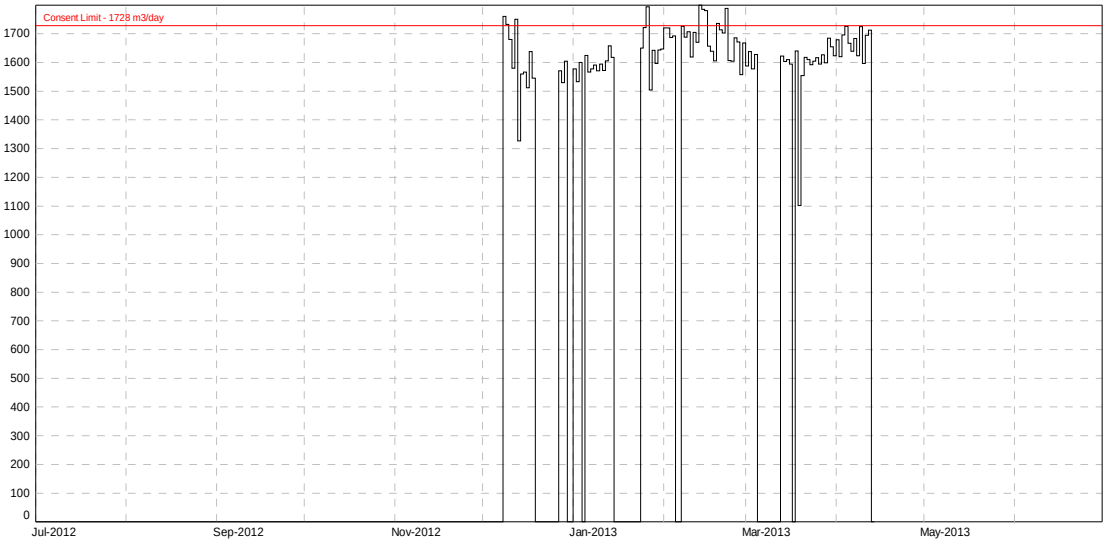

Figure 17 Amounts and dates of exceedance of daily abstraction volume for consent 5773-2

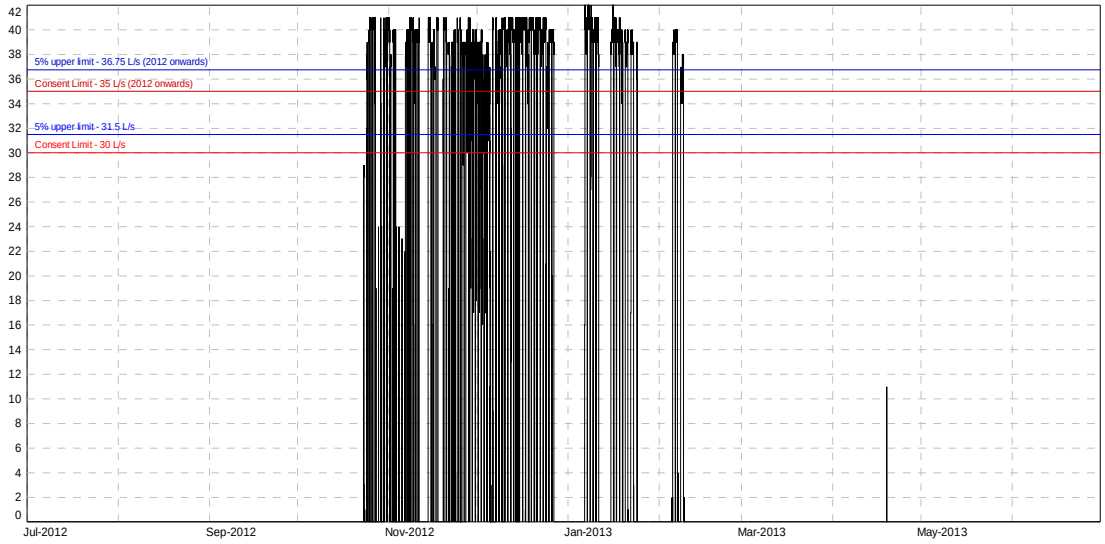

Figure 18 Amounts and dates of exceedance of abstraction rate for consent 5827-2

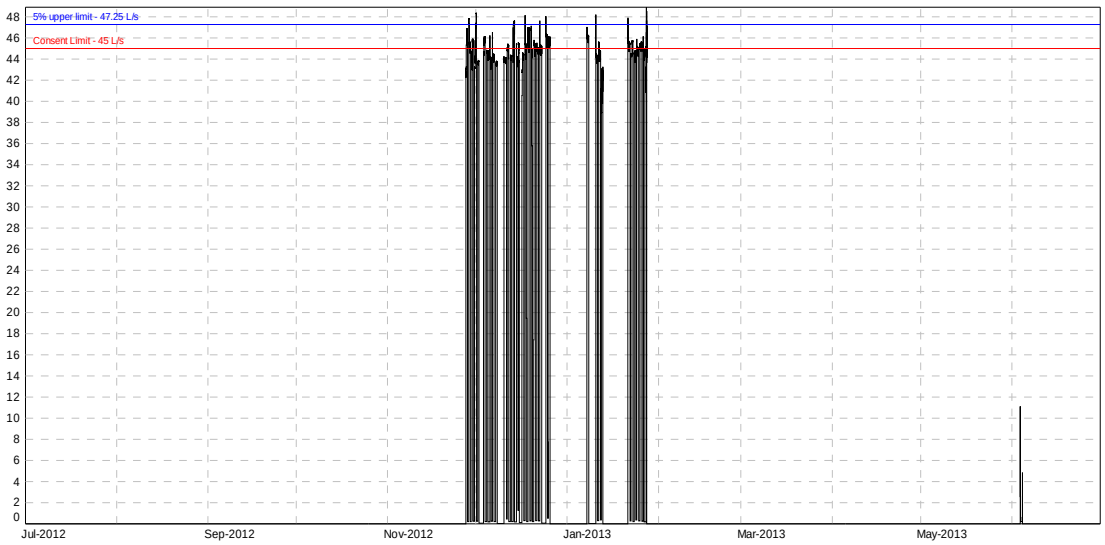

Figure 19 Amounts and dates of exceedance of abstraction rate for consent 5896-1

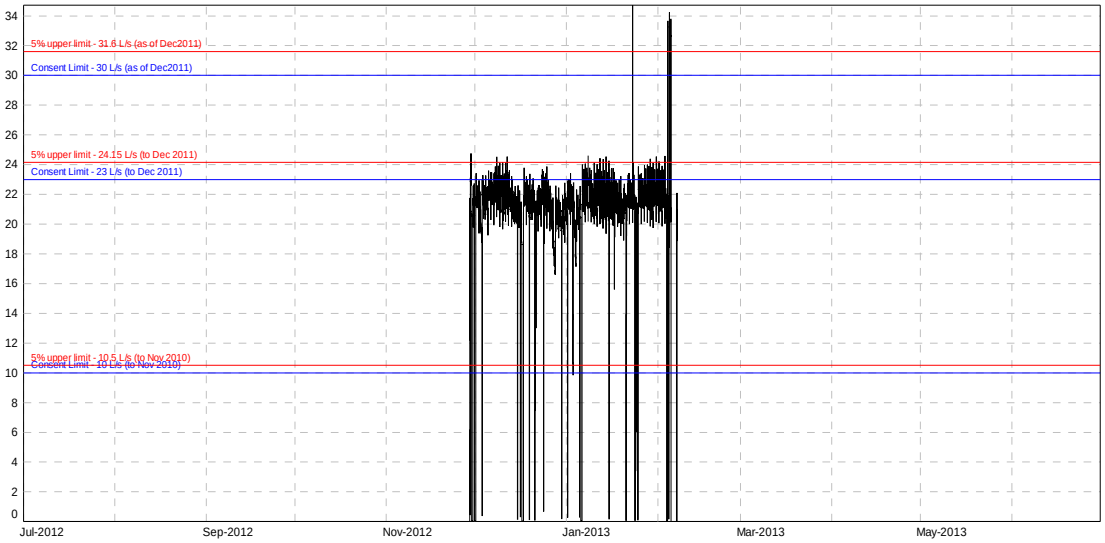

Figure 20 Amounts and dates of exceedance of abstraction rate for consent 5898-2

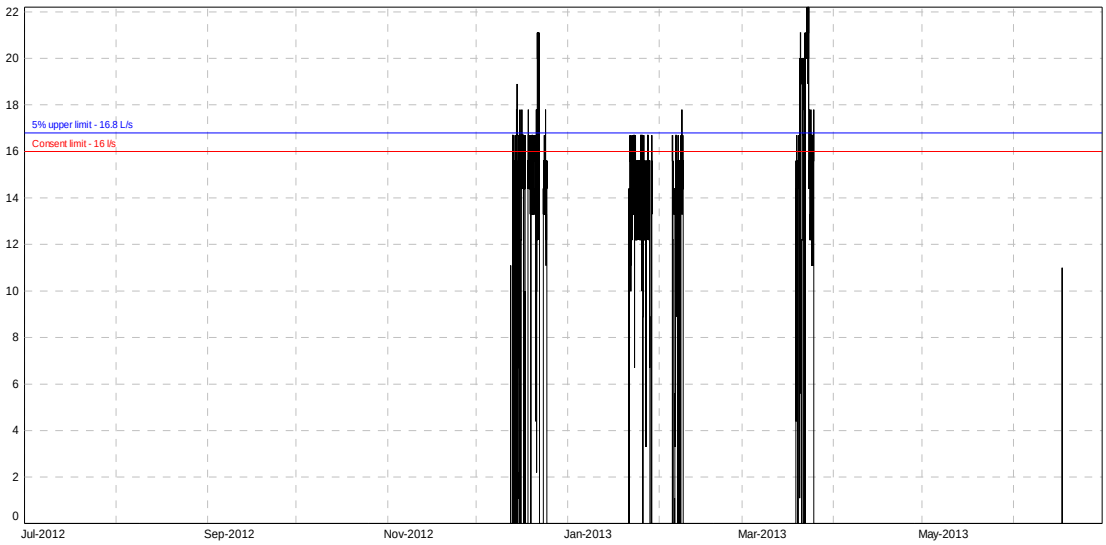

Figure 21 Amounts and dates of exceedance of abstraction rate for consent 5973-1

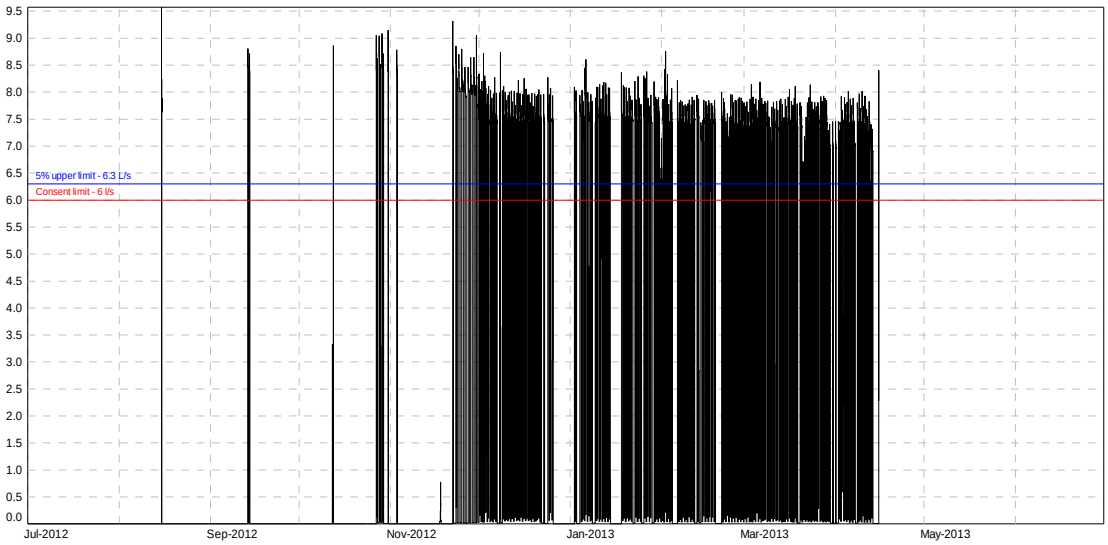

Figure 22 Amounts and dates of exceedance of abstraction rate for consent 6026-1

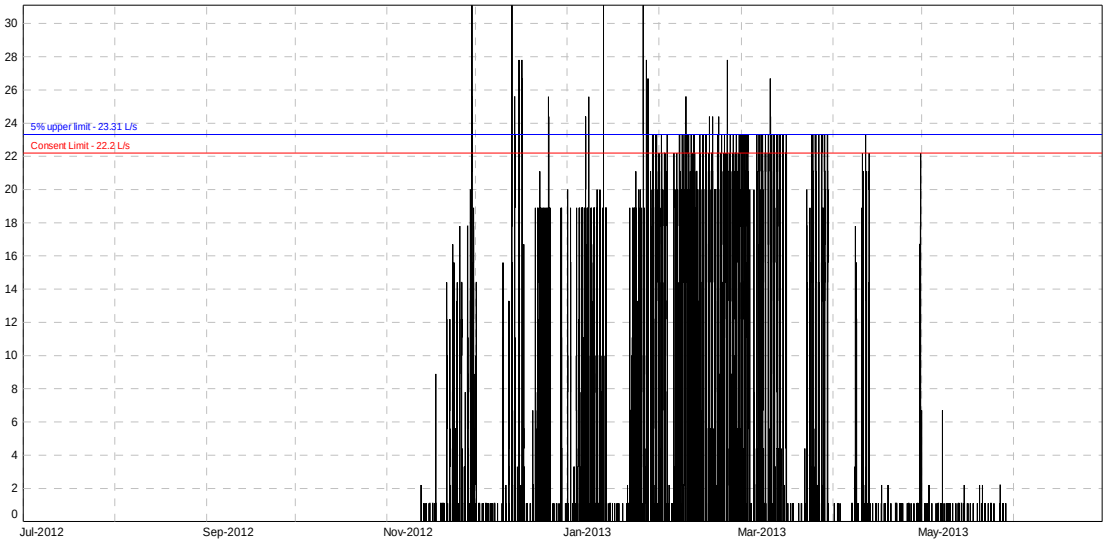

Figure 23 Amounts and dates of exceedance of abstraction rate for consent 6292-1

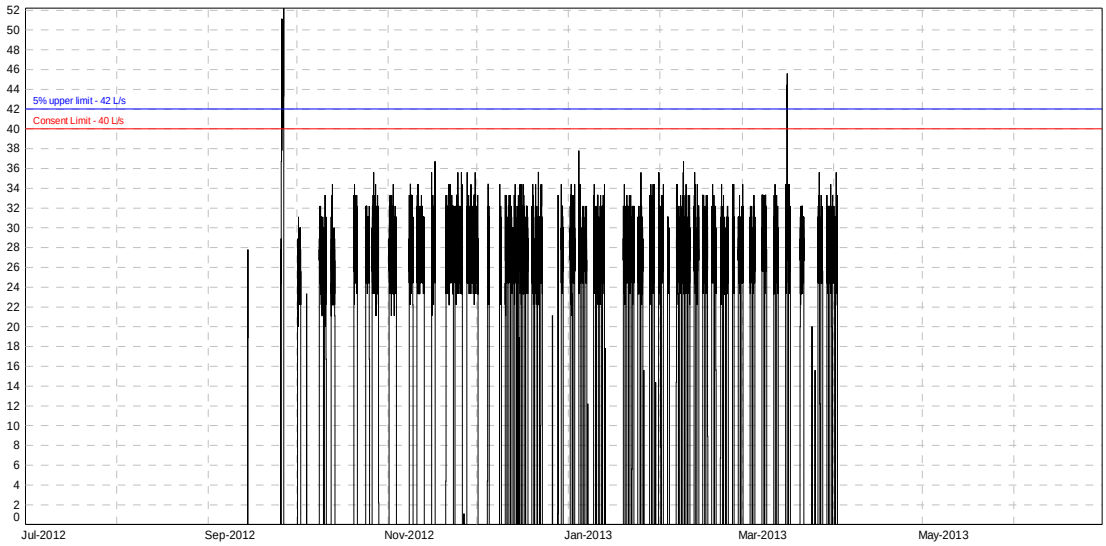

Figure 24 Amounts and dates of exceedance of abstraction rate for consent 6429-1

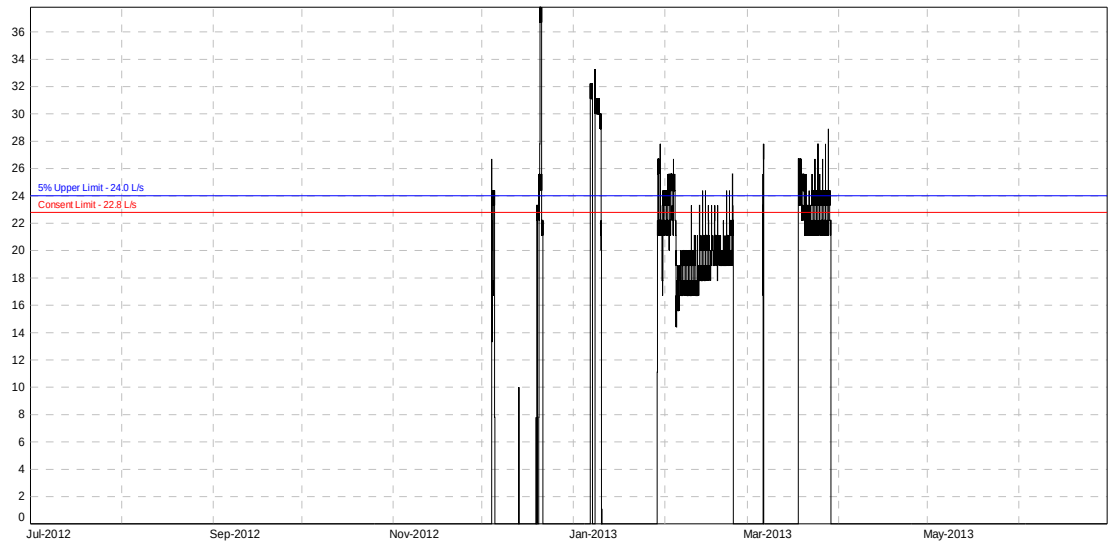

Figure 25 Amounts and dates of exceedance of abstraction rate for consent 6628-1

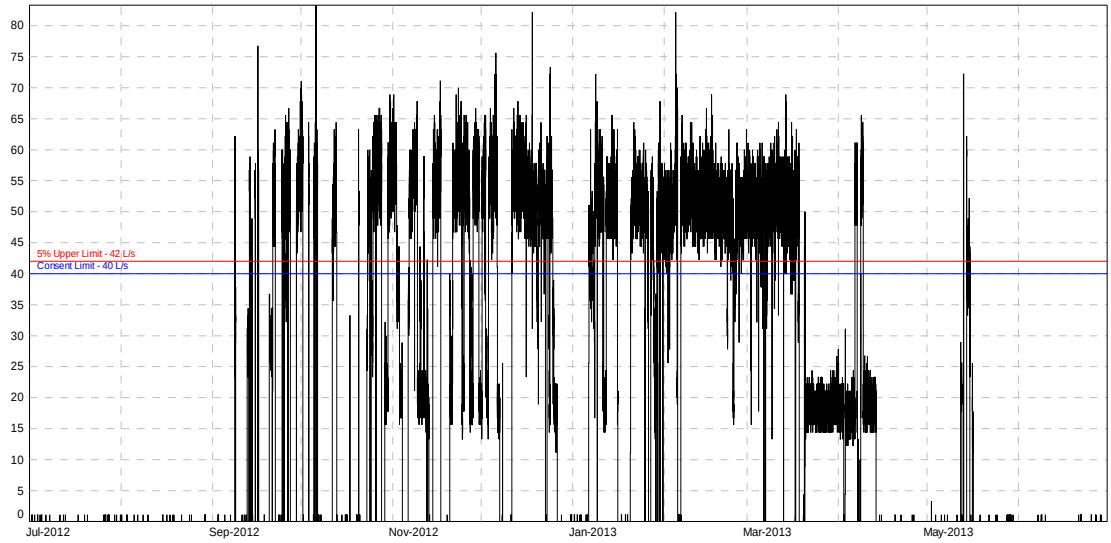

Figure 26 Amounts and dates of exceedance of abstraction rate for consent 7372-1

3.2 Evaluation of performance

A tabular summary of the all the consent holder's compliance record for the year under review is set out in Table 13.

Table 13 Individual performance for all irrigation consent holders

Consent	Consent Holder	Compliance achieved?
0017-3	Manaia Golf Club	Improvement required (environmental)
0124-5	Kaitake Golf Club Inc	High
0132-3	Hawera Golf Club Inc	High
0164-2	JR & DM Baker	Improvement required (environmental)
0184-3	Inglewood Golf Club Inc	Improvement required (environmental)

Consent	Consent Holder	Compliance achieved?
0189-4	AI & KJ Williams	N/A
0270-2	Westown Golf Club Inc	High
0278-4	NRGE Farms Limited/Oceanview Trust	High
0464-3	Oakura Farms Limited	N/A
0647-3	IG Cassie	Improvement required (environmental)
0714-2	GD & HM McCallum	Improvement required (environmental)
0721-3	MD Aiken Family Trust	N/A
0880-3	IHC New Zealand Inc (NORTH TARANAKI)	High
1193-3	Vickers B & NM & Church G & CG	N/A
1223-3	EO & CP Lander	Improvement required (environmental)
1253-3	KA & RD Southall	N/A
1721-3	Manukorihi Golf Club Inc	Improvement required (environmental)
1877-3	Te Ngutu Golf Club Incorporated	Improvement required (environmental)
1879-3	Wairau Nurseries	N/A
2138-3	Riverside Farms Taranaki Ltd	Improvement required (environmental)
3171-3	Taranaki Greenhouses Limited	Improvement required (environmental)
3312-3	GH Lance	Improvement required (environmental)
3859-2	Living Light 2000 Limited	N/A
4450-2	Waitara Golf Club Inc	High
4494-2	CT & JM McDonald	Improvement required (environmental)
Consent	**Consent Holder**	**Compliance achieved?**
4783-2	Larsen Trusts Partnership	High
4993-2	J & EG Sanderson	Improvement required (environmental)
4994-2	J & EG Sanderson	Improvement required (environmental)
5128-2	Coastal Country Farms Limited	High
5306-1	Kapuni Contractors Limited	N/A
5568-1	Cornwall Park Farms Limited	Improvement required (environmental)
5570-2	Kaihihi Trust	Improvement required (environmental)
5571-1	Jimian Limited	Improvement required (environmental)

Consent	Consent Holder	Compliance achieved?
5623-1	WD & SC Morrison	Improvement required (environmental)
5636-1	Waiwira Trust	High
5696-1	Kokako Road Limited	N/A
5709-2	KCCG Sole Trust	Improvement required (environmental)
5773-1	Goodin FJ & Sons Limited	Improvement required (environmental)
5778-1	Mara Trust	High
5781-2	Waikaikai Farms Limited	High
5791-1	AL & LA Campbell	High
5797-1	Pihama Farms Limited	Improvement required (environmental)
5807-1	Dickie Roger Family Trust	High
5827-2	Walker & McLean Partnership	Improvement required (environmental)
5829-1	Julian RM & MC Family Trust	Improvement required (environmental)
5840-2	Gibbs G Trust	High
5863-2	Geary AR Trust (A R Geary)	Improvement required (environmental)
5876-1	GA & RJ Dorn	High
5878-1	Woollaston Family Trust Partnership	Improvement required (environmental)
5879-1	Hilldale Trust	High
5887-1	A & EN Barkla	Improvement required (environmental)
5896-1	Kohi Investments Limited	Improvement required (environmental)
5898-2	David Pease Family Trust	Improvement required (environmental)
5950-1	WD & SC Morrison	Improvement required (environmental)
5973-1	DR & AJ Gibson	Improvement required (environmental)
6026-1	JR & DM Baker	Improvement required (environmental)
6159-1	Pinehill Land Company Limited	N/A
6193-1	Cradles Farm Trust No 2	N/A
6292-1	New Plymouth Golf Club Inc	Improvement required (environmental)
6429-1	Leatherleaf Limited	Improvement required (environmental)
6430-1	Ellingworth Margaret Trust	High
6486-1	GM & PJ Rutten Family Trust Partnership	N/A

Consent	Consent Holder	Compliance achieved?
6628-1	Hamblyn Family Trusts	Improvement required (environmental)
7270-1	Ian Mantey Family Trust & Sally Mantey Family Trust	N/A
7346-1	Spenceview Farms	High
7372-1	Pukeone Partnership	Improvement required (environmental)
7527-1	Pukeone Partnership	High
7528-1	Kereone Farms Limited	High
7626-1	NW & DM King	N/A
7733-2	Hawken Family Trust	N/A
7768-1	Carter AJ Limited	High
Consent	**Consent Holder**	**Compliance achieved?**
7781-1	D Krumm	High
7866-1	Stratford Golf Club Inc	N/A
7895-1	Ohawe Farm	High
9561-1	Kereone Farms Limited	High
9577-1	SB & J May Family Trust	N/A

N/A = not applicable

During the 2012-2013 year, 32% of irrigation consent holders in Taranaki achieved a high level of environmental performance and compliance with their consents, while 46% require improvement in their compliance performance. For reference, 35% of all consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents during the same period, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

3.3 Recommendations from the 2011-2012 Annual Report

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

1. THAT monitoring of consented irrigation activities in the 2012-2013 year continue at the same level as in 2011-2012.
2. THAT the consent holders whose dataloggers are coming to the end of their life are made aware of the situation, so improvements in compliance at all times with consent conditions are achieved.
3. THAT the Council requires consent holders that do not supply good quality records or provide no records at all, to install dataloggers.

4. THAT a pilot project is established and run for at least 12 months to determine the feasibility and communication capabilities of dataloggers and telemetry for the region.

Recommendation 1 was completed for the period under review.

With regards to recommendation 2, the Council has been liaising with consent holders whose dataloggers are coming to the end of their life or becoming faulty and recommending replacement loggers. For recommendation 3, the Council has been actively urging consent holders that provide unsatisfactory records to install dataloggers. For recommendation 4, the pilot project was not deemed necessary, as there are 11 irrigators that send their data straight to the Council and it shows that there is communications via radio or cellular network in all areas of the region.

3.4 Alterations to monitoring programmes for 2013-2014

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

It is recommended that monitoring for 2013-2014 be carried out at the same level as during the 2012-2013 period, with a specific emphasis on ensuring consent holder compliance with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010. In addition, it is recommended that details of the monitoring of water abstraction consents for farm and general water supply purposes be included as an Appendix to this report.

4. Recommendations

1. THAT monitoring of consented irrigation activities in the 2013-2014 year continue at the same level as in the 2012-2013 period.

2. THAT Council continues to liaise with consent holders who have dataloggers that are failing, so improvements in compliance at all time with consent conditions are achieved.

3. THAT the Council encourages consent holders that do not supply good quality records to install a datalogger and transfer data electronically to the Council database via telemetry.

4. THAT the Council requires all consent holders that take above 5 L/s to comply with the Measurement and Reporting of Water Takes Regulations 2010.

5. THAT the Council reports on the water permits held for farm and general water supply purposes as an Appendix to this report.

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Water meter guidelines. Environment Waikato Regional Council.

Appendix I

Example surface water abstraction permit for pasture irrigation

Water Permit

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

Name of Consent Holder:	CT & JM McDonald 69 Airport Drive R D 3 NEW PLYMOUTH 4373
Decision Date (Change):	14 November 2013
Commencement Date (Change):	14 November 2013 (Granted: 1 June 2010)

Conditions of Consent

Consent Granted:	To take and use water from the Mangaroa Stream for pasture irrigation purposes
Expiry Date:	1 June 2016
Site Location:	Lower Ball Road, Kakaramea, Patea
Legal Description:	Lot 5 DP 2782 Bk II Carlyle SD (Site of take & use)
Grid Reference (NZTM)	1720379E-5604145N
Catchment:	Mangaroa

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

General condition

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

Special conditions

1. The volume of water taken shall not exceed 2,160 cubic metres per day, at a rate of 25 litres per second, or 28 litres per second for up to 2 hours per day.

2. Before exercising this consent the consent holder shall install, and thereafter maintain a water meter and a data logger at the site of taking. The water meter and data logger shall be tamper-proof and shall measure and record the rate and volume of water taken to an accuracy of ± 5%. Records of the date, the time and the rate and volume of water taken at intervals not exceeding 15 minutes, shall be made available to the Chief Executive, Taranaki Regional Council at all reasonable times.

   Note: Water meters and data loggers must be installed, and regularly maintained, in accordance with manufacturer's specifications in order to ensure that they meet the required accuracy. Even with proper maintenance water meters and data loggers have a limited lifespan.

3. The consent holder shall provide the Chief Executive, Taranaki Regional Council with a document from a suitably qualified person certifying that water measuring and recording equipment required by the conditions of this consent ('the equipment'):

   a) has been installed and/or maintained in accordance with the manufacturer's specifications; and/or

   b) has been tested and shown to be operating to an accuracy of ± 5%.

   The documentation shall be provided:

   (i) within 30 days of the installation of a water meter or data logger;

   (ii) at other times when reasonable notice is given and the Chief Executive, Taranaki Regional Council has reasonable evidence that the equipment may not be functioning as required by this consent; and

   (iii) no less frequently than once every five years.

4. If any measuring or recording equipment breaks down, or for any reason is not operational, the consent holder shall advise the Chief Executive, Taranaki Regional Council immediately. Any repairs or maintenance to this equipment must be undertaken by a suitably qualified person.

5. The water meter and data logger shall be accessible to Taranaki Regional Council officer's at all reasonable times for inspection and/or data retrieval.

6. Any records of taking shall:

   a) Be in a format that, in the opinion of the Chief Executive, Taranaki Regional Council, suitable for auditing; and

   b) Specifically record the water taken as 'zero' when no water is taken.

7. During periods of low flow in the Mangaroa Stream between the point of residual flow assessment and the point of take of 5636 (Waiwira Trust), the applicant shall manage the abstraction of water, specified in special condition 1, such that sufficient water is available for the exercise of consent 5636 to the satisfaction of the Chief executive, Taranaki Regional Council.

8. The taking of water authorised by this consent shall be managed to ensure that the residual flow in the Mangaroa Stream immediately downstream of the intake point for consent 5636, held by Waiwira Trust (Grid reference 1720771E-5603021N) is not less than 18 litres per second. No taking shall occur when the flow is less than 18 litres per second.

9. The consent holder shall take all reasonable steps to avoid, remedy or mitigate any adverse effect on the environment arising from the exercise of this consent, including, but not limited to, the efficient and conservative use of water.

10. The consent holder shall ensure that the intake structure is screened and designed to avoid the entrainment of fish.

Signed at Stratford on 14 November 2013

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

Appendix II

Report on consented water permits for farm and general water supply purposes

Report on water permits for general farm and domestic supply

Introduction

This report is for water takes for general farm and domestic supply purposes that have been granted by the Council [water takes in excess of the permitted 1.5 litres per second or 50 cubic metres per day entitlement per property according to the Regional Fresh Water Plan for Taranaki, Rule 15], but have not been reported on previously as only water takes for irrigation had. This report discusses the consents active to 30 June 2013 and any compliance issues related to them.

These water takes are different to that for water irrigation, as these are used for general farm use and domestic supply and are used throughout the year unlike irrigation consents that are used for a small portion of the year. These consents generally have different consent conditions attached to them, to that of irrigation water, as the takes are generally of a minor nature and generally fall outside the Measurement and Reporting of Water Takes Regulations 2010.

Current water take consents

At 30 June 2013, there were a total of 19 current water take consents for general farm and domestic supply purposes. Of this seven were from surface water and 12 were from groundwater sources (Table 1).

Table 1 Total consents granted for dairy farm purposes to 30 June 2013

Consent	Consent Holder	Source
0095-2	Ashbrook Farms Limited	Surface Water
0865-3	Alma Trust	Surface Water
1190-3	Pungarehu Farmers Group Water Scheme	Surface Water
1357-3	Oakura Farms Limited	Surface Water
5413-2	MJ Fahy	Groundwater
5990-1	ID & JA Armstrong	Surface Water
6133-1	DJ & ME McKenzie	Groundwater
6372-1	Naplin Trust	Groundwater
6380-1	Caiseal Trust Partnership	Groundwater
6903-1	Awatea Hawkes Bay Trust	Groundwater
7272-1	Belmont Dairies Limited	Groundwater
7280-1	Turangarere Trust	Groundwater
7304-1	Gwerder Brothers	Groundwater
7497-1	Te Rua O te Moko 2B Ahuwhenua Trust	Surface Water
7540-1	Rata View (2008) Limited	Groundwater
7608-1	MD Aiken Family Trust	Groundwater
7711-1	Pariroa Marae (The Trustees)	Groundwater
7783-1	Norwood Farm Partnership	Groundwater
7969-1	AB Middleton	Surface Water

Results and discussion

During the year under review, the Council inspected all water take consents that have a compliance monitoring programme. This meant that some consents were not monitored due to the small nature of the takes, it was deemed unnecessary, and/or there were no enforceable consent conditions to monitor on the systems.

Of the consents that were inspected, they were checked to ensure that they were compliant with their resource consent conditions, which may include presence of a flowmeter, flowmeter tamperproof, adequately screened intakes, bores labelled and cased, pump sheds fenced off, water bodies fenced off, riparian margins planted.

Thirteen of the consents had an end of year site inspection, with six of these being found to be non-compliant with their consent conditions. Table 2 list the consents inspected and whether they were compliant.

Table 2 Site inspections and compliance during 2012-2013

Consent	Consent Holder	Compliant	Reason non-compliant
0865-3	Alma Trust	Yes	n/a
5413-2	MJ Fahy	Yes	n/a
5990-1	ID & JA Armstrong	Yes	n/a
6372-1	Naplin Trust	No	Did not provide records
6380-1	Caiseal Trust Partnership	No	Did not provide records
6903-1	Awatea Hawkes Bay Trust	No	Did not provide records
7272-1	Belmont Dairies Limited	No	Breached consented volume
7304-1	Gwerder Brothers	No	Breached consented volume and rate
7497-1	Te Rua O te Moko 2B Ahuwhenua Trust	No	Did not provide records
7608-1	MD Aiken Family Trust	Yes	n/a
7711-1	Pariroa Marae (The Trustees)	Yes	n/a
7783-1	Norwood Farm Partnership	Yes	n/a
7969-1	AB Middleton	Yes	n/a

Four of the six non-compliances related to the non-provision of records, which if this occurs again in 2013-2014 season enforcement action will occur.

Belmont Dairies Limited (7272-1) received a 14 day letter followed by an abatement notice regarding their non-compliance in breaching their allocated volume (Figure 1), which resulted in them getting a change in consent conditions to take more water. Gwerder Brothers (7304-1) exceeded their consented volume and rate on one occasion (Figure 2), no further action was taken, as the non-compliance was deemed minor in nature.

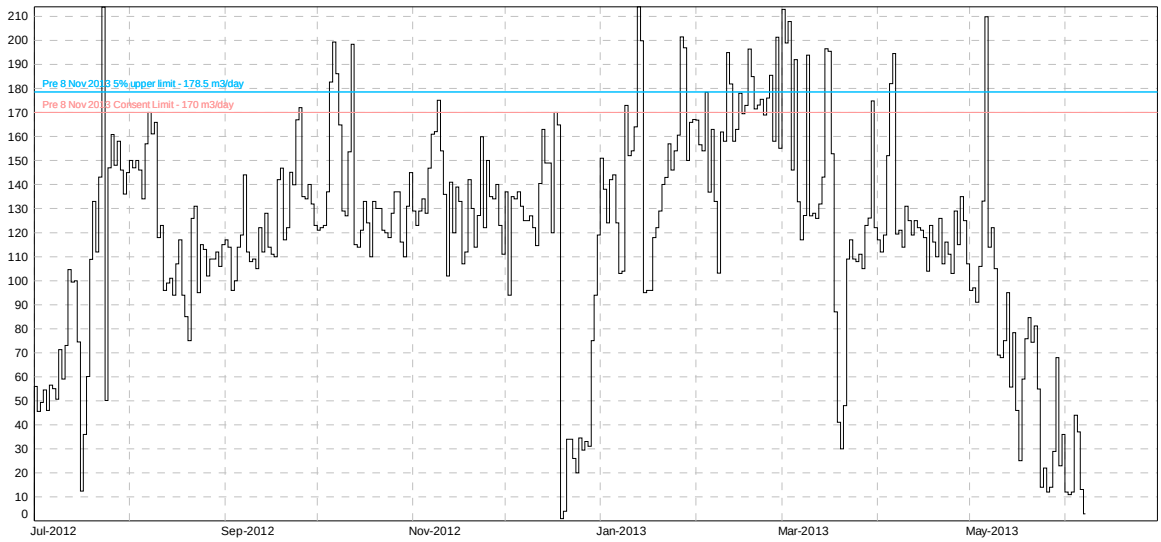

Figure 1 Amounts and dates of exceedance of daily abstraction volume for consent 7272-1

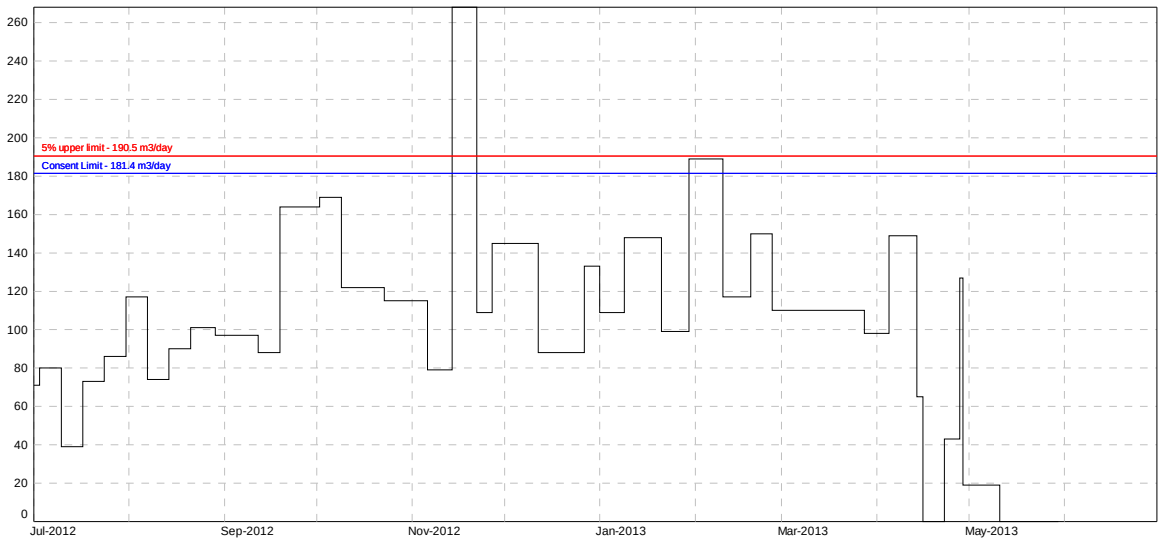

Figure 2 Amounts and dates of exceedance of daily abstraction volume for consent 7304-1

Summary

Of the thirteen sites inspected, there was a 46% non-compliance rate, mainly due to the non-provision of abstraction records. Therefore there will be a greater emphasis that the consent holders need to provide records in future seasons, other enforcement action is likely to occur.

The Council will continue to monitor these water takes and any new consents that may be granted in the future, as although they are relatively minor in size, it is still important to manage the resources and assess if there are any adverse environmental effects arising from the consent being exercised.